Role of Extremophiles and Extremophilic Proteins in Industrial Waste Treatment

Sharmistha Tapadar, Deeksha Tripathi, Saurabh Pandey, Khyati Goswami, Arunima Bhattacharjee, Kunwali Das, Espita Palwan, Mamta Rani, and Ashutosh Kumar

Abstract

Majority of the industrial products are made in variety of extreme environments. These industrial processes generate by-products that are difficult to degrade, harmful for environment, and toxic to animals and humans. These industrial by-products are present in extreme conditions such as high salt and high or low temperature. It is an unfavorable condition for most of the waste-degrading enzymes as they work at ambient condition. The harmful industrial by-products, therefore, needed to shift at ambient condition for their degradation. Extremophiles grow at extreme conditions, and so their enzymes too work optimally under these extreme conditions. Extremophiles have enormous potential in biotechnological industry and waste remediation/management. Some halophilic microorganisms have great efficiency to remove petroleum, heavy metals, and dyes from the water polluted by industries. The chapter details the protein

Sharmistha Tapadar, Deeksha Tripathi, and Saurabh Pandey contributed equally to this work.

S. Tapadar · K. Goswami · A. Bhattacharjee · K. Das · E. Palwan · A. Kumar (✉)
Department of Microbiology, Tripura University (A Central University), Suryamaninagar, Agartala, Tripura, India
e-mail: ashutoshkumar@tripurauniv.in

D. Tripathi
Department of Microbiology, School of Life Sciences, Central University of Rajasthan, Ajmer, Rajasthan, India

S. Pandey
Department of Biochemistry, School of Chemical and Life Sciences, Jamia Hamdard, New Delhi, India

M. Rani
Plant-Microbe Interactions Laboratory, National Institute of Plant Genome Research, New Delhi, India

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adaptations in different extremophiles for their survival and uses of different extremophilic organisms/proteins in bioremediation.

Keywords

Extremophiles · Protein adaptations · Extremophilic proteins · Industrial waste treatment

1 Extremophiles

Extremophiles thrive in intolerably hostile or even lethal environments. These extreme conditions are extreme hot niches, arctic frost, and salty lakes. Some extremophiles can grow in presence of toxic waste and organic and heavy metal contaminants that are lethal to other organisms. Extremophiles are found in hydrothermal vents, in deep sea, as well as in the volcano. They are the Earth's most prolific group of organisms yet less studied. Extremophiles have members of all the three domains of life, bacteria, eukarya, and archaea. However, the members of the group archaea are least versatile; archaea are the major group that can survive in extreme environmental conditions. Among the bacteria, cyanobacteria are best adapted in extreme environments. Fungi are the most versatile among the eukaryotes. Example of most impressive eukaryotic polyextremophiles is the Tardigrade, a microscopic invertebrate. Tardigrades can survive in temperature of about −272 °C to 151 °C, pressure of about 6000 atmospheric pressure, extreme dehydration, and in the exposure to X-rays and gamma rays (Rampelotto 2013).

Extremophiles can be grouped based on different extreme growth conditions. Thermophiles can grow between 55 and 80 °C or higher temperature, whereas psychrophiles are between −20 and 10 °C. Halophiles are salinity tolerant and can grow at extremely high salt concentration, approximately 0.6 M to >5 M NaCl. Acidophiles and alkaliphiles are pH-tolerant microorganisms. Acidophiles have optimal growth at pH 3 or below 3, whereas alkaliphiles have optimal growth up to pH 10. Piezophiles are organisms that survive at high pressure (Dworkin et al. 2006). Radiation-resistant or radio-resistant extremophiles grow under extreme radiation such as gamma rays (GR), X-rays, UV radiation (UVR), and radio waves.

Recently, multicellular eukaryotic salmon parasite *Henneguya salminicola* is characterized with ability to grow in hypoxic environment. Evolution at hypoxic environment makes them lose the total of aerobic pathway. They have unusual characteristics of lacking mitochondrial genome, thus devoid of aerobic respiration. This makes them unique; otherwise, aerobic respiration is ubiquitous among eukaryotes (Yahalomi et al. 2020).

2 Industrial Waste and Bioremediation

Manufacturing, mining, and other industries emit/discharge unwanted industrial wastes. Due to complex nature, industrial waste management is more problematic and less predictable than management of municipal solid waste (MSW), particularly as industrial waste often contains hazardous pollutants. Aquatic organisms are continuously exposed to different industrial waste in contaminated water bodies. Industrial and household wastewater contains chemicals such as carbaryl, chlorpyrifos, diethyl phthalate, *p*-nonylphenol, tri(2-chloroethyl)phosphate, naphthalene, anthracene, 1,2,3-tricholoropropane, phenol, 1,4-dichlorobenzene, acetophenone, etc. (Petrie et al. 2015). Some chemicals, which have anthropogenic origin, such as dichlorodiphenyltrichloroethane (DDT), trichloroethylene, 1,2,3-trichloropropane, etc., are resistant to natural biodegradation (Janssen et al. 2005). 1,2,3-trichloropropane (TCP) is an industrial by-product of anthropogenic origin, which is a major groundwater contaminant (Samin and Janssen 2012). Chemicals in industrial waste have diverse physicochemical properties and occupy heterogeneous physical niches in the environment (Meckenstock et al. 2015).

Unregulated anthropogenic activities result in metal pollution. Bioremediation strategies have been implemented in many contaminated areas, using bacterial bioremediation approach. Some examples are as follows. In *Chromobacterium violaceum*, various genes and proteins are associated with the metabolism of metals, such as arsenic, iron, zinc, etc. (Alencar et al. 2016). *Pseudomonas aeruginosa* is mostly used for soluble cadmium removal (Sinha and Mukherjee 2009). *Pseudomonas putida* uses bioaccumulation and biosorptive mechanism for removal of metals such as cobalt, nickel, manganese, vanadium, lead, titanium, and copper (Kamika and Momba 2013). *Acinetobacter guillouiae* also uses the mechanism of biosorption for the removal of copper (Majumder et al. 2015). *Geobacter metallireducens* is used in the removal vanadium, in which the V(V) ions are precipitated after reduced to V (IV) ions (Ortiz-Bernad et al. 2004). *Paenibacillus polymyxa* is used for the removal of cadmium, copper, and zinc, by biosorption, adsorption, and bioaccumulation in the polymeric matrix or biomass (Martins et al. 2008). Intracellular accumulation and extracellular adsorption are used by the bacterium *Bacillus cereus*, for bioremediation of cadmium (Huang et al. 2014). Also, chromium ions are removed by biosorption of ions by immobilized *Bacillus cereus* (Maiti et al. 2009). *Rhodococcus erythropolis* is used for the removal of copper, cadmium, and lead, due to its capability to synthesize microbial surfactant (Pirog et al. 2013). *Bacillus licheniformis* uses bioaccumulation and biosorptive mechanism for the removal of zinc, copper, nickel, manganese, vanadium, lead, titanium, and copper (Kamika and Momba 2013). *Bacillus barbaricus* uses the mechanism of biosorption with bacterial consortium action, for the removal of cadmium and lead (Sen et al. 2014). *Chlamydomonas* spp., *Oscillatoria* spp., and *Chlorella vulgaris* are suggested to bioaccumulate heavy metals inside their tissues in higher concentration. *Aspergillus niger, Bacillus* spp., *Pseudomonas aeruginosa, Citrobacter* spp., *Chlorella vulgaris, Rhizopus arrhizus, Zooglea* spp., and *Volvariella volvacea* are some examples of microbes that utilize heavy metals (Mishra 2017).

Radionuclides are the radioactive wastes that are life-threatening upon exposure. Nuclear power plants contribute to about 95% of the total radioactive wastes generated (Ahier and Tracy 1995; Tamponnet and Declerck 2008). Bioremediation is the ecologically beneficial way by which radioactive wastes can be removed from the environment. Microorganism-mediated bioremediation can affect the solubility, bioavailability, and mobility of radionuclides (Prakash et al. 2013).

Bacteria such as *Shewanella putrefaciens* and *Geobacter sulfurreducens* are capable of U(VI) reduction (Wildung et al. 2000; Lloyd et al. 2003). ^{99}Tc, a radionuclide found in nuclear wastes, can be reduced by direct metabolic reduction by the bacteria *Shewanella putrefaciens* and *Geobacter metallireducens* (Lloyd and Macaskie 1996). Some biofilm-producing microorganisms serve as a platform for the precipitation of insoluble minerals (Prakash et al. 2013). *Citrobacter* sp. produces deposits of metal phosphate enzymatically (Prakash et al. 2013). Genetically modified *Pseudomonas aeruginosa* is be able to precipitate a complex containing phosphorus and uranium on their cell surface (Keasling et al. 2000). Several proteins of microorganisms such as *Deinococcus radiodurans*, *Sphingomonas* sp. BSAR-1, *Salmonella enterica* serovar Typhi, and *Desulfovibrio vulgaris* are utilized in the bioremediation of uranium (Appukuttan et al. 2006; Nilgiriwala et al. 2008; Misra et al. 2012). In the bioremediation of cobalt, genes and proteins of *Rhodopseudomonas palustris* and *Novosphingobium aromaticivorans* can be utilized (Raghu et al. 2008). Thus, huge progress had been made in the field of radionuclide bioremediation using microorganisms in recent years. However, many challenges still lie ahead in remediation of radioactive wastes.

3 Contaminants in Wastewater

3.1 Microbial Components

Wastewater contains numerous pathogenic as well as non-pathogenic bacteria, helminths, protozoa, and viruses. *Enterococcus faecalis*, *Escherichia coli*, *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Vibrio cholerae*, *Bacillus anthracis*, *Clostridium botulinum*, *Clostridium perfringens*, *Pseudomonas aeruginosa*, *Clostridium difficile*, *Corynebacterium diphtheria*, *Mycobacterium tuberculosis*, *Streptococcus agalactiae*, *Yersinia pestis*, *Bacillus anthracis*, and *Salmonella enterica* are bacterial pathogens present in wastewater (Kumaraswamy et al. 2014). There is presence of different viruses such as noroviruses (Pouillot et al. 2015), rotaviruses (Baggi et al. 2001), adenoviruses (Osuolale and Okoh 2015), rhinoviruses, enteroviruses (Baggi et al. 2001), and herpes simplex viruses (Bibby and Peccia 2013).

3.2 Non-microbial Components

Nitrogen is abundantly found in wastewater. Both nitrogen and phosphorus are found in waste of agricultural industries. This increase of inorganic nitrogen

enhances eutrophication of water bodies. Similarly, phosphorous-containing sludge from industries also causes eutrophication (Camargo and Alonso 2006).

Industrial wastewater is often heterogeneous mixture of aromatic amines, nitro-containing compounds, polynuclear aromatic hydrocarbons (PAHs), chlorinated organics, solvents, and heavy metals. Chemical industries are the largest producer of hazardous materials, such as hydrocarbons and coal tars (Houk 1992). Their wastes may contain carcinogens like acetonitrile and acetamide (Houk 1992). Extracts of wastewater also contain nitrobenzoic acids, nitrotoluenes, benzoic acids, and cresols (Sundvall et al. 1984). Organic chemical manufacturers release some of the most genotoxic discharges (McGeorge et al. 1985). Also plastics, resins, and rubber industries produce black tar, containing high levels (550 mg/g) of aniline, which is a mutagen in some organisms (DeMarini et al. 1987; DeMarini and Houk 1988). Textile industries produce carcinogens, such as benzidine and beta-naphthylamine. They also release heavy metals, especially chromium, copper, and zinc, and hazardous chemical intermediates, such as aromatic amines as waste (Houk 1992). In addition, these industries discharge several mutagens and carcinogens such as benzo-pyrene, fluoranthene, and phenanthrene/anthracene (Houk 1992). However, some chlorinated compounds or solvents, including dichlorobenzenes, carbon tetrachloride, and trichloroethylene, are identified in the wastes (DeMarini and Houk 1988). Also, pesticide manufacturers generate high alkylamines containing waste (DeMarini et al. 1989). Wood-preserving wastes contain phenols, cresols, carcinogenic PAHs (such as fluoranthene, pyrene), pentachlorophenol, and other chlorinated hydrocarbons (Donnelly et al. 1983, 1987a, b). Latex paint waste contains high levels of ethylbenzene, zinc, copper, and mercury and smaller amounts of some carcinogenic or mutagenic metals such as arsenic and selenium (Houk 1992). Polynuclear aromatic and aliphatic hydrocarbons and their derivatives were found to be the primary components of petrochemical wastes (Somani et al. 1980).

A mutagen, neoabietic acid, is also found in some effluents from pulp and paper mills (Houk 1992). The discharges from defense and munitions plants are trinitrotoluene (TNT), which is nonpolar, and the major organic component is dinitrotoluene (DNT) sulfonic acids (Houk 1992). TNT and DNT are mutagenic (Spanggord et al. 1982). Discharge from munition plants also contains small amounts of genotoxic compounds, such as 2,4,5-trinitrotoluene, 3,5-dinitroaniline, and 1,3,5-trinitrobenzene (Spanggord et al. 1982). Food processing industries produce large amounts of organic wastewater, containing carbon, ammonium, sodium hydroxide, etc. (Frenkel et al. 2017). Pharmaceutical industry contributes a lot of chemical waste to the water bodies.

Industrial wastewaters contain toxic heavy metals such as Zn, Cu, Cr, Ni, Cd, and Hg and may cause clinical manifestations (Zawierucha et al. 2016). Thus, all these wastes must be treated before discharging into water bodies (Frenkel et al. 2017). Radioactive contaminants can also be seen in wastewater from different industries that work with radioactive metals, mining industry, nuclear power station, and biomedical engineering.

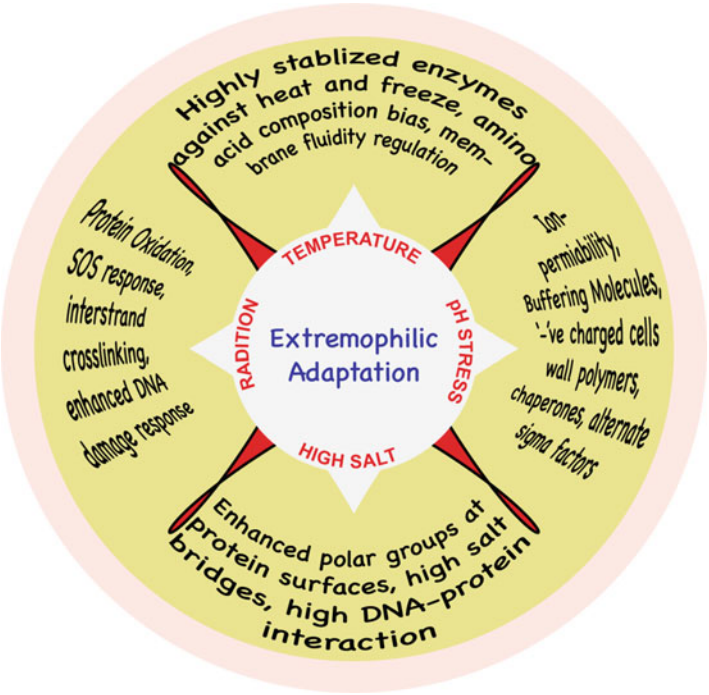

Fig. 1 Extremophilic adaptations for the survival in different stresses such as pH stress, temperature, high salt, and radiation. (Figure adapted, with permission, from Kumar et al. 2018 © 2018 Elsevier Ltd.)

4 Protein Adaptation of Extremophiles

Extremophiles can thrive in extreme environments that are intolerably hostile or even lethal for other life forms. Extremophiles have various adaptations that keep their cellular proteins stable and active which enables them to cope up with such harsh conditions. One such adaption is their enzymes known as "extremozymes" which perform the same enzymatic functions as their non-extreme counterparts. Extremozymes are capable to catalyze chemic activity inside the cell under harsh conditions (Fig. 1).

4.1 Protein Adaptation in Thermophiles

Though thermophiles can grow at very high temperature because of their thermostable enzymes and adaptation of the membrane, there is also high energy demand. Protons and sodium ions are used during energy transduction in bacteria; by

increasing the rate of proton pumping, they sustain the proton's electrochemical gradient to increase permeability at high temperature; consequently, they use an increased fraction of metabolic energy for maintenance.

The proteins of thermophilic bacteria have different amino acid content than that of ordinary protein. Thermophile proteins undergo various modifications for adaption. The most common are increase in the number of large hydrophobic residues, larger hydrophobic core, more number of disulfide bonds, and increased ionic interactions (Reed et al. 2013). Also, increased disulfide bridges lead to enhanced stability of the thermophilic proteins (Boutz et al. 2007; Cacciapuoti et al. 2012). Thermophilic proteins also have increased electrostatic interactions by replacement of uncharged residues with charged ones, increasing stability (Haney et al. 1999). Further, thermal stability also increases by subunit-subunit and subunit-cofactor interactions (Reed et al. 2013). Thermostable proteins have high amount of arginine and result in elevated incidence of salt bridge formation and ion pairing to stabilize thermophilic proteins. Lastly, extremophilic proteins have biotechnological applications. It can be used in many industries to reduce pollution by industrial waste treatment.

4.2 Protein Adaptation in Psychrophiles

Psychrophiles inhabit frozen lakes, polar regions, deep sea, arctic glaciers, and high altitudes. Since low temperature hampers bacterial cellular activity, they have adapted to low temperatures. Severe physicochemical constraints like increased water viscosity, decreased molecular diffusion rates, reduced biochemical reaction rates, increased solubility of gases, increased osmotic stress, desiccation, and ice formation are faced constantly by psychrophiles (D'Amico et al. 2006; Gerday and Glansdorff 2007). To overcome all these conditions, psychrophiles modify the fatty acid composition by increasing the content of unsaturated fatty acids of the lipid bilayer in the cell membrane (Chintalapati et al. 2004; Russell 2008). Psychrophile contains enzymes which have a high specific activity in the cold. In psychrophile proteome, there is an increased occurrence of glycine and decreased occurrence of proline. Glycine provides greater conformational mobility, whereas proline residues ensure conformational rigidity (Feller 2010). Psychrophilic proteins have less cysteine residues which correspond to decrease in the number of disulfide bridges (Parrilli et al. 2019). Psychrophilic enzymes have larger cavities that help to retain hydrophilic groups which in turn increases enzyme flexibility by enhancing the internal solvation (Paredes et al. 2011). Also, anti-freeze or ice-binding proteins (IBPs) inhibit the formation of ice crystals inside the cell (Bar Dolev et al. 2016).

4.3 Protein Adaptation in Halophiles

Halophiles thrive in salty oceans, sea, lakes, and coastal areas. Halophiles adapt themselves to prevent losing water or can shrink and ultimately die. Low

hydrophobicity is considered as one of the protein adaptive mechanisms in halophiles. Lower water availability is responsible for dehydration of a protein as a result hydrophobic interactions strengthen. Also, halophilic proteins bind salt and water in solvent conditions like their environment. This binding ability is dependent on the acidic amino acid residues in the protein surface (Mevarech et al. 2000; Bergqvist et al. 2003; Tadeo et al. 2009). Halophilic proteins also have a high excess of negatively charged amino acids such as aspartate and glutamate over amino acids with a positive charge such as lysine and arginine (Gunde-Cimerman et al. 2018). Increased negative surface charge on the proteins makes them more soluble and provides them flexibility at high salt concentrations, whereas their non-halophilic counter-proteins tend to form a cluster making them non-flexible (Gunde-Cimerman et al. 2018).

4.4 Protein Adaptation in Acidophiles

Acidophiles maintain the cytoplasmic pH close to neutrality to protect their acid-labile cellular protein and other constituents, which needs a large pH gradient across cell membrane. Also, DNA becomes unstable in highly acidic condition. Acidophiles have special mechanisms to pump acid out of the cell cytoplasm to maintain neutral to weak acid conditions (Matin 1999). Three main mechanisms are involved in the adaptation of acidophiles: use of a reversed membrane potential, building an impermeable cell membrane, and cytoplasmic buffering (Baker-Austin and Dopson 2007). They have decreased permeability for the entry of protons into the cytoplasm. The inside positive membrane potential restricts the influx of protons by the formation of K^+ ions (Buetti-Dinh et al. 2016; Christel et al. 2018). Cytoplasmic buffering helps in maintaining intracellular pH because the cell cytoplasm possesses basic amino acids such as lysine, histidine, and arginine which are capable of sequestering protons (Baker-Austin and Dopson 2007).

4.5 Protein Adaptation in Alkaliphiles

Alkaliphiles are usually found in acidic environment of soda deserts and soda pans. Maintaining cell integrity and function of intracellular organelles is difficult but critical for survival. pH homeostasis in cells is achieved by lowering of cytoplasmic pH by proton uptake, reducing proton leakage, also production of organic acid, and inhibiting the entry of hydroxyl ions (Mamo 2019). Alkaliphilic *Bacillus* species uses the H^+ ions and also employs sodium ion solute uptake taken from extracellular environment for solute transport systems. The bacterial Na^+/H^+ antiporters help in uptake of cytoplasmic H^+. Alkaliphiles have more sodium proton antiporters, sodium-dependent flagellum rotor proteins, and F_1F_0-ATPase pump (Wernick et al. 2013).

5 Role of Extremophiles in Waste Treatment

Due to urbanization, the expansion of industrial activities has increased the various contaminations in the environment. Human activities create waste, and these wastes can pose risks to both the environment and public health. Extremophiles can produce different novel enzymes which are stable in harsh environments. They have potential to be used for waste degradation and bioremediation.

5.1 Bioremediations Using Thermophiles

For bioremediation, there are two widely used approaches: bio-absorption and bioaccumulation. Thermophiles are always preferred for bioremediation of heavy metals. Some thermophiles can tolerate high metal concentration which may increase metal solubilization by oxidation. Thermophiles are able to reduce a wide spectrum of metals such as Mn, U, Tc, Cr, Co, Mo, Au, and Hg. A thermophilic bacterium *Thermus thermophilus* is able to tolerate very high concentration of arsenate and arsenite. It has been reported that *Thermus scotoductus* and *Thermoanaerobacter* sp. are able to reduce enzymatic uranium and technetium. For the biodegradation of hydrocarbons, use of thermophiles is well known. Also, thermophiles have high potentiality for bioremediation of heavy metals of groundwater and surface water. They are also used for the removal of organic compounds such as aliphatic and aromatic hydrocarbons and synthetic dyes (Sar et al. 2013).

Thermophiles survive at temperature, like hot springs, volcanic environments, fumaroles, geysers, and deep-sea hydrothermal vents. Their enzymes remain active even at very high temperature. *Bacillus* sp. from hot springs have industrial applications (Derekova et al. 2008; Kumar et al. 2013; Panda et al. 2016). Metagenomic studies have shown great diversity of thermophiles present in the hot springs (Tekere 2011).

Anoxybacillus sp. produces hydrolytic enzymes and oxidoreductases that are useful for bioremediation of wastewater (Jardine et al. 2018). Also, thermophiles can reduce phenol, a constituent of many pollutants (Jardine et al. 2018). Enzymes produced by the *Anoxybacillus* sp. may reduce pollutants from food industries, viz., polyaromatic hydrocarbons dyes, antibiotic residues, phosphates, and heavy metals (Jardine et al. 2018). Thermophilic enzymes or thermozymes have maximum activity at elevated temperatures (Mehta et al. 2016).

Thermophilic molds also secrete thermostable enzymes capable of degradation of organic and other toxic contaminants and hence have potential applications in bioremediation of industrial wastes and effluents (Singh and Satyanarayana 2009; Singh et al. 2016). *Talaromyces emersonii*, *Mucor* sp., *Rhizopus* sp., and *Thermomucorindicae seudaticae* are some of the examples of thermophilic molds that are employed in the bioremediation of polluted water and decolorization of dyes (Singh et al. 2016). Enzymatic technetium reduction have been shown in

thermophilic microorganisms, such as *Thermus scotoductus*, *Pyrobaculumis landicum*, *Thermoanaerobacter* sp., and *Thermoterrabacterium ferrireducens* (Chernyh et al. 2007). Considering the various advantages, bioremediation of wastes using thermophiles and thermophilic proteins (enzymes) seems to be a promising tool to increase the efficiency of the process of bioremediation of wastes (Urbieta et al. 2015).

5.2 Bioremediation Through Psychrophiles

Psychrophiles are known to be used for the bioremediation of polluted cold soils and wastewater. At low temperature, *Arthrobacter psychrolactophilus* degrades organic compounds and clarifies synthetic wastewater turbid medium (Margesin and Feller 2010). Some psychrophiles can act as a biofertilizer at low temperature. They degrade xenobiotic compounds which are man-made synthetic compounds. Enzymes produced by psychrophiles act on organic pollutants. Psychrophiles degrades toxic compounds into nontoxic substances (Kumar et al. 2019). Oil spills in marine water are one of the reasons of water pollution. During Deepwater Horizon spill, initial phases were dominated by *Oceanospirillales* which consume a variety of alkanes (Hazen et al. 2010), followed by dominance of *Colwellia* and *Cycloclasticus* that consume propane, ethane, and butane and BTEX (benzene, toluene, ethyl benzene, and xylenes), respectively (Redmond and Valentine 2012). Finally, there is dominance of *Flavobacteria* (*Tenacibaculum* and *Polaribacter*), *Alteromonadaceae*, and *Rhodobacteraceae* (Dubinsky et al. 2013) which degrade high molecular weight organics and dissolved organic matter in the marine water.

5.3 Bioremediation by Halophiles

Polyhydroxyalkanoates (PHAs) and polyhydroxybutyrate (PHB) are storage materials that are accumulated within bacteria as a source of energy and carbon reserve. The interest in these polymers is due to its unique characteristics of biodegradable, eco-friendly, and also biocompatible in nature. *Cupriavidus necator*, *Alcaligenes latus*, *Azotobacter vinelandii*, *Methylobacterium extorquens*, *Pseudomonas*, and recombinant *Escherichia coli* are some of the bacteria that accumulate PHAs (Lee 1996; Steinbüchel and Füchtenbusch 1998). Among halophiles, *Haloferax mediterranei* is so far the best PHA producer. Some other examples of haloarchaea that can synthesize PHA are *Haloterrigena hispanica*, *Haloquadratum walsbyi*, *Halorhabdus tiamatea*, *Halorhabdus utahensis*, *Halopiger aswanensis*, *Halobiforma haloterrestris*, and *Natrinema altunense* (Wainø et al. 2000; Xu et al. 2005; Burns et al. 2007; Romano et al. 2007; Antunes et al. 2008; Hezayen et al. 2010). Halophiles that produce poly-3′-hydroxybutyrate (PHB) are obtained from high salt sludge that are capable of producing bio-plastic (Hermann-Krauss et al. 2013; Legat et al. 2010). PHB biopolymer can be isolated from a halophilic strain

Halomonas boliviensis in its stationary phase (Quillaguamán et al. 2005). PHB biopolymer can be obtained by culturing with glucose, sucrose, volatile fatty acid, and hydrolyzed starch in fed-batch culture medium, making it cheapest and easily made PHB biopolymer (Quillaguamán et al. 2005). Biofuels are considered the best substitute for fossil fuel. Among all the biofuel, bioethanol is known as the best substitution. It has been shown that under aerobic and anaerobic conditions, *Nesterenkonia* sp., a moderately halophilic bacterium, is capable of producing butanol, ethanol, and acetone (Amiri et al. 2016).

Few strains of halophilic microorganisms can generate organophosphorus acid anhydrases (OPAA) which have a strong hydrolytic property to denature organophosphorus chemicals and its derivative. Decontamination of chemical substances can be done by these biocatalysts (DeFrank et al. 1993). By using recombinant DNA technology, cloning of OPAA compound facilitates the isolation and characterization of specific OPAA coding genetic segment which can help in detoxification of organophosphorus substances.

5.4 Bioremediation by Acidophiles

Acidophilic archaea and some thermophilic bacteria are capable of pollutant degradation from industrial wastewater, as it is hot and acidic in nature. *Sulfolobus solfataricus* can degrade phenol at 80 °C and pH 3.2 (Christen et al. 2011, 2012; Comte et al. 2013). *Thiomonas arsenitoxydans*, *Acidithiobacillus caldus*, and *Acidithiobacillus ferrooxidans* are some examples of acidophiles that can tolerate significantly high loads of heavy metals (Navarro et al. 2013). *Acidithiobacillus ferrooxidans* is widely used in mineral bioleaching (Ramos-Zúñiga et al. 2019). Similarly, acid mine drainage contributes a major portion of heavy metal waste by releasing highly acidic effluent. *Ferroplasma* spp. are acidophilic metal oxidizers which has optimal growth at very low pH (Edwards et al. 2000; Golyshina and Timmis 2005). Waste electric and electronic equipment generates huge amount of heavy metals like copper, lead, zinc, and nickel. Studies showed that a mixed culture of *A. ferrooxidans* and *A. thiooxidans* is more efficient in metal recovery than their pure culture (Wang et al. 2009; Liang et al. 2010). Use of mixotrophic acidophiles is shown to significantly increase cadmium removal from cadmium-contaminated soils (Hao et al. 2019). Low-pH iron oxidation is also used as a bioremediation strategy. Although sulfate is not considered as toxic, but it is still very harmful when present in wastewater. Sulfate can be reduced to zero-valent sulfur (ZVS) in order to remove it from wastewater. Autotrophic acidophilic and neutrophilic bacteria catalyze conversion of gaseous H_2S to ZVS under low redox conditions. Sulfur reducers usually grow at a broad spectrum of both temperature ranging from 2 to 110 °C and pH ranging from 1 to 10.5 (Johnson and Sánchez-Andrea 2019).

5.5 Bioremediation by Basophiles

Tributyltin (TBT) is present in waste affluent discharged from various industries such as wood, textiles, paper mill, and breweries. It is toxic to aquatic fauna and humans. Alkaliphilic bacteria *Stenotrophomonas chelatiphaga* decreases the TBT concentration (Hassan et al. 2018). Further, phenol toxic to aquatic terrestrial fauna and humans is degraded by *Arthrobacter* spp. which is obligate alkaliphilic bacteria (Kanekar et al. 1999). Hydrocarbon removal from high pH industrial wastes is also treated by alkaliphiles (Margesin and Schinner 2001). In textile industry, waste discharge contains various synthetic dyes. Synthetic dyes deplete the dissolved oxygen and hence affect the aquatic life. Biodegradation of azo dyes is made by alkaliphilic bacterial consortium in effluents of textile industry. Other bacterial species capable to remove dyes of textile effluents are *Bacteroides* spp., *Eubacterium* spp., *Clostridium* spp., *Proteus vulgaris*, *Streptococcus faecalis*, *Bacillus* spp., and *Sphingomonas* (Wuhrmann et al. 1980; Rafii et al. 1990; Bragger et al. 1997). Gold mining and jewelry industry generate large amount of cyanide waste. *Pseudomonas pseudoalcaligenes* uses cyanide, cyanate, and different metal-cyanide complexes as the sole nitrogen source (Luque-Almagro et al. 2005, 2008). Industrial effluent also contains nitrile as pollutant at high pH/salt conditions. *Comamonas* sp. (Manolov et al. 2005), *Pseudomonas putida* (Chapatwala et al. 1993), and *Rhodococcus* spp. (Blakey et al. 1995; Kohyama et al. 2006) use acetonitrile as source of carbon, nitrogen, and energy. They possess the nitrile hydratase/amidase enzymatic pathway. *Natronocella acetinitrilica* is high salt-tolerant, and obligate alkaliphile can be used for removal of nitriles as they use aliphatic nitriles as carbon and energy source (Sorokin et al. 2007).

6 Conclusion

Extremophiles have a huge potential in bioremediation as these organisms survive at extreme conditions and majority of pollutants are also present in extreme environment. Extremophilic proteins are functional in respective extreme conditions due to adaptations in protein structure. Many extremophilic organisms are being used in bioremediation. Genetic engineering techniques offer further opportunities to improve different strains or extremophilic proteins to make improvements in bioremediation.

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Assessment of Body Mass Index of Tribal Students in Tripura

Sudip Das[a], Pawan Kumar Singh[b]
[a]Assistant Professor, Department of Physical Education, Tripura University, India
[b]Assistant Director of Physical Education, Tripura University, India

Abstract

To know the current body mass index of tribal students of Tripura, the present study was carried out on 2400 male tribal students belonging to Tripura and falling in the age range of 9 to 14 years. Stature, body mass and BMI were taken to the standard procedure. Participants body mass was measured without shoes and with light clothing to the nearest 0.1 kg, using a digital weighing machine. Their stature was measured to the nearest 0.1 cm using a stadiometer. BMI were measured by weight (kg)/height (cm.) X height (cm). Body mass index was calculated by using the BMI charts for children. Data on anthropometry revealed that out of total tribal students screened (N=2400), mean height and weight in all the age group was significantly increasing due to the amount of body fat changes with age. BMI of 9 to 14 years tribal students of Tripura was placed in healthy weight category due to shows greater than 5th percentiles. The purpose of the study is to find out the current body mass index of tribal students of Tripura.

KEYWORDS: Body Mass Index, Tribal Students.

Introduction

The tribal populations of Tripura being neglected for long period in nutritional and health issues, needs to be uplifted and so we required empirical evidence which can be achieved through this research. Nutritional status is the current body status of a person or a population group related to their state of nourishment (the consumption and utilization of nutrients). The nutritional status is determined by a complex interaction between internal/constitutional factors and external environmental factors: internal factors like age, sex, nutrition, behaviour, physical activity and diseases. External environmental factors like food safety, cultural, social and economic circumstances. Anthropometry is the measurement of body height, weight and proportions. It is an essential component of clinical examination of infants, children and pregnant women. To know the current nutritional status of tribal students, the present study was carried out on 2400 male tribal students belonging to Tripura and falling in the age range of 9 to 14 years. For the study researcher has applied nutritional assessment by Anthropometric methods that is Body mass index for children. The criteria used to interpret the meaning of the BMI number for children and teens are different from those used for adults. For children and teens BMI age and sex specific percentiles are used for two reasons these are the amount of body fat changes with age and the amount of body fat differs between girls and boys. The purpose of the study is to find out the current body mass index of tribal students of Tripura.

Objective of the study

i. To find out the current body mass index of tribal students of Tripura.
ii. The study will assess the nutritional status of tribal students of Tripura.

Assessment of Nutritional Status of B.Ed & D.El.Ed Students in Tripura

Kishan Shome[a], Sudip Das[b]
[a] Assistant Professor, Bhavans Tripura Teacher Training College, Anandanagar, Tripura, India
[b] Assistant Professor, Department of Physical Education, Tripura University, India

Abstract

To know the current nutritional status of tribal students of Tripura, the present study was carried out on 110 male & female B.Ed & D.El.Ed students belonging to Tripura and falling in the age range of 18 to 35 years. Stature, body mass and BMI were taken to the standard procedure. Participants body mass was measured without shoes and with light clothing to the nearest 0.1 kg, using a digital weighing machine. Their stature was measured to the nearest 0.1 cm using a stadiometer. BMI were measured by weight (kg)/height (cm.) X height (cm). Body mass index was calculated by using the BMI charts for children. Data on anthropometry revealed that out of total tribal students screened (N=480), mean height and weight in all the age group was significantly increasing due to the amount of body fat changes with age. BMI of 18 to 35 years B.Ed & D.El.Ed students of Tripura was maximum fallen in healthy weight category due to shows within 18.5 to 24.9 range. The purpose of the study is to find out the current nutritional status of B.Ed & D.El.Ed students of Tripura.

KEYWORDS: Nutritional status, Body mass index, B.Ed & D.El.Ed Students.

Introduction

Nutritional status is the current body status of a person or a population group related to their state of nourishment (the consumption and utilization of nutrients). The nutritional status is determined by a complex interaction between internal/constitutional factors and external environmental factors: internal factors like age, sex, nutrition, behaviour, physical activity and diseases. External environmental factors like food safety, cultural, social and economic circumstances. Anthropometry is the measurement of body height, weight and proportions. It is an essential component of clinical examination of infants, children, adults and pregnant women. To know the current nutritional status of B.Ed & D.El.Ed students, the present study was carried out on 110 male & female B.Ed & D.El.Ed students belonging to Tripura and falling in the age range of 18 to 35 years. For the study researcher has applied nutritional assessment by Anthropometric methods that is Body mass index. The criteria used to interpret the meaning of the BMI number for children and teens are different from those used for adults. For children, teens and adults BMI age and sex specific percentiles are used for two reasons these are the amount of body fat changes with age and the amount of body fat differs between girls and boys. The purpose of the study is to find out the current nutritional status of tribal students of Tripura.

Objective of the study

i. To find out the current nutritional status of B.Ed & D.El.Ed students of Tripura.

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Effect of Visuo-Motor Behavior Rehearsal on enhancing Mental Toughness of Soccer Players

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Sorokhaibam Premananda Singh[1] & Sanjib Kumar Bhowmik[2]

Assistant Professor, National Sports University (A Central University), Ministry of Youth Affairs & Sports, Govt. of India, jonaprem@gmail.com

Assistant Professor, Department of Physical Education, Tripura University (A Central University), Suryamaninagar, 799022, Tripura, India.

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Abstract

The present study aimed to evaluate the effect of six weeks of Visuomotor Behavior Rehearsal on Enhancing Mental Toughness of Soccer Players. For the purpose of study forty (n=40) soccer players in the age groups of 17 to 21 years belong to Th. Birchandra Singh Football Academy (TBSFA), Imphal West, Manipur were selected. Subjects were divided into Treatment and controlled group (20 players in each group). The data was collected through the administration of the Psychological Performance Inventory (PPI) by James E. Loehr (1996) containing 42 items. To find out the significant effect of the Psychological Skills Training Program on Selected Psychological Variables of Soccer Players, MANOVA for psychological variables was used and the level of significance was set at 0.05. The findings of the study revealed that there was a significant effect of soccer players on those who underwent the PST program as compared to the players in the controlled group.

Keywords*:* Visuo Motor Behavioural Rehearsal, Mental Toughness, self-confidence, negative energy control, attention control, Visual & imagery control, motivational level, positive energy control and attitude control.

Design of an Industrial Internet of Things-Enabled Energy Management System of a Grid-Connected Solar–Wind Hybrid System-Based Battery Swapping Charging Station for Electric Vehicle

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- Somudeep Bhattacharjee (1)
- Champa Nandi (1) Email author (cnandi@tripurauniv.in)

1. Department of Electrical Engineering, Tripura University, , Agartala, India

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Abstract

Increasing greenhouse gases imposes severe concern over the environment since it results in rising dangerous calamities of climate change in the form of flood, cyclone, the rise of sea level, and so on. By promoting renewable power generation and electric vehicles, greenhouse gas emissions can be reduced to a very low level. But both the solutions have some major disadvantages like the intermittency of renewable sources is very high and also electric vehicles need to be charged after traveling a fixed distance. This paper mainly provides a remedy for these disadvantages. In this study, a grid-connected solar–wind hybrid system-based battery swapping charging station for the electric vehicle is designed, which includes an IIoT (Industrial Internet of Things)-enabled energy management system to efficiently utilize and control the flow of energy of different sources. This study includes a twenty-four-hour case study analysis on Meghalaya, India, by utilizing the real-time data of solar radiation and wind speed of January month to check the feasibility and power generation capacity. The results of this analysis simply indicate that the IIoT-enabled energy management system is efficiently managing the energy from different renewable energy sources in the proposed hybrid system for supplying the load and for storing a fixed amount of energy in the battery for electric vehicle charging which shows that the overall hybrid system is feasible, profitable, and environmentally friendly.

Keywords

Hybrid energy system Climate change Renewable energy Industrial internet of things Electric vehicle Battery swapping charging station

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Role of Hybrid Energy System in Reducing Effects of Climate Change

Dynamics of Energy, Environment and Economy pp 115-138 | Cite as

- Somudeep Bhattacharjee (1)
- Uttara Das (1)
- Moumita Chowdhury (1)
- Champa Nandi (1) Email author (cnandi@tripurauniv.in)

1. Department of Electrical Engineering, Tripura University, , Agartala, India

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Abstract

Climate change is a very rising topic nowadays since the climate of this world is changing rapidly day by day. In the technical field, it is seen that so many things or techniques used here, which have a very bad impact on our environment like use of non-renewable energy source, emission of greenhouse gases and so on. At present electric power generation is mainly dependent upon non-renewable sources. Due to rapid uses of non-renewable energy sources, its storage reserves are decreasing rapidly. So an alternate source is required and that is the renewable energy source, nowadays renewable sources are utilized but in small amount. Renewable sources are environmentally friendly, so using of renewable energy sources are more preferable than non-renewable sources for the betterment of our environment. Due to rising environmental concerns day by day, the utilization of renewable energy need to be increased as much as possible. There are so many remote or island places in this world where huge numbers of renewable sources are available which can be used for power generation. And the most important thing is that they have no effect (or very less effect) in this environment. So our goal is to model and simulate a grid connected solar-wind hybrid energy system which is used to solve the problems regarding the power generation. In this chapter a 24 h case study analysis is done by taking the real time data of solar radiation and wind speed of a selected location. The results of this analysis indicate that the hybrid system is profitable and environmentally friendly. This analysis simply gives an idea about to what extent there will be the generation of power and how much it will be helpful to this environment. In addition, it includes detailed discussion on climate change, harmful effects of non-renewable energy sources on the environment and the need of renewable energy based hybrid energy system to combat climate change. By this explanation we will get to know more about how renewable energy sources mitigate two problems – climate change & power demand.

Keywords

Climate change Renewable energy sources Solar power Wind power Grid Hybrid energy system

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Design of a Smart Energy Management Controller for Hybrid Energy System to Promote Clean Energy

Advances in Greener Energy Technologies pp 527-563 | Cite as

- Somudeep Bhattacharjee (1)
- Champa Nandi (1) Email author (cnandi@tripurauniv.in)

1. Department of Electrical Engineering, Tripura University, , Agartala, India

Chapter
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Abstract

Due to the emissions of greenhouse gases, the dangerous impacts of climate change are increasing. In order to combat climate change, hybrid energy system started playing a crucial role. Since individual renewable energy sources are not able to generate a fixed amount of power, the hybrid energy system is used to maintain continuity of power supply. For efficiently utilizing the energy from different renewable energy resources in the hybrid energy system, there has been a growing interest toward those algorithms that make controlling and management of hybrid renewable energy systems with conventional energy system easier and less complex for electricity generation. This chapter proposes the design of a smart energy management controller that uses an energy management algorithm to take decisions in order to integrate and utilize four different renewable energy technologies to reduce the contribution of thermal power generation. This controller stores a large amount of energy for electric vehicle charging. This chapter also proposes the design of an energy storage algorithm for effectively controlling the energy storage operation of the charging station for charging an electric vehicle. This book chapter also includes a detailed discussion on the role of the hybrid system to battle against climate change in Tamil Nadu with a detailed discussion on the scenario of climate change in Tamil Nadu. For analyzing the feasibility of the proposed hybrid system, a twenty-four hours case study analysis is done using the real-time data of renewable energy resources of a selected area in Tamil Nadu, India.

Keywords

Renewable energy technologies Hybrid energy system Solar power plant Hydroelectric power plant Wind farm Electric vehicle

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- Somudeep Bhattacharjee (1)
- Samrat Chakraborty (1)
- Champa Nandi (1) Email author (cnandi@tripurauniv.in)

1. Department of Electrical Engineering, Tripura University, , Agartala, India

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Abstract

With a large and growing population, the demand for electricity is increasing which results in the emissions of greenhouse gases that also increasing. In India, a major portion of the power is generated from fossil fuel-based conventional resources which emit greenhouse gases. The Indian electricity sector is a major contributor to greenhouse gases, and these greenhouse gases are responsible for the dangerous impacts of climate change like floods, drought, storms, etc. In order to reduce the impacts of climate change, the use of clean energy sources needs to be increased. In this chapter, a grid-connected hybrid energy system is designed utilizing solar power, wind power, battery, and gas generator as a backup system. This hybrid system is analyzed for four different areas of India based on their real-time data of climatic conditions. This hybrid system is deliberately planned, so that there will be a little emanation of carbon, as carbon emanation is one of the primary causes behind the environmental change. This chapter also explains the role of renewable energy-based hybrid power system to combat climate change. This optimization analysis estimates the amount of production of electrical energy, per unit cost of energy, and the total installation cost of the hybrid energy system. The proposed hybrid system is most profitable in Kavaratti, where its levelized cost of energy is 0.688 $/kWh. This chapter will contribute toward the dream of making India pollution free.

Keywords

Clean energy Hybrid energy system Solar power plant Wind farm Optimization Climate change

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Personalised recommendations

Green Energy Generation Using Renewable Energy Technologies

Advances in Greener Energy Technologies pp 259-276 | Cite as

- Sanghita Baidya (1)
- Champa Nandi (1) Email author (cnandi@tripurauniv.in)

1. Tripura University, , Agartala, India

Chapter
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Abstract

The sustainable development of energy market is depending on the improvement of renewable energy technologies. The renewable technologies are eco-friendly, green, and clean resources for power generation. Conventional sources for generating energy are limited on earth which creates scarcity and they are also producing harmful gases to atmosphere. The technologies based on renewable energy sources are providing a great opportunity to minimize the global warming by reducing the production of greenhouse gases (like CO_2). Some renewable energy sources are useful for minimizing the wastes from the locality (like biogas). In rural areas, renewable technologies are offering employment opportunities. Though earth is plenty with renewable sources, they are dramatically depending on the geographical positions and environmental situations. This creates several challenges for the development of renewable technologies. This chapter gives a concise overview on merits and limitations of renewable energy sources. For monitoring and controlling the renewable technologies, Internet of things (IoT) can play a vital role. The chapter mainly focuses on the different types of renewable technologies. The implementation of this green energy technology offers a sustainable development of the energy market. In this chapter monitoring of solar PV is also briefly discussed with IoT technology.

Keywords

Background of renewable energy Different types of renewable energy Environment protection Difficulties with renewable energy technologies IoT on renewable energy technology

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Personalised recommendations

Modeling and Implementation of Advanced Electronic Circuit Breaker Technique for Protection

Applications of Internet of Things pp 15-26 | Cite as

- Tushar Kanti Das (1)
- Rajesh Debnath (2) Email author (rajdb.16@gmail.com)
- Sangita Das Biswas (2)

1. Electrical Engineering, Techno College of Engineering Agartala, , Madhuban, India
2. Department of Electrical Engineering, Tripura University, , Agartala, India

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Abstract

The following paper narrates a microcontroller-based system which is an advanced electronic circuit breaker that designed for voltage fluctuation, frequency fluctuation, short circuit, overload, and residual leakage current. The advanced circuit breaker announces various watchful parameters that users get information other then any smart energy device during any electrical fault-based accident. During twenty-first century, many IoT-based energy monitoring and control projects are done. This project has also on features of smart energy monitoring system in coordination with web server-based IoT model. However, this project can be initiated for the protection scheme of household service as well as protective model of smart power system [1], 2]. Nowadays, power system is dealing with high-voltage alternating current (HVAC) and extra high-voltage current (EHVC). For making high-voltage circuit breaker and protective devices, special attention should be taken for designing such equipment. The circuit breaker technique is used in this paper and can be installed in the protection scheme to make a fault-free power system and also IoT-enabled smart power system. A hardware prototype model is designed using Arduino microcontroller to make this project a successful one.

Keywords

Advanced circuit breaker Residual current leakage Energy monitoring Arduino Internet of things

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Personalised recommendations

Complex Adaptive Systems (CAS) Perspective on Human Resource Management in Agile Teams: An Exploratory Study

Badri N. Srinivasan[1] and Debarshi Mukherjee[2]
[1]Societe Generale GSC
[2]Tripura University
E-mail: [1]thirumazhisaiazhwar@gmail.com; [2]mukherjeeassociates@gmail.com

ABSTRACT: Living in the VUCA (volatile, uncertain, complex and ambiguous) world necessitates a relook at the approach that needs to be followed for managing the human resources in an IT organization. The teams created in IT organizations earlier were formed based on the specialized functional domain and the individual members specialized in specific skills like development, testing, release and related areas and they followed waterfall model of software development. However, subsequently organizations found that for managing the market changes more effectively and for improving customer satisfaction, they need to focus on creating cross functional teams known as feature teams that can deliver and maintain the software product/service end to end across the complete software development life cycle (SDLC). With the focused growth of agile methodologies in the late 1990s and the beginning of the twenty first century, the emphasis shifted to the characteristics of teams that lead to improved customer satisfaction in comparison to the individual attributes of the team members only. The organizations also observed that they were operating in the complex domain as per the Cynefin framework and this required a different perspective to be adopted if they were to survive and also effectively manage the market changes and satisfy the customer. As per Conway's Law, organizations which design systems are constrained to produce designs that are copies of the communication structures of these organizations. This led to the growth of feature teams, which are cross functional and self-organizing teams that can deliver software end to end across the SDLC to the customer. Human Resource Management in

these organizations focused on the Resource Based View (RBV) and it was thought that this can be used to gain a strategic and competitive market advantage. The focus on best practices only and the integration of the best practices made it easier for the organizations to imitate each other and this precluded the IT organizations from gaining a sustainable competitive advantage through these human resource practices. Additionally, in organizations, which are following agile methodologies, the resource based view was found to be restrictive and it could not support the concept of feature or agile teams. The organizations also observed that operating in the complex domain was not very effective when the focus was on a resource based view only. Moreover, RBV presupposes the concept of rationality within the organizations, but this is not always typical of human behavior, which could be irrational. The focus of this paper is to present another perspective to the human resource management practices being followed in IT organizations. The focus on a different perspective related to complex adaptive systems (CAS) theory on human resources management in agile teams in IT organizations is considered in the form of an exploratory study through secondary research on literature.

Keywords: *Agile Methodologies; Self-organizing Teams; Agile Teams; Software Development; Agile; Complex Adaptive Systems (CAS); Resource Based View (RBV).*

Consumer Sentiment Analysis of Budget Hotels: A Text Mining Approach

Debarshi Mukherjee[1] and Ranjit Debnath[2]
Tripura University
E-mail: [1]debarshimukherjee@tripurauniv.in; [2]jeetdebnath@gmail.com

ABSTRACT: Budget hotels are growing very fast and becoming an emerging industry in the tourism sector in terms of convenience and affordability. To understand the experience and sentiment of customers availing the services of Budget hotels and subsequent evaluation of their post purchase behaviour through recent trends in online reviews is of paramount importance for the industry. Social media and online web portal has become integral part of tourism industry, from gathering of travel related information and purchasing of travel products, food and lodging etc to sharing views and experiences. This user-generated data has become top priority for many, especially true in the tourism industry, which enables the players in the industry to carry out predictive and behavioural analysis and allowing them to take evidence-driven decisions. This study uses text mining, deep learning and machine learning techniques of artificial intelligence for data collections and sentiment analysis along with the help of other statistical analysis to address the set of objectives. Total 1,17,153 online reviews of the customers posted on the Trip Advisor website from the period May, 2008 to May, 2019 from 197 hotels of 5 prominent budget hotels groups spread across India is collected for analysis. This study explains the pattern of reviews, satisfaction and trends with understanding of the customer's requirements particularly. The service provider will have the required insights of customers' preferences and indications on the improvement areas on which they need to concentrate.

Keywords: *Budget Hotel; Text Mining; Deep Learning; Artificial Intelligence; Sentiment Analysis.*

Metaliteracy: A Comprehensive Learning Framework for New Age Students

Debarshi Mukherjee[1] and Khandakar Kamrul Hasan[2]
Tripura University (Central University)
E-mail: [1]debarshimukherjee@tripurauniv.in; [2]kkhasan@gmail.com

ABSTRACT: Among the many priorities in today's higher education environment, it is especially worth exploring metaliteracy, a pedagogical framework that promotes reflective thinking and collaborative learning with participatory technologies. Metaliteracy is envisioned as a comprehensive model for information literacy, which promotes critical thinking and collaboration among various contemporary learning technologies in this digital age, thus providing a comprehensive framework to effectively participate in social media and online communities. Social media environments are transient, collaborative, and free flowing, requiring a comprehensive understanding of information to critically evaluate share and produce content in multiple forms. Metaliteracy provides a unifying framework that builds on the core information literacy competencies while addressing the revolutionary changes in how learners communicate, create and distribute information and participatory environments. Metaliteracy developed by Mackey and Jacobson (2010), not only expands the scope of traditional information sharing skills (determine, access, locate, understand, produce and use information) but also requires a higher level of understanding of one's own knowledge and cognitive abilities – meta-cognition. If cognition involves perceiving, understanding, remembering and so forth, then meta-cognition involves thinking about how one perceives, understands, remembers, etc. It also calls upon meta-literate individuals to be active and self-reflective while critically engaging in the collaborative spaces of today's social media pages. This approach leads to expanded competencies for adapting to the ongoing changes in emerging technologies and for advancing critical thinking and empowerment for producing, connecting, and distributing information to independent and collaborative learners. Today's learners are faced with a range of

options for lifelong discovery of knowledge that defies traditional boundaries of time, place, access, content, and modality. Metaliteracy empowers learners to participate in interactive information environments, equipped with the ability to continuously reflect, change, and contribute as critical thinkers. It emphasizes four learning domains: cognitive, behavioral, affective and metacognitive.

This paper aims to study the intriguing facets of metliteracy and reveal the interplay of four important learning domains through a comprehensive literature review. The paper finds that Metaliteracy provides a conceptual framework for information literacy that diminishes theoretical differences, builds practical connections, and reinforce central lifelong learning goals among different literacy types. It has challenged students to take on enhanced or new roles in both formal and lifelong learning environments, and to do so thoughtfully and ethically. Providing these opportunities for students in a course may shift the boundaries between student and teacher, the content, or the assignments. The relevant review of literature explains that metaliteracy can be applied in classroom-based instruction, blended and online learning, as well as competency-based environments, challenging students to reimaging the traditional boundaries around the design and delivery of instruction. The study further resolves that in order to foster meta cognitive thinking reflective and participatory learning activities are required through ethical production and sharing of user-generated content.

Keywords: *Metaliteracy; Metacognition; Blended Learning; E-Learning; Tertiary Education*

MGNREGA on People's Health and Quality of Life – Opening of a Novel Market for Health

Debarshi Mukherjee[1], Rajesh Chatterjee[2] and Sudakhina Mitra[3]
Tripura University
E-mail: [1]debarshimukherjee@tripurauniv.in;
[2]rajeshchatterjee@tripurauniv.in; [3]sudakhina.24@gov.in

ABSTRACT: People's health and economy are greatly impinged by improved income levels. As the most successful job guarantee programme of the nation, MGNREGA has not only provided an alternative source of livelihood but has also created durable assets such as road construction, land development, water conservation and irrigation facility, which has tremendous influence on different sectors of village economy and personal lives of the rural people. This paper examines the impact of MGNREGA on the improvement of overall quality of life of people such as impact on income earning levels of household, expenditure on food and non food items, expenditure on education, impact on social life and its overall impact on health. The paper also tries to find how the programme has introduced a new private market for health into the rural economy. The paper examines these issues in the context of West Tripura District of the state Tripura which is one of the rapidly growing north eastern state in India. The paper also attempts to suggest some points which if implemented at ground level may help to enhance the quality of life.

Keywords: *Quality of Life; Health Impact; Employment; Empowerment.*

PURVOTTARAN

THE RISE OF NORTH EAST: Paradigms of Development in the VUCA World

Editors

Dr. Debarshi Mukherjee
Dr. Mahasweta Saha

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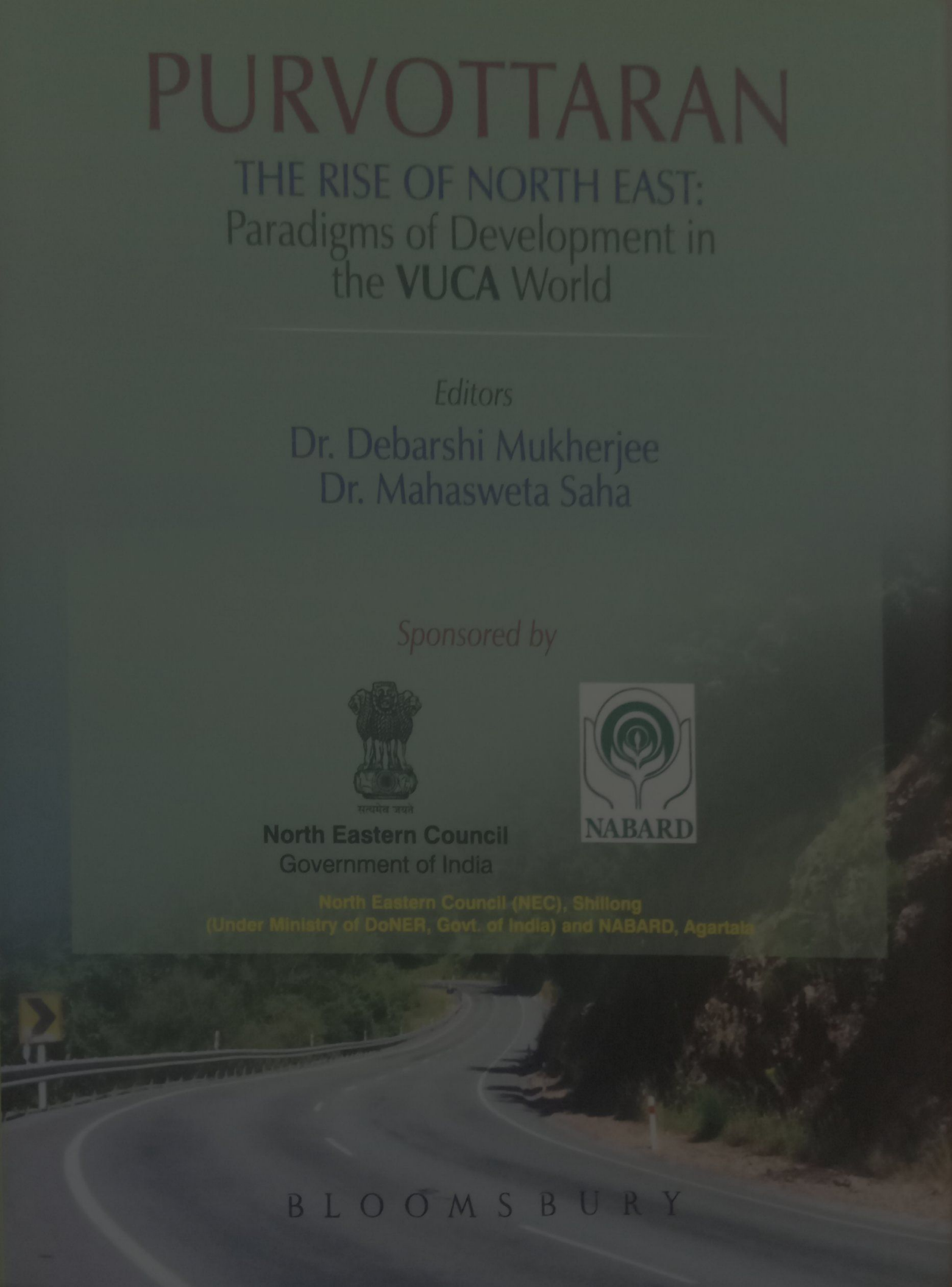

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Unfolding Tourism Potential in Tripura: A Case Study of Dumburnagar

Mahasweta Das Saha[a*] and Kaushik Dutta[b]

[a] *Assistant Professor, Department of Business Management, Tripura University*
[b] *MBA IV Semester, Department of Business Management, Tripura University*
*E-mail: mahasweta_saha@tripurauniv.in | *Corresponding Author*

Abstract

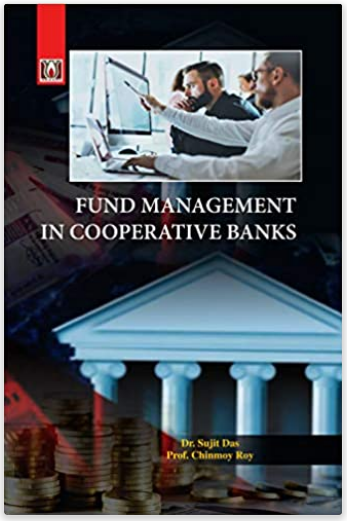
Tripura is one of the North-eastern states of India with pleasant climatic conditions and scenic landscape offering as an attractive tourist destination. Tripura is home to historical Hindu and Buddhist places, rivers, temples, forests, water bodies and rock carvings offering as tourist attractions. However, tourism has not grown over the years compared to other states due to lack of infrastructure, accommodation, and connectivity. This is the first-ever study that provides empirical evidence by deploying mixed-method research and connects the research findings with the practical implications related to tourism development in Tripura. This study conducts a qualitative analysis using NVivo by examining online reviews of tourists and identifies the most popular nature-based tourist destination, Dumburnagar. Secondly, the study analyzes the online reviews provided by the tourists after visiting the destination encompassing travel-related experience using NVivo. Thirdly, this research study designs a questionnaire and surveys 128 respondents to assess the current situation of Dumburnagar in terms of tourist's satisfaction. The findings reveal that some areas need immediate attention such as accommodation, eating and drinking facilities, activities and events, and accessibility at Dumburnagar. The development in the above-mentioned areas will increase tourists' inflow and tourist satisfaction resulting in revisits and positive recommendations. This will further strengthen the identity of Tripura at a national and global level with tourism development in Tripura, specifically Dumburnagar as well as other places. Our study immensely contributes towards the tourism and marketing knowledge pool and provides valuable directions for policymakers, tourism development authorities, and related Government bodies for tourism development in Dumburnagar, Tripura.

Keywords: *Tripura, Tourism, Dumburnagar, Tourist satisfaction, Mixed method*

Introduction

Tripura is one of the eight North-eastern states and the second smallest state of India having a geographical area of 10,492 sq. km and surrounded on three sides by the deltaic basin of Bangladesh. Tripura is surrounded by Bangladesh except a small area surrounded by two of the North-eastern States-Assam and Mizoram. Tripura is rich in natural resources such as natural gas, tea, rubber, and medicinal plants (IBEF, 2020). Tripura is endowed with the pleasant climatic conditions with scenic landscape offering as an attractive tourist destination. Tripura is home to historical Hindu and Buddhist places, rivers, temples, forests, water bodies, and rock carvings offering as tourist attractions.

Tripura has immense potential as a tourist destination, however, tourism has not grown over the years compared to other states due to lack of infrastructure, accommodation, and



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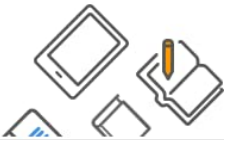

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Examining the Nexus Between Indian and U.S. Stock Market: A Time Series Analysis

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EXAMINING THE NEXUS BETWEEN INDIAN AND U.S. STOCK MARKET: A TIME SERIES ANALYSIS

Animesh Bhattacharjee
Research Scholar
Department of Commerce
Tripura University, Suryamaninagar
Agartala, Tripura (West)

Dr. Joy Das
Assistant Professor
Department of Commerce
Tripura University, Suryamaninagar
Agartala, Tripura (West)

Abstract

The aim of the study is to provide an analytical analysis of cointegration between Indian and U.S stock market. The study used monthly average data from the stock indices namely, NSE Nifty (NSE) and NASDAQ Composite (NASDAQ), for the period from January 2010 to December 2018. A number of statistical methods were employed including unit root test, Johansen cointegration test and Granger Causality test. The results concluded that NSE Nifty and NASDAQ are not cointegrated, which indicates that a long run equilibrium relationship do not exists between the indices. The Granger causality test showed a unidirectional causality exists between the indices and the causality runs from NASDAQ to NSE. Thus, indicating that NASDAQ have the ability to influence NSE.

Keywords: *Cointegration, Johansen Cointegration test, Granger causality test*

Introduction

The revolution in information technology vastly transformed the capital markets all around the world. Investors can now keep track of the fluctuations in the stock market index and can react to the flow of information more promptly. Deregulations of financial markets, abolishment of foreign exchange control, growth in international capital flows and international financial innovations have increased cross-country correlation; thus, bringing countries

together economically(Dasgupta, 2014). In the backdrop of all these developments it is important to examine whether investing in geographically separated stock markets can benefit the investors financially in times of crisis in the domestic market. For the last three decades researchers are trying to find markets which can be an alternative for investors to achieve their international diversification goals and many studies were carried out that investigated the interdependence among various stock markets (Aggarwal and Kyaw, 2005;Bekaert and Campbell, 1995;Bose and Mukherjee, 2006;Caporale *et al.*, 2016; Nath and Verma, 2003; Yi and Tan, 2009) but due to the number of stock markets and volume of trade, any number of research study carried out is just not enough to explain the behavior of stock markets.

Data and Methodology

Data and Sources of Data

The empirical work is based on monthly time series data relating to Indian stock market and U.S. stock market. NSE Nifty is used as a proxy for Indian equity market while NASDAQ Composite Index is used as a proxy for U.S. stock market. The daily closing values of these two stock indices were used to calculate the monthly average data. The study covers a time span of nine years; from January 2010 to December 2018.

Table 1: Data Sources in the Study

Index	Symbol used	Stock Exchange	Data source
NSE Nifty	NSE	National Stock Exchange	www.nseindia.com
NASDAQ Composite	NASDAQ	NASDAQ	www.nasdaq.com

Tools and Techniques

Normality test

The data series of all the stock indices are tested for normality to know the nature of data distribution. The study used the Jarque-Bera (JB) test to check whether the monthly closing values of the

stock market indices are normally distributed. The JB test is most commonly used to verify the nature of the distribution of time series data.

Linear Correlation

Correlation analysis is used to know how two variables move in relation to each other. The linear correlation shows the strength of the association between dependent and explanatory variables.

Unit root test

A unit root test examines whether a time series variable is stationary or non- stationary using and autoregressive model. The presence of a unit root in the data series is checked by employing the Augmented Dickey-Fuller (ADF). Although there are many available tests for verifying the presence of a unit root, we used this test because of itspopularity and wide application in the previous studies (e.g. Aggarwal and Kyaw, 2005; Ahmad *et al.*,2005;Kumar, 2002; Mohanasundaram & Karthikeyan, 2015;Yi & Tan, 2009).

Co-Integration

Johansen's test is an improvement over the cointegration test proposed by Engle and Granger(1987).It is used to find the long term relationship or association existing between the two variables. If the two variables are co-integrated with each other, then they are presumed to have long term relationship. It avoids the issue of choosing a dependent variable and the test can detect multiple Cointegrating vectors. Johansen's cointegration test is sensitive to the lag length. So, we have used VAR lag order selection criterion to select the appropriate lag length.

Granger Causality Test

For the purpose of identifying the causal relationship between NSE Nifty and NASDAQ Composite Index, the Granger(1969) causality test will be used in the study. Granger Causality Analysis is a statistical hypothesis test for determining whether one times series data is useful in predicting another. It exhibits two types of output, namely, unidirectional relationship and bidirectional

relationship. The optimal lag length will be decided on the basis of AIC value. At first, descriptive statistics and correlation co-efficient are calculated on raw data. Each time series is then converted into their natural logarithms for further analysis. Testing for the existence of a long-run relationship between the Indian and U.S. stock markets involves two critical steps a) the unit root test b) the Johansen's Cointegration test and at last Granger causality test was employed to determine the direction of causality between the variables.

Results and Findings

Descriptive Statistics

As shown in table 2, the value of standard deviation indicates that NSE Nifty is comparatively more volatile than NASDAQ Composite Index and both the variables are positively skewed. The value of Kurtosis has pointed out that both NSE Nifty and NASDAQ Composite index have a Platykurtic distribution (i.e. <3). Jarque-Bera test showed that the variables do not follow a normal distribution, since the probability of 0.013 and 0.026 indicates that the null hypothesis of normality assumption should be rejected.

Table 2: Descriptive Statistics of stock market indices

Variable	NSE	NASDAQ
Mean	7347.720	4387.028
Standarddeviation	1937.852	1627.395
Skewness	0.432	0.502
Kurtosis	1.913	2.220
Jarque-Bera	8.673	7.277
Probability	0.013	0.026
Results	Not normal	Not normal

Source: Estimates based on data collected by author.

Correlation Analysis

The hypothesis of the test is:

H_0: There is no correlation between NSE and NASDAQ

H_1: There is correlation between NSE and NASDAQ

Table 3: Result of Correlation Analysis

Correlation-coefficient	t-statistics	p-value	H0:Hypothesis
0.975	1.00	0.000	Rejected

Source: Estimates based on data collected by author.

The summary of the results of correlation analysis is reported in table 3. The value of correlation coefficient is 0.975 with a probability value of 0.000 which indicates a strong significant association between the indices.

Unit root test

The Augmented Dickey-Fuller (ADF) test has been employed to check whether the time series data used in the study has a unit root. The hypothesis for the test is:

H_0: Variable has a unit root

H_1: Variable has no unit root

Table 4: Augmented Dickey -Fuller (ADF) Test: At Level

Variables	t-statistics	Critical value	p-value	Outcome
NSE	-0.349	-2.888	0.912	Non stationary
NASDAQ	-0.211	-2.888	0.817	Non stationary

Source: Estimates based on data collected by author.

Table 5: Augmented Dickey-Fuller (ADF) test: At 1st Difference

Variables	t-statistics	Critical value	p-value	Outcome
NSE	-10.234	-2.888	0.000	Stationary
NASDAQ	-8.810	-2.888	0.000	Stationary

Source: Estimates based on data collected by author.

The findings of Augmented Dickey Fuller (ADF) test is reported in table 4 and table 5. The Augmented Dickey Fuller test is carried out to verify the stationarity of the time series data. The test is carried out with the null hypothesis of non stationarity for each data series. The results suggests that both the stock price indices exhibit the unit root property, and therefore, we can conclude that both the stock price indices are I (1).

Johansen Cointegration Test

Before applying Johansen Cointegration test optimal level of lag is selected. For selecting the lag, the study used three criteria namely Akaike Information Criteria (AIC), Schwarz Information Criteria (SC) andHannan-Quinn Information Criterion (HQ). The AIC shows the optimal lag of 2 while SC and HQ show the optimal lag length of 1. In this study, the optimal lag length has been selected using AIC and we, therefore, used the optimal lag of 2.

Table 6: VAR Lag Order Selection Criterion

Lag	LogL	LR	FPE	AIC	SC	HQ
0	90.645	NA	0.0005	-1.772	-1.720	-1.751
1	415.450	630.121*	9.52e-07	-8.189	-8.032*	-8.125*
2	419.554	7.796	9.50e-07*	-8.191*	-7.930	-8.085
3	419.826	0.506	1.02e-06	-8.116	-7.751	-7.968
4	423.416	6.533	1.03e-06	-8.108	-7.639	-7.918
5	424.009	1.056	1.11e-06	-8.040	-7.467	-7.808
6	424.443	0.754	1.19e-06	-7.968	-7.291	-7.694
7	425.665	2.078	1.26e-06	-7.913	-7.131	-7.597
8	427.539	3.110	1.32e-06	-7.870	-6.985	-7.512

Source*:* Estimates based on data collected by author.

*Indicates Lag order selected by the criterion
LR: Sequential modified LR test statistic (each test at 5% level)
FPE: Final Prediction Error
AIC: Akaike Information Criterion
SC: Schwarz Information Criterion
HQ: Hannan-Quinn Information Criterion

Table 7: Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(S)	Eigenvalue	Trace Statistic	Critical Value	Probability**
None	0.058	6.625	15.494	0.621
At most 1	0.003	0.343	3.841	0.557

Source: Estimates based on data collected by author.

Trace test indicates no cointegration at the 0.05 level
**denotes rejection of the hypothesis at the 0.05 level*
***Mackinnon-Haug-Michelis (1999) p-values*

Table 8: Unrestricted cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(S)	Eigenvalue	Max-Eigenvalue	Critical Value	Probability**
None	0.058	6.281	14.264	0.577
At most 1	0.003	0.343	3.841	0.557

Source: Estimates based on data collected by author.

Max Eigenvalue test indicates no integration at the 0.05 level
*denotes rejection of the hypothesis at the 0.05 level
**Mackinnon-Haug-Michelis (1999) p-values

From table 7 and 8 it can be observed that both Trace statistic and Max-Eigen value statistic indicatesno cointegration at 0.05 level. Thus, it can be concluded that there is no long run equilibrium relationship between NSE Nifty and NASDAQ Composite Index.

Granger Causality Test

To study the causal relationship between NSE Nifty and NASDAQ Composite Index the Granger Causality test has been used. The hypothesis for the test is:

H_0: LNSE does not Granger Cause LNASDAQ

H_1: LNASDAQ does not Granger cause LNSE

The null hypothesis has been rejected or selected on the basis of P value of f statistic. The results of Granger Causality test are depicted below:

Table 9: Granger Causality Test

Null Hypothesis	F Statistics	p-Value	Conclusion
LNSE does not Granger cause LNASDAQ	0.259	0.771	Do not reject H_0
LNASDAQ does not Granger cause LNSE	3.091	0.049	Reject H_0

Source: Estimates based on data collected by author.

The test result in table 9 suggests that NASDAQ granger cause NSE. Thus, it can be concluded that there is unidirectional causality between NASDAQ and NSE which flows from NASDAQ to NSE and NASDAQ can be used to forecast the NSE Nifty Index.

Conclusion

This study examined the long-run relationship between the Indian and U.S. stock markets. The paper also investigated the casual relationship between the two stock markets. We applied the correlation analysis for the purpose of examining the degree of association between the variables. The result of the correlation analysis indicates that there is a significant strong association between the two stock markets. The correlation result is further verified for the direction of influence by the Granger Causality test, which found that NASDAQ granger causes NSE. The unit root property of the time series data is examined by employing Augmented Dickey Fuller (ADF) test. The ADF test confirmed that both the data series is non-stationary at level. However, each data series become stationary after first-order difference. The empirical results of Johansen Cointegration test have indicated that there is no Cointegrating vector between the stock markets. Regardless of significant strong correlation, there is no evidence of long run relationship between the stock markets. As the Indian and U.S. stock markets are independent in the long run, U.S. stock market offers the possibility of international diversification for Indian investors.

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CHAPTER

Concomitant administration of selenium and vitamin B12 ameliorates arsenic-induced oxidative stress in male wistar rats

Sudipta Pal*[1] and Ajay Kumar Chatterjee[2]

[1]Department of Human Physiology, Tripura University, Suryamaninagar, West Tripura, India

[2]Ex-Professor and H.O.D, Department of Human Physiology, University of Calcutta, Kolkata, India

*E-mail: sudiptapal@tripurauniv.in, sudiptap12@yahoo.co.in

Abstract: Arsenic toxicity is a serious environmental issue globally. Both chronic and acute exposure cause adverse health effects affecting almost all organ systems. It is a challenge to combat against arsenic toxicity to keep healthy life. Various natural and synthetic compounds have been tried to ameliorate arsenic induced organ toxicity. In the present study protective effect of selenium and vitamin B_{12} co-administration was assessed against arsenic-induced oxidative stress in liver tissue of male Wistar rats. Intraperitoneal administration of sodium arsenite at a dose of 5.55 mg/kg body weight/ day (equivalent to 35% of LD_{50}) produced depletion of reduced glutathione (GSH) content of liver, associated with enhanced lipid peroxidation (LPO) level and free hydroxyl radical (·OH) formation. Activities of antioxidant enzymes like glutathione reductase (GR), superoxide dismutase (SOD), catalase were inhibited after arsenic exposure, indicating disturbed pro-oxidant-antioxidant equilibrium in rat liver tissue. Liver NADPH oxidase activity increased significantly following arsenic treatment, and thus enhances superoxide radical production. The same treatment of arsenic also cause liver injury as reflected by the elevated activities of serum γ-glutamyl transpeptidase (γ-GT), glutamate-oxaloacetate transaminase (SGOT), and reduced serum glutamate-pyruvate transaminase (SGPT) activity. Concomitant administration of selenium and vitamin B_{12} with arsenic appreciably restored almost all of these parameters to their control levels. Combination of selenium with vitamin B_{12} restored liver NADPH oxidase and serum GPT activities to their respective control values. In addition, they exhibited better efficacy to restore liver LPO level, SOD and catalase activities, serum γ-GT activity and carbonylated protein content. These results suggest that co-administration of selenium and vitamin B_{12} is capable of reducing arsenic-induced oxidative and degenerative changes in rat liver.

Keywords: Arsenic, oxidative stress, free radical, selenium, vitamin B_{12}, antioxidant

Chapter

Decoding the role of inflammation in lung cancer development

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Authors:

Debasish Maiti
Tripura University

Debabrata Majumder
Tripura University

Abstract

Lung cancer is the leading cause of cancer-related deaths and is responsible for one-quarter of all cancer deaths. The pulmonary diseases that are associated with the greatest risk for lung cancer are characterized by abundant and deregulated inflammation. Pulmonary disorders such as COPD are characterized by profound abnormalities in inflammatory pathways. Inflammation predisposes all that required to transform the cells in airways and alveoli into cancer cells. Inflammation is required to promote the survival of cancer cells in the tumor microenvironment and apart from that it also helps the tumor cells to evade the immune response and also reduces their response towards chemotherapeutic drugs. Two important transcription factors viz. NF-κB and Nrf2 are involved in inflammation-induced lung cancer development. Carcinogen activated NF- κB in lung tissue is reported to induce the expression of various inflammatory cytokines as well as matrix metalloproteinases and finally, NF-κB facilitates lung carcinogenesis positively. Inflammation also required for epithelial-mesenchymal transition (EMT) of lung tissue cells. But less information is available about the molecular mechanism involved in this. So in this review, the connection between inflammation and lung cancer development will be highlighted.

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About these proceedings

Introduction

This book features extended versions of selected papers from the International Conference on Computer Communication and Internet of Things (ICCCIoT 2020). Presenting recent research addressing new trends and challenges, and promising technologies and developments, it covers various topics related to IoT (Internet of Things) and communications, and machine learning for applications such as energy management systems, smart asthma alerts, smart irrigation systems, cloud healthcare systems, preventing side channel attacks, and cooperative spectrum sensing in cognitive radio networks.

Keywords

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Editors and affiliations

- Jyotsna K. Mandal (1)
- Somnath Mukhopadhyay (2)
- Alak Roy (3)

1. Department of Computer Science and Engineering, University of Kalyani, , Nadia, India
2. Department of Computer Science and Engineering, Assam University, , Silchar, India
3. Department of Information Technology, Tripura University, , Agartala, India

About the editors

Dr. Jyotsna K. Mandal received his M.Tech. in Computer Science from the University of Calcutta and his Ph.D. from Jadavpur University in the field of Data Compression and Error Correction Techniques. Currently, he is a Professor of Computer Science and Engineering and Director of the IQAC at the University of Kalyani, West Bengal, India. He is a former Dean of Engineering, Technology & Management (2008–2012). He has 33 years of teaching and research experience. He has served as a Professor of Computer Applications, Kalyani Government Engineering College for two years and as an Associate and Assistant Professor at the University of North Bengal for sixteen years. He has been a life member of the Computer Society of India since 1992 and senior member of IEEE. Further, he is a Fellow of the IETE and a member of the AIRCC. He has produced 176 publications in various

international journals, has edited thirty-four volumes as a Volume Editor for Science Direct, Springer, CSI, etc., and has successfully executed five Research Projects funded by the AICTE, Ministry of IT Government of West Bengal. In addition, he is a Guest Editor of Microsystem Technology Journal. 23 scholars awarded Ph.D. degree under his supervision and eight are pursuing.

Dr. Somnath Mukhopadhyay is currently an Assistant Professor at the Department of Computer Science and Engineering, Assam University, Silchar, India. He completed his M.Tech. and Ph.D. degrees in Computer Science and Engineering at the University of Kalyani, India, in 2011 and 2015, respectively. He has co-authored one book and has six edited books to his credit. He has published over 30 papers in various international journals and conference proceedings, as well as five chapters in edited volumes. His research interests include digital image processing, computational intelligence, and remote sensing. He is a member of IEEE and IEEE Computational Intelligence Society, Kolkata Section; life member of the Computer Society of India; and currently the regional student coordinator (RSC) of Region II, Computer Society of India.

Dr. Alak Roy, B.Tech. in Computer Science and Engineering from North Eastern Regional Institute of Science and Technology in 2008, M.Tech. in Information Technology from Tezpur University in 2010, awarded Ph.D. in Computer Science and Engineering from Tezpur University in 2010. Qualified UGC NET and GATE in 2017. Presently, he is working as an Assistant Professor in the Department of Information Technology at Tripura University, India, from May, 2012. He has served as an Assistant Professor, Department of Computer Science & Engineering at the National Institute of Technology Agartala from October 2010 to April 2012. He has nine years of teaching and research experience in Wireless Ad-Hoc and Sensor Networks, Internet of Things, Wireless and Mobile Communication, Underwater Sensor Networks, and Computer Networks. He has supervised more than 26 master dissertations. Dr. Roy has published more than 25 papers in international journals and conference proceedings and organized 2 International conferences and 13 workshops. He serves as a Reviewer of 6 journals and 10 conferences and professional member of IEEE, ACM, IAENG, and IAASSE.

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Dr. Abhishek Das

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Applications of Internet of Things

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- Jyotsna K. Mandal
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- Alak Roy

Conference proceedings

Part of the Lecture Notes in Networks and Systems book series (LNNS, volume 137)

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About these proceedings

Introduction

This book features extended versions of selected papers from the International Conference on Computer Communication and Internet of Things (ICCCIoT 2020). Presenting recent research addressing new trends and challenges, and promising technologies and developments, it covers various topics related to IoT (Internet of Things) and communications, and machine learning for applications such as energy management systems, smart asthma alerts, smart irrigation systems, cloud healthcare systems, preventing side channel attacks, and cooperative spectrum sensing in cognitive radio networks.

Keywords

Wireless Networking IoT-based Applications Networking and Network Security Machine Learning Computer Communications ICCCIOT 2020 ICCCIOT Proceedings

Editors and affiliations

- Jyotsna K. Mandal (1)
- Somnath Mukhopadhyay (2)
- Alak Roy (3)

1. Department of Computer Science and Engineering, University of Kalyani, , Nadia, India
2. Department of Computer Science and Engineering, Assam University, , Silchar, India
3. Department of Information Technology, Tripura University, , Agartala, India

About the editors

Dr. Jyotsna K. Mandal received his M.Tech. in Computer Science from the University of Calcutta and his Ph.D. from Jadavpur University in the field of Data Compression and Error Correction Techniques. Currently, he is a Professor of Computer Science and Engineering and Director of the IQAC at the University of Kalyani, West Bengal, India. He is a former Dean of Engineering, Technology & Management (2008–2012). He has 33 years of teaching and research experience. He has served as a Professor of Computer Applications, Kalyani Government Engineering College for two years and as an Associate and Assistant Professor at the University of North Bengal for sixteen years. He has been a life member of the Computer Society of India since 1992 and senior member of IEEE. Further, he is a Fellow of the IETE and a member of the AIRCC. He has produced 176 publications in various

international journals, has edited thirty-four volumes as a Volume Editor for Science Direct, Springer, CSI, etc., and has successfully executed five Research Projects funded by the AICTE, Ministry of IT Government of West Bengal. In addition, he is a Guest Editor of Microsystem Technology Journal. 23 scholars awarded Ph.D. degree under his supervision and eight are pursuing.

Dr. Somnath Mukhopadhyay is currently an Assistant Professor at the Department of Computer Science and Engineering, Assam University, Silchar, India. He completed his M.Tech. and Ph.D. degrees in Computer Science and Engineering at the University of Kalyani, India, in 2011 and 2015, respectively. He has co-authored one book and has six edited books to his credit. He has published over 30 papers in various international journals and conference proceedings, as well as five chapters in edited volumes. His research interests include digital image processing, computational intelligence, and remote sensing. He is a member of IEEE and IEEE Computational Intelligence Society, Kolkata Section; life member of the Computer Society of India; and currently the regional student coordinator (RSC) of Region II, Computer Society of India.

Dr. Alak Roy, B.Tech. in Computer Science and Engineering from North Eastern Regional Institute of Science and Technology in 2008, M.Tech. in Information Technology from Tezpur University in 2010, awarded Ph.D. in Computer Science and Engineering from Tezpur University in 2010. Qualified UGC NET and GATE in 2017. Presently, he is working as an Assistant Professor in the Department of Information Technology at Tripura University, India, from May, 2012. He has served as an Assistant Professor, Department of Computer Science & Engineering at the National Institute of Technology Agartala from October 2010 to April 2012. He has nine years of teaching and research experience in Wireless Ad-Hoc and Sensor Networks, Internet of Things, Wireless and Mobile Communication, Underwater Sensor Networks, and Computer Networks. He has supervised more than 26 master dissertations. Dr. Roy has published more than 25 papers in international journals and conference proceedings and organized 2 International conferences and 13 workshops. He serves as a Reviewer of 6 journals and 10 conferences and professional member of IEEE, ACM, IAENG, and IAASSE.

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SPRINGER NATURE

Angle-Based Feature Extraction Method for Fingers of Hand Gesture Recognition

Applications of Internet of Things pp 187-192 | Cite as

- Mampi Devi (1)
- Alak Roy (2) Email author (alakroy@tripurauniv.in)

1. Department of Computer Science and Engineering, Tripura University, , Suryamaninagar, Agartala, India
2. Department of Information Technology, Tripura University, , Suryamaninagar, Agartala, India

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Abstract

In this paper, two types of features ‘angle’ feature and Finger_{Tips} distance feature extraction methods for gestures of finger recognition are proposed. The entire image is segmented into several spatial modules and the task of feature extraction is carried out on finger of the hand images. Application of this method is extended to medical systems, sign languages for hearing-impaired people, crisis management and disaster relief, entertainment and human- -robot interaction. This method is tested on medial axis transformation (MAT) image and it does not require any gloves for recognition. This feature extraction algorithm has an advantage of very low feature dimension.

Keywords

Feature extraction Classification MAT image Hand gestures recognition

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Personalised recommendations

Smart Irrigation System Using Internet of Things

Applications of Internet of Things pp 119-129 | Cite as

- Madhurima Bhattacharya (1)
- Alak Roy (1) Email author (alakroy@tripurauniv.in)
- Jayanta Pal (1)

1. Department of Information Technology, Tripura University, , Agartala, India

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Abstract

As agriculture is the backbone of Indian economy, it deserves to be modernized. To overcome backwardness of traditional methods of agriculture and to enhance the crop production, to avoid the risk of damaging crops, and to do efficient use of water resources, the latest technology of Internet of things (IoT) is playing a crucial role nowadays. So, this paper “smart irrigation system” is proposed where the soil sensor is used to collect large number of real-time data from the agricultural fields. The sensors interact with each other through Internet connection. The data collected from the sensors sent to the Web server using wireless sensor network. IoT framework analyzes and processes the sensed data. Then, notifications are sent to the farmer’s smartphone application periodically. The farmer can track changes in soil moisture. In this way, unnecessary wastage of water can be avoided. This paper discusses the various experiments done in this context and a comparatively low cost system module with sensors and wireless networks for modernized irrigation is represented.

Keywords

Smart irrigation Internet of things Arduino Wireless sensor network Sensors

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- Alak Roy (1) Email author (alakroy@tripurauniv.in)
- Jayanta Pal (1)

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Personalised recommendations

Fingerprint Authentication System for BaaS Protocol

Applications of Internet of Things pp 39-48 | Cite as

- Ranadhir Debnath (1)
- Swarup Nandi (1) Email author (swarupnandi@tripurauniv.in)
- Swanirbhar Majumder (1)

1. Department of Information Technology, Tripura University, , Agartala, India

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Abstract

Over the past many years, several corporations have benefited from the implementation of cloud solutions among the organization. Due to the advantages such as flexibility, mobility, and cost saving, the number of cloud users is expected to grow rapidly. Consequently, organizations want a secure system, credit to manifest its users so as to make sure the practicality of their services and information hold on within the cloud storages are managed in a private environment. In the current approaches, the user authentication in cloud computing is predicated on the credentials submitted by the user like secret, token and digital certificate. Unfortunately, these credentials can often be stolen, accidentally revealed, or hard to remember. In view of this, we propose a fingerprint-based authentication system to support the user authentication for the cloud environment. We take into account a distributed state of affairs wherever the biometric templates are hold on within the cloud storage, whereas the user authentication is performed without the leak of any sensitive information.

Keywords

Biometric authentication Fingerprint recognition BaaS protocol Minutiae

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Queries in the Structure of Language

Editor
Tariq Khan

Central Institute of Indian Languages
&
Linguistic Society of India

CENTRAL INSTITUTE OF INDIAN LANGUAGES
Manasagangotri, Mysuru, Karnataka, India, 570006

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Officer-in-Charge, Publication Unit: Aleendra Brahma
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Message
Director, Central Institute of Indian Languages

The Central Institute of Indian Languages (CIIL) works for the promotion of Indian languages and provides assistance and advice to the Central and State Governments in matters related to language. This Institute has also been the leading centre for research in various areas of Linguistics. Established in 1969, CIIL has a glorious history of five decades during which it has developed as a hub of activities focusing teaching-learning and research on Indian languages. A scholar working on any aspect of language/linguistics finds resonance with the on-going activities at CIIL. The year 2018 was special for CIIL as this year the Institute entered into the 50th year of its establishment. To commemorate this accomplishment, the Institute decided to celebrate 2018-19 as the Golden Jubilee Year. On this account, the Institute proposed to organize the 40th International Conference of Linguistic Society of India. The response was so overwhelming that the organizing committee decided to publish all such papers that met the standards and passed the scrutiny. I am glad that the decision and the efforts thereafter have culminated into the preparation of three collective volumes.

I am very sure that the readers, the reviewers and the contributors will find these volumes worthy of their time and efforts. The academic fraternity and administrative and support staff of the Institute have put in considerable efforts in preparing these volumes and they deserve for the same. I strongly believe that these volumes would set a new trend for ICOLSI events and create a benchmark for future linguists.

Best wishes

Prof. D. G. Rao
Director, CIIL

Acknowledgement

The editorial team would like to thank the Director, CIIL, the office bearers of LSI and the academic, administrative and support staff of various schemes and projects of CIIL for their relentless support.

Thanks are also due to the panel of anonymous reviewers whose keen observations and cheerful advice have immensely helped the authors in improving their papers qualitatively. The editorial team is pleased to mention with gratitude the constant academic inputs and moral support it received from the advisory committee.

The team engaged for proofing and copyediting tasks deserves special thanks for its meticulous efforts. The staff members of National Translation Mission merit a special acknowledgement of thanks. The untiring efforts of Ms Gayathri Nataraj, the outstanding support of Dr Soibam Rabika Devi & Dr Sunetra Sholapurkar in the form of proofing and the valued contribution of Ms Seethalakshmi M. L. through typesetting keep the editorial team in a debt of gratitude. Mrs Manjula Bevoor's contribution in the form of the illustrious cover designs is outstanding and is also acknowledged with thanks.

The editorial team would also like to place on record its heartfelt thanks to the committed staff of Printing and Publication Unit of the Institute, especially the Head, OiC, Shri H. Manohara, Shri Nandeesh R., and Shri M. N. Chandrashekar with whose prompt response we have been able to bring out this much–awaited book.

Editorial Team

Abbreviations

1P	first person
2P	second person
3P	third person
ABL	ablative
ABS	absolutive
ACC	accusative
ADJ	adjective
ADV	adverb(ial)
AGR	agreement
ALL	allative
ART	article
AUX	auxiliary
BEN	benefactive
CAUS	causative
CLF	classifier
COM	comitative
COMP	complementizer
COMPL	completive
COND	conditional
COP	copula
CVB	converb
DAT	dative
DECL	declarative
DEF	definite
DEM	demonstrative
DET	determiner
DU	dual
DUR	durative
ERG	ergative
EXCL	exclusive
F	feminine
FOC	focus
FUT	future
GEN	genitive
IMP	imperative
INCL	inclusive
IND	indicative
INDF	indefinite
INF	infinitive
INS	instrumental
INTR	intransitive
IPFV	imperfective
LOC	locative
M	masculine
N	neuter
NPST	nonpast
NEG	negation, negative
NOM	nominative
OBJ	object
OBL	oblique
PASS	passive
PFV	perfective
PL	plural
POSS	possessive
PRED	predicative
PRF	perfect
PROG	progressive
PROH	prohibitive
PRS	present
PST	past
PTCP	participle
Q	question particle/marker
RECP	reciprocal
REFL	reflexive
REL	relative
SBJ	subject
SBJV	subjunctive
SG	singular

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Kukis in Tripura : A Glimpse

Dr. Anjana Bhattacharjee

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Growth and Reproductive Biology of Earthworms in Organic Waste Breakdown Under the Indian Condition

July 2020
DOI: 10.1007/978-981-15-4522-1_11
In book: Earthworm Assisted Remediation of Effluents and Wastes (pp.179-193)
Project: Survey on earthworm resource in organic wastes, forest, agro-ecosystem and their role in waste management and nutrient dynamics in Northeast India (Tripura, Nagaland) and Uttarakhand

Authors:

Priyasankar Chaudhuri

Susmita Debnath
Tripura University

Abstract and Figures

Environmental improvement is an accepted national goal. Under the present condition of the acute energy crisis and environmental degradation with rise in population, it has become essential to develop an appropriate technology for the recovery of energy from non-conventional sources like organic wastes. India produces 350 million tonnes of organic wastes from different agricultural sources. Out of these, several million tonnes of plant nutrients are produced. Earthworm (verm) is known to be a good biological source for the recovery of vermifertilizer and vermiprotein from the organic wastes to be used in agro-ecosystem and aquaculture and poultry, respectively. Vermicomposting is a process of conversion of organic waste through the synergistic actions of epigeic earthworm and bacteria. When earthworms (endogeic or anecic) are applied for breakdown and stabilization of municipal solid wastes, the process is termed 'vermistabilization'. The ultimate goal of both the processes is the production of plant-available nutrients and earthworm biomass (vermiprotein). Earthworm species to be selected for the process (1) should have great adaptability with respect to environmental factors, (2) should be capable of inhabiting high percentage of organic matter, (3) should be a prolific breeder (high fecundity) with high hatching success, and (4) should have short life cycle. Recent studies indicated that under Indian conditions epigeic species, such as Perionyx excavatus, Perionyx ceylanensis, Eudrilus eugeniae, Eisenia fetida, Eisenia andrei, can complete their life cycle in organic waste and produce vermicompost. Lampito mauritii, Polypheretima elongata, Drawida nepalensis, Drawida willsi, Metaphire posthuma, Metaphire houlleti can degrade organic matter in municipal sewage sludge which contains considerable amounts of sand particles. This chapter deals with the growth and reproduction of these organic waste degrading earthworms. Based on the study, suitable species for organic waste degradation are being suggested.

and 11.2 Cocoons of...

Growth and reproduction...

Sartaj Ahmad Bhat
Adarsh Pal Vig
Fusheng Li
Balasubramani Ravindran *Editors*

Earthworm Assisted Remediation of Effluents and Wastes

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Perionyx ceylanensis is a newly discovered epigeic species with promising vermicomposting ability. Being a native vermicomposting earthworm species, it is necessary to know about detailed biology of this species so that it can be used in vermiculture-based biotechnology. But literature is scanty regarding its growth and reproduction in different organic wastes. Our present study deals with the ... [Show full abstract]

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Pre-decomposed (15 days), turkey litter was mixed with cow dung (1:1, w/w) and vermicomposted with earthworm, Perionyx ceylanensis for 60 days. The vermicompost thus obtained was amended with regular farmers practice in the field soil for the cultivation of paddy (Oryza sativa, ADT-37) in six different treatments with and without vermicomposts (RBD). Before application of vermicompost and after ... [Show full abstract]

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Chapter

MANAGEMENT OF INVASIVE WEEDS AND LEAF LITTER THROUGH VERMICOMPOSTING (PERIONYX EXCAVATUS)

July 2020

In book: Microbes, Environment and Human Welfare (pp.394) · Publisher: Nova Science Publishers

Project: Survey on earthworm resource in organic wastes, forest, agro-ecosystem and their role in waste management and nutrient dynamics in Northeast India (Tripura, Nagaland) and Uttarakhand

Authors:

Susmita Debnath
Tripura University

Priyasankar Chaudhuri

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Abstract

Organic waste can be recycled through earthworms into beneficial manure with available plant nutrients. Weeds and leaf litter have always been a problem for the society. Burning of leaf litter causes air pollution, human health hazards, besides plant nutrients loss. On the other hand, higher adaptive capabilities of exotic weeds, now a day's made havoc for the society that is difficult to control. Vermicomposting technology is an eco-friendly approach for the management of organic wastes through the synergistic actions of epigeic earthworms such as Perionyx excavatus, Eudrilus eugeniae, etc. and microbes. Perionyx excavatus is a native potential vermicomposting species under Indian conditions. Vermicompost prepared from weeds and leaf litter will not only reduce the cost of cultivation but also will encourage organic farming for sustainable agriculture.

To read the full-text of this research, you can request a copy directly from the authors.

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Impact of Modernization and Globalization on Tribal Music with Special Reference to North East India

*Dr. Rabindra Bharali
&
**Mahua Roy

ABSTRACT

The English word "Tribe" has come from the Latin word "Tribus" which implies a particular type of common and political organization which is alive in every regions of India. Tribal population basically found in forest and hilly areas. The North East part of India, which is famous for tribal culture and tradition, has acquired an important place in Indian map. In North-Eastern region of India there are different communities of tribal people such as Munda, Garo,Kuki, Khasi and every community has their own cultural heritage and music .It has been observed that most of the tribal people use to live in forest and hilly areas and they have inherited different traditional music and dance forms like different festivals of harvesting, wedding ceremonies etc. Nowadays with the emergence of the

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*Assistant Professor, Dept. of Music, Tripura University (A Central University)
**Research Scholar, Dept. of Music, Tripura University (A Central University)

concept, modernization and globalization a drastic change can be found in the lives of the tribal people which is influencing the cultural and musical aspects. Most of the tribes of North East India adopted Christianity as their religion and due to this they are exposed to western culture and music and for the dominance of western culture and music most of the tribes are on the verge of loosing their own traditional music and culture. Though, different cultural activists are trying their best to revive their culture and music.

Key words: - Tribe, tradition, cultural, western.

INTRODUCTION

Tribals are believed to be the original inhabitants of India. India is a land of many religions and many tribes .There are many distinct ethnic tribes. Similarly, there are many castes, races and sects. In short it is a land of variety. The current tribal population of India is 20 million altogether. Each of the tribe has a distinctive community, either migrated from a different place or the original denizens of the land. These various tribes still inhabit the different parts , especially the seven states of North-eastern region of India.

The specialities of the tribes lie in their customs, culture and music. Each and every tribe became identical by their tradition of music as well as dance. Every single community has their own traditional music which represents the views of that particular community. Most of the tribes posses their own Gods and Goddess, reflecting the dependence of tribal people on nature and animals. most of the tribes are affable, hospitable and fun-loving and some of them share patriarchal cultural ties and some of the tribal societies are inclined towards women oriented issues. Thus, they have their own festivals and celebrations. North-eastern part of India is famous for its tribal culture and music. Such as , Garia dance of Tripuri tribe

of Tripura, Cheraw dance of Mizoram and Bihu dance of Assam etc. Due to the fact of globalization and modernization, tribal communities have started losing their own culture and it is observed that Christianity has brought about a change that can be termed as a total transformation in tribal lifestyle and outlook, particularly in the North-eastern states of India.

EFFECT OF MODERNIZATION AND GLOBALIZATION ON TRIBAL MUSIC OF NORTH EAST INDIA

The North East region of India contains eight states Assam, Mizoram, Nagaland, Manipur, Arunachal Pradesh, Meghalaya, Sikkim and Tripura. This hilly region of India specially known for its music and tradition of various tribes which reside in every states of this region. Every single state of this region has a rich and varied culture. These eight states of North east India carry different kinds of tribes and various cultural activities and life styles. These states are inhabited by a fair number of native tribes and they have their own distinct traditions in art, culture, dance, music and instruments.

Music is an art which has played a vital role in human society. Generally, musical forms of different tribes bear the characteristics of the entire region. Each group of the North east along with its sub-groups has its own musical traditions. Folk songs and dances bear the identity of respective tribes. Such as Bihu dance of Assam, Hazagiri of Tripura and Lai-haroba of Manipur and so on. History of cultural evolution of all places was remoulded, by the tastes and habits of the people, at different times. North East India is considered as one of the most culturally diverse regions of the world and it is a land inhabited by more than 200 fascinating tribes, these tribes have originated from the ethnic groups of Tibeto-Burmese, Proto Austrialaids and some group of Indo Mongoloids. Some examples

of prominent tribes are Garo, Khashi, Bodo, and Deori. The most important thing is tradition which can be seen in the looks, in their daily life styles and in their music.

Nowadays it has been observed that most of the tribes are adopting Christianity as their religion, which indicates the influence of western culture. Having a very rich culture most of the tribes are trying to change their religion and culture. As a result they are leaving their own traditions, customs, and practices. They are losing their tradition of music and they have become more interested about western songs.

The advent of Christianity brought about far reaching affects on the tribal society of most of the north eastern states, pervading all spheres of activities, outlook, and ways of life, culture and music. It also brought a new awareness and concern leading the society to move toward modernism. As a result they have started learning new musical forms, dances, playing techniques of instruments. They became more interested about western culture which is a good sign of modernism as they are becoming more educated than before and making themselves self-dependant. But the negative impact is that the tribes whose specialty lie only in their music and tradition, they have almost lost it and inherited other cultural activities. Due to the fact of modernization and globalization most of the tribes are practicing western dance forms like Hip-Hop, Salsa, Samba, Break dance etc. Instruments of tribal music play an important role to accompany different types of songs and dances. There are various instruments like sumui, Kham, pepa and very well known instrument is Champreng. But with the advent of western culture the practice of playing these traditional instruments have already gone and western instruments have come into practice and still in use.

Pharmacology of Angiotensin and Its Receptors

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- Satyajeet Biswal (1)
- Rajat Ghosh (1)
- Pratap Chandra Acharya (1) Email author (pratapacharya@tripurauniv.in)

1. Department of Pharmacy, Tripura University (A Central University), , Suryamaninagar, India

Chapter
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Abstract

Angiotensin is a peptide hormone produced by the proteolytic cascade initiated by the enzyme renin. The physiological effects of angiotensin are articulated by a particular receptor subtype, and it allows the cells to respond to extracellular signals. In earlier days, receptors were used to be identified using in vitro radioimmuno assay methods similar to the method used to identify receptor-binding properties of antibodies. However, nowadays the validation of receptors is done by doing the molecular or gene grafting into an unresponsive cell and then by observing the changes in chemical messengers. These innovative methods of identifying receptors have led to the discovery of two major angiotensin receptors, angiotensin type 1 receptor (AT_1 receptor) and type 2 receptor (AT_2 receptor), which produce cellular signals. Angiotensin has various physiological functions in different places such as juxtaglomerular cells, aldosterone, heart and kidney. The pharmacological intervention of renin–angiotensin system can be done by using beta blockers which create the inhibitory effect on renin secretion from juxtaglomerular (JG) cells. There is another method which involves the use of the renin inhibitory peptide. However, this method is not yet proved to be a successful approach for controlling the renin–angiotensin system. By far the most appropriate method of controlling the renin–angiotensin system is by using orally active angiotensin-converting enzyme (ACE) inhibitors, which interrupt the whole system. However, due to the associated adverse effects of ACE inhibitors, angiotensin receptor blockers (ARBs) are chosen over them. This chapter describes the history and origin of angiotensin, its biosynthesis, its mechanism of action and its physiological role. Further, the chapter also narrates the role of angiotensin as drug target and the use of ARBs for the pharmacotherapeutic intervention of hypertension.

Keywords

Angiotensin Angiotensin receptor blockers Renin–angiotensin systems *Ang II* AT_1 AT_2 Sartans Hypertension

Abbreviations

ACE

: Angiotensin-converting enzyme

Ang II

: Angiotensin II

ARBs

: Angiotensin receptor blockers

AT_1

: Angiotensin type 1 receptor

AT_2

: Angiotensin type 2 receptor

AT_3

: Angiotensin type 3 receptor

AT_4

: Angiotensin type 4 receptor

CHF

: Congestive heart failure

CKD

: Chronic kidney disease

GPCR

: G-Protein-coupled receptor

JG Cells

: Juxtaglomerular cells

mRNA

Messenger RNA

NC-IUPHAR

International Union of Pharmacology Committee on Receptor Nomenclature and Drug Classification

RAS

Renin–angiotensin system

US FDA

United States Food and Drug Administration

WHO

World Health Organization

Notes

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Personalised recommendations

A Comprehensive Survey on Computer Vision Based Approaches for Moving Object Detection

Publisher: IEEE

Sourav Dey Roy ; Mrinal Kanti Bhowmik **All Authors**

Abstract

Document Sections

I. Introduction

II. Methodological Review on Background Modeling Based Techniques for Moving Object Detection

III. Methodological Review on Frame Difference Based Techniques for Moving Object Detection

IV. Methodological Review on Optical Flow Based Techniques for Moving Object Detection

Abstract: Moving object detection has achieved a noticeable attention in many computer vision applications. The research community have contributed lot of works for dealing with ma... **View more**

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Abstract:
Moving object detection has achieved a noticeable attention in many computer vision applications. The research community have contributed lot of works for dealing with major challenges of moving object detection in real-world scenarios. The paper presents a comprehensive review on different moving object detection techniques classified into four categories: Background Modeling Based techniques; Frame Difference Based techniques; Optical Flow Based techniques and Deep Learning Based techniques. Moreover, detailed descriptions of various methods in each of this category are also provided.

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V. Methodological Review on Deep Learning Based Techniques for Moving Object Detection

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Conference Location: Dhaka, Bangladesh, Bangladesh

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Contents

I. Introduction

During the last few decades, automated video analysis has become a potential research area in computer vision due to its numerous applications to video based intelligent systems. There are three fundamental stages for analysis of video sequences: detection of salient moving objects, tracking of these salient objects on frame basis, and analysis of object tracks to predict the activity or behaviour of this objects. Furthermore, surveillance system have significant role in the defence against criminality and terrorist threats in both public and private sectors. It rely on the ability to detect moving objects in outdoor and indoor scenes which is considered as an efficient step for information extraction in computer vision applications. The term 'object' usually refers to its generalized form, including pedestrians and man-made objects (e.g. vehicles, ships, buildings, etc.) that have sharp boundaries and are independent of background environment.

Authors

References

Keywords

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A Comparative Study of Background Segmentation Approaches in Detection of Person with Gun under Adverse Weather Conditions

Publisher: IEEE

Rajib Debnath ; Anu Singha ; Biswajit Saha ; Mrinal Kanti Bhowmik All Authors

Abstract

Document Sections

I. Introduction

II. Dataset Description

III. Methodology

IV. Experimental Results and Discussion

V. Conclusion

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Abstract: The ability to detect gun held in hand or other body parts is an ordinary human skill. The same detection problem presents an exceptional challenge for machine vision sys... **View more**

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Abstract:
The ability to detect gun held in hand or other body parts is an ordinary human skill. The same detection problem presents an exceptional challenge for machine vision system. Very few works has been done in the area of automatic detection of moving persons carrying gun in hand under adverse weather condition, although it has several implication in the area of video surveillance and security. The quality of outdoor video scenes suffered from poor visibility and loss it's contrast due to adverse weather atmospheric conditions by scattering of aerosols. In this article, we present a structured comparison carried on between the state-of-art object detection algorithm. Different quality assessment matrices has been used for the evaluation of the performances of state-of-the-art methods. Incidentally relevant public datasets handling such a problem is scanty, if not absent, so far as our knowledge goes. As a result, the present article provides a newly collected several real time crime scene based video data clips from different web sources. The dataset consists of seven sets of data clips, such as, clear

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day, night, blur, disguise, dusty, foggy, and rainy. The proposed dataset will facilitate the research community to assess the performance of algorithms.

Published in: 2020 11th International Conference on Computing, Communication and Networking Technologies (ICCCNT)

Date of Conference: 1-3 July 2020

INSPEC Accession Number: 20063954

Date Added to IEEE *Xplore*: 15 October 2020

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Contents

I. Introduction

In recent days surveillance is a monitoring tool for combat with crimes. The aim of Close Circuit Television (CCTV) is to fight against the crime and different social offences by monitoring the scene under the surveillance. CCTV footage of crime area and its analysis are used in forensic for discovering clue to detect suspect [1]. Security systems are already installed at the important areas such as airports, offices, places of worships, shopping mall, border areas, and parking areas etc. [2]. Along with this security issues, video monitoring systems (such as CCTV) is used to reduce other crimes and social offenses in public areas. CCTV footage are also accepted as evidence in courts for prosecution [1] [3]. Video monitoring consists of one remotely mounted camera and an operator for monitoring the videos transmitted by the cameras to a screen of the base station. The operator has the twin responsibility of (i) giving due attention to all the video feeds from the camera and at the same time (ii) detecting suspicious activities of any objects carrying gun, thereby collecting evidence followed by informing appropriate authorities thereof [4]. It is a challenging task for an operator to pay attention to all the videos. So, automation of suspicious object detection becomes imperative for achieving comprehensive security and surveillance system. Such an automated system is liable to raise the alarm or indication whenever any aberrant activity is encountered under CCTV surveillance, because of which the operator will prioritize his awareness on the video feed and will initiate appropriate action there on [4].

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Figures

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Fwd: Your paper #1570669658 ('Automatic Visual Gun Detection Carried by A Moving Person')

2 messages

Rajib Debnath <rajibdebnath.cse@gmail.com> Fri, Nov 6, 2020 at 10:15 AM
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Date: Sat, 31 Oct 2020 at 17:51
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Dear Mr. Rajib Debnath:

Congratulations - your paper #1570669658 ('Automatic Visual Gun Detection Carried by A Moving Person') for ICIIS'2020 for 15th IEEE ICIIS 2020 has been provisionally accepted for presentation in Signal and Image Processing track.

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Please correct all formatting errors, improve the quality of figures and tables and correct gramatical errors in your revised version of the paper, positively.

Comments by reviewers:

======= Review 1 =======

> *** Specific Details for Improvements (Text): Please indicate any changes that should be made to the paper if accepted

1.Some figures are of low resolution. Figures included in the manuscript must be of high resolution.
2.What happens if background is also moving along with the moving person? Will this method work with same efficiency?
3.Overall manuscript is good and can be accepted for presentation in ICIIS 2020 with few modifications suggested above.

> *** Relevance - scope: Relevance to the conference
Yes (1)

> *** Originality of the Work: Novelty, Methodology, Derivations & Proofs: Overall contribution to the research community

Good (4)

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Good (4)

> *** Presentation - clarity: Introduction, Research Methodology, Results
Sections and sub-sections, Formating according to IEEE Conference Proceedings, Equations, Figures, Paper Length, and English
Good (4)

> *** Overall Quality: Appropriateness of Title, Use of References, Technical Value, Abstract, Keywords and Conclusions
Good (4)

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> *** Specific Details for Improvements (Text): Please indicate any changes that should be made to the paper if accepted

1. Authors should include computational complexity and time analysis as compare to state-of-the-art approaches for better representation of their approach in term of required computation and space, as they claimed that their proposed work is complexity efficient.

> *** Relevance - scope: Relevance to the conference
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> *** Originality of the Work: Novelty, Methodology, Derivations & Proofs: Overall contribution to the research community
Average (2)

> *** Technicality: Is the paper technically sound?
Average (2)

> *** Presentation - clarity: Introduction, Research Methodology, Results
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Above Average (3)

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Dr. Subrahmanyam Murala,
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Rajib Debnath,
Ph.D Research Scholar,
Department of Computer Science & Engineering,
Tripura University (A Central University),
Suryamaninagar - 799022

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On behalf of Program Committee and Conference Organizers,
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SUBMISSION: 40
TITLE: Deep Classification of Gun Carried by Moving Persons Using Proposed TUVD-CSA Dataset

---------- REVIEW 1 ----------
SUBMISSION: 40
TITLE: Deep Classification of Gun Carried by Moving Persons Using Proposed TUVD-CSA Dataset
AUTHORS: Rajib Debnath and Mrinal Kanti Bhowmik

---------- Overall evaluation ----------
SCORE: 2 (accept)
----- TEXT:
The manuscript describes the classification of gun carried by the moving person. The authors used a convolutional neural network-based model and applied transfer learning to train the classification model based on the TUVD-CSA dataset. The authors have used holistic and RoI both types of input for classification.

The dataset is novel, but the approach is quite similar to the image classification approach. Authors have used transfer learning to train the model, which is most common in computer vision.

Overall the paper is written very well.
---------- Strength of submission ----------
1. ROI and Holistic based approach for gun classification.
2. TUVD-CSA dataset.
---------- Major Concerns on the manuscript ----------
Though authors have mentioned the gun classification approach is novel, it is very common in the object classification method in computer vision.

It is suggested to add the following changes to make the manuscript more sound.

1. Use Class Activation Mapping based approach to get more interpretability of the results.
2. show the model's convergence rate using learning curves and verify whether the model is overfitted or under fitted or good fitted.

---------- REVIEW 2 ----------
SUBMISSION: 40
TITLE: Deep Classification of Gun Carried by Moving Persons Using Proposed TUVD-CSA Dataset
AUTHORS: Rajib Debnath and Mrinal Kanti Bhowmik

---------- Overall evaluation ----------
SCORE: 1 (weak accept)
----- TEXT:
-The author(s) said that they implemented from scratch. They just have only shown the diagrammatic picture and that too in an abstract way. The work did not include any algorithm regarding their approach.
---------- Strength of submission ----------
The topic of research is quite interesting.
---------- Major Concerns on the manuscript ----------

- Various holistic methods are applied but it is not shown how they applied and where they applied in the algorithm perspective.
- How authors supplied ROI to their approach aren't given.
- It is better to provide a link to their GUI or implementation to review it.
- The advantage of Layer freezing is not mentioned.

---------- REVIEW 3 ----------
SUBMISSION: 40
TITLE: Deep Classification of Gun Carried by Moving Persons Using Proposed TUVD-CSA Dataset
AUTHORS: Rajib Debnath and Mrinal Kanti Bhowmik

---------- Overall evaluation ----------
SCORE: -2 (reject)
----- TEXT:
The work is not novel, no significant contribution is there and should be rejected.
---------- Strength of submission ----------
The authors of the paper titled "Deep Classication of Gun Carried by Moving Persons Using Proposed TUVD-CSA Dataset" have proposed a CNN based frame work for real-time scene detection where person with gun appears. The authors have created a dataset, namely Tripura University Video Dataset for Crime Scene Analysis (TUVD-CSA), and have compared the existing state-of-the art classification techniques based on CNNs architecture using that dataset. The idea is interesting and the paper is well presented.
.
---------- Major Concerns on the manuscript ----------
Though the paper presents an interesting idea, it has the following flaws-

1. Authors have claimed that there are few gun detection techniques with CNN exists. If it is true, there are many more existing techniques with CNN exists to detect various objects. Please justify that why those techniques will not be suitable for gun detection.
2. The authors have created the dataset TUVD-CSA, the validation process of which is not explained properly. How it can be justified that 25 clips are sufficient?
3. Feature extraction process is not explained.
4. The performance should be compared on some benchmark dataset also.
5. The work don't have any promising novelty.
6. Why Softmax function is used instead of ReLu?
7. How ROI is extracted from the source image?
8. Only ROI is not sufficient to identify an object. What about toy gun?

--

Rajib Debnath,
Ph.D Research Scholar,
Department of Computer Science & Engineering,
Tripura Universitry (A Central University),
Suryamaninagar - 799022

3. Algae - and bacteria - driven technologies for pharmaceuticals remediation in wastewater.

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Algae- and bacteria-driven technologies for pharmaceutical remediation in wastewater

Mamta[a,*], Shashi Bhushan[a,b,*], Mohit Singh Rana[a], Shaon Raychaudhuri[c], Halis Simsek[b], and Sanjeev Kumar Prajapati[a]

[a]Environment and Biofuel Research Lab, Department of Hydro and Renewable Energy, Indian Institute of Technology (IIT) Roorkee, Roorkee, Uttarakhand, India, [b]Agricultural and Biosystems Engineering, North Dakota State University, Fargo, ND, United States, [c]Department of Microbiology, Tripura University, Agartala, Tripura, India

1 Introduction

Pharmaceuticals are drugs used to treat, diagnose, and help in preventing animal and human diseases. Various new and more effective pharmaceuticals are being developed in order to meet the ever-increasing demand worldwide. In a study conducted by the IMS Institute for Healthcare Informatics, global medicine consumption is predicted to be 4.5 trillion by 2020 (Aitken & Kleinrock, 2015). With the excessive production and subsequent usage of pharmaceuticals, these compounds are inevitably being released into waste streams. Pharmaceutical compounds enter the environment through hospital effluents, industrial discharges, agricultural runoff, and human as well as animal excreta (Zhang et al., 2016). Additionally, unused and discarded drugs eventually get into the ecosystem due to mishandling (Rogowska, Zimmermann, Muszy, Ratajczyk, & Wolska, 2019). The fate of the pharmaceutical compound is illustrated in Fig. 15.1. Hospitals are one of the leading sources of pharmaceutical contaminants. Hospital effluents include active drugs, their metabolites, expired pharmaceuticals, hazardous chemicals, solvents, disinfectants, and heavy metals (Tiwari et al., 2017). These contaminates have an inherent property to interact with living systems. They can remain in nature for a long time without any deterioration and have high mobility in the

[*] These authors contributed equally to the work.

Removal of Toxic Pollutants Through Microbiological and Tertiary Treatment. https://doi.org/10.1016/B978-0-12-821014-7.00015-0

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Landslide Susceptibility Mapping Using Geo-statistical Method for Kohima, Nagaland

Kedovikho Yhoshü[1] and Y.V. Krishnaiah[2*]

[1] Department of Geography
Nagaland University, Lumami, India, Nagaland-798627

[2] Department of Geography
Tripura University, Agartala-799022

Corresponding mail* : yvkrishna09@gmail.com

Abstract

Landslide is a resultant between interactions of various factors such as geological, geomorphologic and meteorological factors. Factors like landuse land cover, lithology, lineament, drainage, road, aspect and slope have been considered as thematic layers for estimating and mapping landslide susceptibility in this study using geo-statistical method. The present study implores the usage of high resolution satellite data for deciphering landslide. The causative factors along with landslide were incorporated to generate a landslide susceptible map. The landslide susceptibility map was categorised from low to very high susceptible zone. Low landslide susceptible zone covered an area of 3.65 km^2, moderate landslide susceptible zone was 4.49 km^2, high landslide susceptible zone was 4.21 km^2 and very high landslide susceptible zone encompassed a total area of 1.68 km^2.

Keywords: Landslide, geo-statistical, landslide susceptibility, Kohima

Queries in the Structure of Language

Editor
Tariq Khan

Central Institute of Indian Languages
&
Linguistic Society of India

CENTRAL INSTITUTE OF INDIAN LANGUAGES
Manasagangotri, Mysuru, Karnataka, India, 570006

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Message
Director, Central Institute of Indian Languages

The Central Institute of Indian Languages (CIIL) works for the promotion of Indian languages and provides assistance and advice to the Central and State Governments in matters related to language. This Institute has also been the leading centre for research in various areas of Linguistics. Established in 1969, CIIL has a glorious history of five decades during which it has developed as a hub of activities focusing teaching-learning and research on Indian languages. A scholar working on any aspect of language/linguistics finds resonance with the on-going activities at CIIL. The year 2018 was special for CIIL as this year the Institute entered into the 50th year of its establishment. To commemorate this accomplishment, the Institute decided to celebrate 2018-19 as the Golden Jubilee Year. On this account, the Institute proposed to organize the 40th International Conference of Linguistic Society of India. The response was so overwhelming that the organizing committee decided to publish all such papers that met the standards and passed the scrutiny. I am glad that the decision and the efforts thereafter have culminated into the preparation of three collective volumes.

I am very sure that the readers, the reviewers and the contributors will find these volumes worthy of their time and efforts. The academic fraternity and administrative and support staff of the Institute have put in considerable efforts in preparing these volumes and they deserve for the same. I strongly believe that these volumes would set a new trend for ICOLSI events and create a benchmark for future linguists.

Best wishes

Prof. D. G. Rao
Director, CIIL

Acknowledgement

The editorial team would like to thank the Director, CIIL, the office bearers of LSI and the academic, administrative and support staff of various schemes and projects of CIIL for their relentless support.

Thanks are also due to the panel of anonymous reviewers whose keen observations and cheerful advice have immensely helped the authors in improving their papers qualitatively. The editorial team is pleased to mention with gratitude the constant academic inputs and moral support it received from the advisory committee.

The team engaged for proofing and copyediting tasks deserves special thanks for its meticulous efforts. The staff members of National Translation Mission merit a special acknowledgement of thanks. The untiring efforts of Ms Gayathri Nataraj, the outstanding support of Dr Soibam Rabika Devi & Dr Sunetra Sholapurkar in the form of proofing and the valued contribution of Ms Seethalakshmi M. L. through typesetting keep the editorial team in a debt of gratitude. Mrs Manjula Bevoor's contribution in the form of the illustrious cover designs is outstanding and is also acknowledged with thanks.

The editorial team would also like to place on record its heartfelt thanks to the committed staff of Printing and Publication Unit of the Institute, especially the Head, OiC, Shri H. Manohara, Shri Nandeesh R., and Shri M. N. Chandrashekar with whose prompt response we have been able to bring out this much–awaited book.

Editorial Team

Abbreviations

1P	first person
2P	second person
3P	third person
ABL	ablative
ABS	absolutive
ACC	accusative
ADJ	adjective
ADV	adverb(ial)
AGR	agreement
ALL	allative
ART	article
AUX	auxiliary
BEN	benefactive
CAUS	causative
CLF	classifier
COM	comitative
COMP	complementizer
COMPL	completive
COND	conditional
COP	copula
CVB	converb
DAT	dative
DECL	declarative
DEF	definite
DEM	demonstrative
DET	determiner
DU	dual
DUR	durative
ERG	ergative
EXCL	exclusive
F	feminine
FOC	focus
FUT	future
GEN	genitive
IMP	imperative
INCL	inclusive
IND	indicative
INDF	indefinite
INF	infinitive
INS	instrumental
INTR	intransitive
IPFV	imperfective
LOC	locative
M	masculine
N	neuter
NPST	nonpast
NEG	negation, negative
NOM	nominative
OBJ	object
OBL	oblique
PASS	passive
PFV	perfective
PL	plural
POSS	possessive
PRED	predicative
PRF	perfect
PROG	progressive
PROH	prohibitive
PRS	present
PST	past
PTCP	participle
Q	question particle/marker
RECP	reciprocal
REFL	reflexive
REL	relative
SBJ	subject
SBJV	subjunctive
SG	singular

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Social Movements

Concepts, Experiences and Concerns

Edited by

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Globalization and New Religious Movements

Rajeev Dubey

LEARNING OBJECTIVES

After reading this chapter, you will be able to

- Explain the concepts of NRMs and globalization and understand their relationship
- Describe the 'newness' of NRMs
- Differentiate between the 'old' and 'new' religious movements
- Understand and appreciate the global circumstances which necessitate and facilitate the rise and growth of NRMs

INTRODUCTION

It has been widely believed in the sociological parlance that with the advancement of science and rationality, the influence of religion will decline. Contrary to the prophecy of the modernization theory envisioning the decline of religion, it has been found that the test of reality eludes these prophecies, and evidence suggests otherwise. The worldwide spiritual enthusiasm and religious resurgence of the 1950s and thereafter in the form of cults and gurus, proliferation of religious channels on television, and an increasing inclination towards alternative religious life are referred in sociological parlance as 'new

Kukis in Tripura : A Glimpse

Dr. Anjana Bhattacharjee

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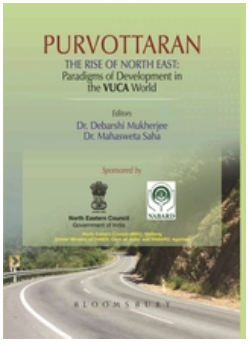
Purvottaran

The Rise of North East

By: Debarshi Mukherjee, Mahasweta Saha



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About Debarshi Mukherjee

Debarshi Mukherjee is an alumnus of Visva Bharati, Santiniketan (A Central University) and Banasthali Vidyapith, Rajasthan. He is an Associate Professor and Head of the Department of Business Management, Tripura University (A Central University). His... Read more

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Dr. Nirmal Sundar Mishra Felicitation Volume

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Edited by

Dr. Sashibhusan Mishra

Assistant Professor (Senior Grade)

Department of Grammar

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Edited by

Dr. Sashibhusan Mishra (M.A., Ph.D., D.Lit.)

(Recipient of Presidential (2009), Bharata Mata (2014), Ganesh Pratima (2015) & Rashtriya Gaurav (2016) Awards)

Assistant Professor (Senior Grade)

Department of Grammar

Sri Sitaram Vaidic Adarsha Sanskrit Mahavidyalaya

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बौद्धों की दृष्टि में भगवान श्रीजगन्नाथ : एक पर्यालोचन

डॉ. देवराज पाणिग्राही

भूमिका : - श्रीनीलाचलधाम में अधिष्ठित त्रिमूर्ति श्रीजगन्नाथ, बलभद्र तथा सुभद्रा आदि देवों में से श्रीजगन्नाथ हिन्दू धर्म का या बौद्ध धर्म के प्रमुख आराध्य देव माने जाएँ कि नहीं, आजतक सन्देह के घेरे में है ये, परन्तु कुछ शास्त्रीय प्रत्नतात्त्विक, पौराणिक तथा कायिक प्रमाण हमें इस विषय में शोचने के लिये यथासाध्य प्रेरित करता है। इन सब बातों को लेकर यहां एक संक्षिप्त चर्चा निम्न प्रकार है।

शास्त्रीय प्रमाण : - विभिन्न शास्त्रीय प्रमाणों के अनुसार 'श्रीजगन्नाथ' भगवान विष्णु के नवम अवतार माने जाते हैं, और उनका अपरनाम 'बुद्ध' भी माना जाता है। ख्रीष्टीय अष्टम शतक के प्रारम्भ में उड्र सम्राट इन्द्रभूति स्वरचित ज्ञानसिद्धि ग्रन्थ में आदि बुद्ध को सर्वप्रथम श्रीजगन्नाथ जी के नाम से अभिहित कर के प्रणिपात कर रहे हैं। जैसे -

प्रणिपत्य जगन्नाथं सर्वजीनवरार्च्चितम्,
सर्वबुद्धमयं सिद्धिं वापीनं गमनोपमम्।
सगुरु: शिष्य सद्ग्राही सर्व बुद्धानुकारक:,
इत्युवाच जगन्नाथो नान्यै वै गुरव: स्मृता:।।

प्राचीन बौद्ध पालिग्रन्थ एवं श्रीमन्दिर गात्र से मिली भगवान विष्णु की प्रतिमूर्ति प्रमाणित करती है कि, बुद्ध एवं विष्णु, दोनों ने २४ बार अवतार लिया था। इस के अतिरिक्त श्रीमन्दिर के पश्चिम पार्श्वस्थ चूडा में विदित आसीन बुद्ध, विष्णु के २१ तम अवतार के रूप में विद्यमान हैं।

प्रत्नतात्त्विक प्रमाण : - पुरी में श्रीजगन्नाथ जी स्वयं अवस्थापित होने से पहले वे नीलमाधव के रूप में शबरों के द्वारा पूजित होते थे। उनका मूल अवस्थान महानदी के किनारे पर अत्यन्त दूर्गम स्थान पर होता था। सोनपुर, बौद आदि स्थान से लेकर चौद्वार तक महानदी के किनारे पर जो बौद्ध स्थापत्य मिलता है, वह सब भञ्जवंशीय राजाओं की पृष्ठपोषकता के द्वारा हुआ है, ऐसा अनुमान लगाया आ सकता है। हुएन्सां

ঈশ্বরচন্দ্র বিদ্যাসাগর

দুইশো বছরের নিঃসঙ্গ পথিক

সম্পাদনা

নির্মল দাশ-রূপশ্রী দেবনাথ

ঈশ্বরচন্দ্র বিদ্যাসাগর
দুইশো বছরের নিঃসঙ্গ পথিক

ISWARCHANDRA VIDYASAGAR : DUISHO BACHARER NISWANGA PATHIK

(a Collection of essays on Iswarchandra Vidyasagar)

By : Dr. Nirmal Das & Dr. Rupasree Debnath

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প্রচ্ছদ	ঃ	রঘুনাথ সরকার
গ্রন্থস্বত্ত্ব	ঃ	ঝর্ণা দাশ
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সূচিপত্র

বিধবাবিবাহ আন্দোলনের আলোকবর্তিকায় মনীষী বিদ্যাসাগর
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সুব্রত রায়

চিরনমস্য ও প্রাতঃস্মরণীয় ঈশ্বরচন্দ্র বিদ্যাসাগর (১৮২০-১৮৯১) সমগ্র বঙ্গদেশ তথা ভারতবর্ষের ইতিহাসে এমন এক বিরল ব্যক্তিত্ব ও স্মরণীয় নাম যাঁর সম্পর্কে প্রভূত আলোচনার পরেও অন্তহীন অতৃপ্তিতে ভরে থাকে মানুষের মন, সমালোচকের আকাঙ্ক্ষা অনিবারণীয় থেকেই যায়। তাই তাঁকে নিয়ে আলোচনার অন্তিমে তাঁকে শ্রদ্ধা জানানোর ভাষা খুঁজে পান না বিদগ্ধ পণ্ডিত মহল। তাইতো তিনি বহু আলোচিত, বিশ্ব বন্দিত, বহু পঠিত, বহু চর্চিত একজন সর্বজনবিদিত অসামান্য মনীষী পুরুষ। তিনি একাধারে জ্ঞানী, গুণী, পণ্ডিত প্রবর, বিদ্বান, সাহিত্যিক, সমাজসেবী, সংস্কারক, দয়ার সাগর, কর্মবীর, করুণানিধান ও অক্লান্ত কর্মী তিনি। গর্বিত বাঙালি, যিনি পূজিত হয়েছেন বাঙালির ঘরে ঘরে, সাহিত্যের পাতায় পাতায়, তাঁর অক্ষয় আসন পাতা রয়েছে নারী সমাজের অন্তরের প্রকোষ্ঠে। অবাক বিস্ময়ে ও বিমুগ্ধ চিত্তে তাই তাঁকে স্মরণ করাকে বর্তমান কালে দাঁড়িয়েও আমাদের গর্বের ও কর্তব্যের কাজ বলেই মনে হয়। এই কর্তব্যের পরাকাষ্ঠা দেখাতে গিয়ে শ্রদ্ধেয় সমালোচক গোপাল হালদার মহাশয় বলেছেন, "তোমার কীর্তির চেয়ে তুমি যে মহৎ'— একথা উনিশ শতকের কীর্তিমান বাঙালিদের মধ্যে যাঁর সম্বন্ধে সবচেয়ে বেশি সত্য তিনি বিদ্যাসাগর।"[১] আমাদের মনে হয় অধ্যাপক গোপাল হালদারের এই অভিমত সর্বাংশে প্রযোজ্য।

এক একজন মানুষকে জনগণ যে ঐকমত্য হয়ে তাদের মনের মতো এক একটি অভিধা দানে ভূষিত করে তা কখনও অকারণে ঘটে না। এই আখ্যা দানের মধ্যে তাৎপর্য থাকে তা সামান্য নয় এবং যাকে সেই সম্মান প্রদান করা হয় তা তাঁর সর্বাপেক্ষা মহৎ চারিত্রিক গুণ ও বৈশিষ্ট্যের পরিচয় বাহক অবশ্যই হয়ে থাকে। গান্ধীজীকে যেমন সঙ্গত কারণেই 'মহাত্মা' বলে অভিহিত করা হয় কিংবা রামমোহনকে 'ভারত পথিক' এবং রবীন্দ্রনাথকে 'বিশ্বকবি', তেমনই ঈশ্বরচন্দ্রকে একাধারে 'বিদ্যাসাগর' ও 'দয়ার সাগর'

সুব্রত রায় : সহকারী অধ্যাপক, বঙ্গভাষা ও সাহিত্য বিভাগ, বঙ্গাইগাঁও কলেজ, আসাম।

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৬. তদেব,পৃষ্ঠা. ঐ

৭। ইন্দ্রমিত্র : করুণাসাগর বিদ্যাসাগর, আনন্দ পাবলিশার্স কলকাতা, ২০০৭, পৃষ্ঠা. ২৪২। এখানে 'গতে মৃতে' বলা হলেও কেউ কেউ এটিকে ''নষ্টে মৃতে'... বলেছেন।

৮। রামকৃষ্ণ ভট্টাচার্য : বিদ্যাসাগর নানা প্রসঙ্গ, চিরায়ত প্রকাশন কলকাতা ৭৩, ১৪১৮, পৃষ্ঠা. ৪৬।

৯। সন্তোষকুমার অধিকারী : বিদ্যাসাগর, রূপা অ্যান্ডকোং, কলকাতা, ১৯৭০, পৃষ্ঠা. ৬০

১০। ইন্দ্র মিত্র ঃ দয়ার সাগর বিদ্যাসাগর, আনন্দ পাবলিশার্স, অক্টোবর ২০০৭, পৃষ্ঠা. ৩১৬

১১। তদেব, পৃষ্ঠা. ঐ

১২। রামকৃষ্ণ ভট্টাচার্য : 'বিদ্যাসাগর : নানা প্রসঙ্গ', চিরায়ত প্রকাশন, কলকাতা ৭৩, ২০১১, পৃষ্ঠা. ১০১.

১৩। তদেব, পৃষ্ঠা. ১০২, আলোচ্য রচনাটি 'বঙ্গশ্রী ১', ৬ শ্রাবণ ১৩৪০ এর সংখ্যায় রয়েছে।

১৪। তদেব,

১৫। তদেব, পৃষ্ঠা. ১০২

১৬। রামমোহন রচনাবলী (প্রধান সম্পাদক : ডক্টর অজিত কুমার ঘোষ) হরফ প্রকাশনী, কলকাতা ৭, ১৯৭৩, প্রবন্ধ : 'প্রবর্ত্তক ও নিবর্ত্তকের দ্বিতীয় সম্বাদ' (১৮১৯), পৃষ্ঠা. ২০২

১৭। দ্রষ্টব্য ১০নং উল্লেখপঞ্জি, পৃষ্ঠা. ১৮৭

১৮। তদেব, পৃষ্ঠা. ১৮৮

১৯। দ্রষ্টব্য ১০নং পদ্দ টীকা, পৃষ্ঠা. ২৩৭-৩৮

২০। দ্রষ্টব্য ১০নং উল্লেখপঞ্জি, পৃষ্ঠা. ৪১২

২১। দ্রষ্টব্য ১০নং পাদটীকা, পৃষ্ঠা. ৪১৭

২২। তদেব, পৃষ্ঠা. ঐ

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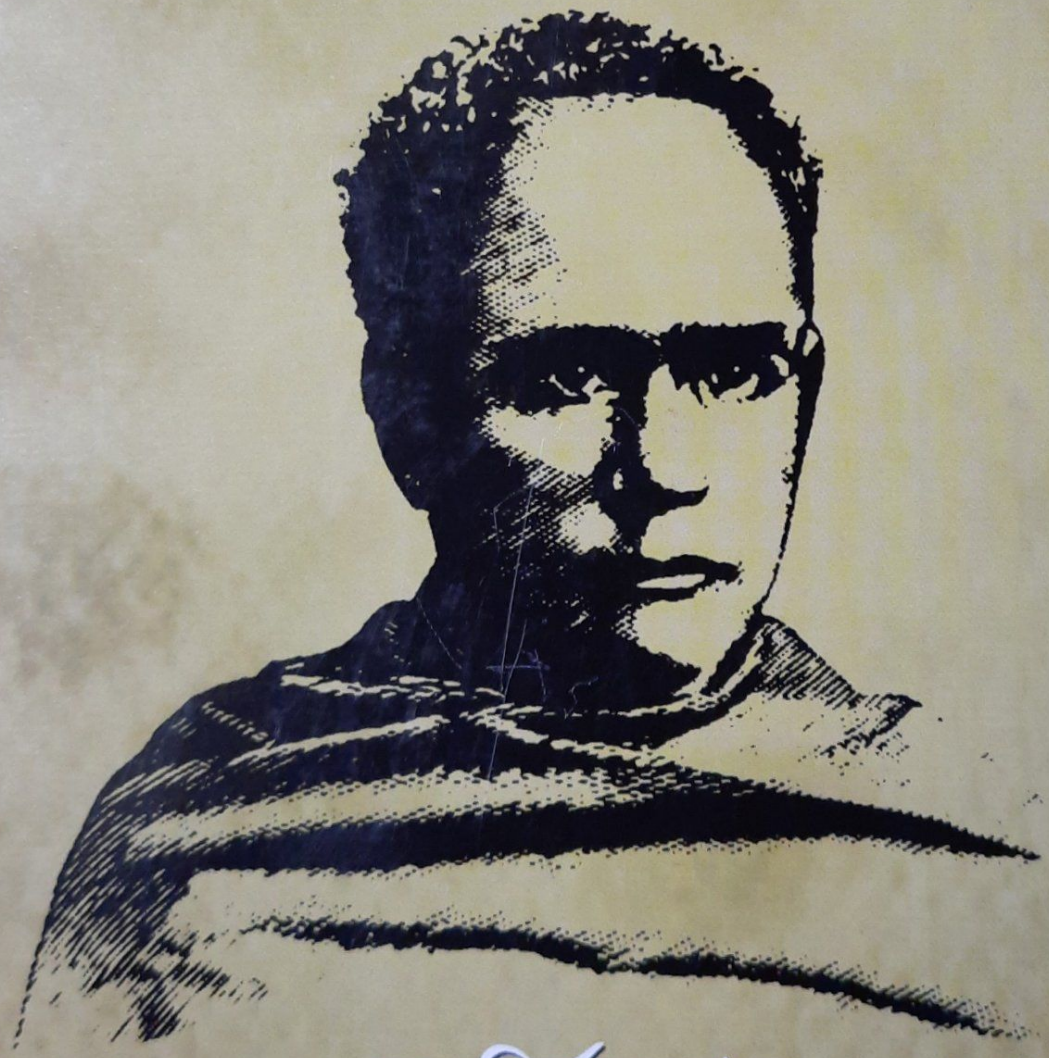

ড. নির্মল দাস

punnyasloke Iswarchandra
by
Dr. Nirmal Das
(a collection of short biography on vidyasagar)
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অক্ষর সংস্থাপন ও মুদ্রণ ঃ ক্যাক্সটন প্রিন্টার্স, জে বি রোড, আগরতলা, ত্রিপুরা

□

অক্ষর পাবলিকেশনস্-এর পক্ষে শুভব্রত দেব কর্তৃক জগন্নাথবাড়ি রোড, আগরতলা, ত্রিপুরা এবং ২৯/৩, শ্রীগোপাল মল্লিক লেন, কলকাতা-১২ থেকে একযোগে প্রকাশিত।

আগরতলায় নিজস্ব বিক্রয় কেন্দ্র : অক্ষর জগন্নাথবাড়ি রোড,
আগরতলা, ত্রিপুরা-৭৯৯০০১
কলকাতা কেন্দ্র : ২৯/৩, শ্রীগোপাল মল্লিক লেন, কলকাতা- ৭০০০১২
১২ এ, বঙ্কিম চ্যাটার্জী স্ট্রীট, (দ্বিতল) কলকাতা - ৭০০০৭৩
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সার্বিক যোগাযোগ
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মূল্য □ ১৭৫ টাকা

।। ১ ।।

পশ্চিমবঙ্গের মেদিনীপুর জেলার বীরসিংহ গ্রাম। সেখানে ঠাকুরদাস বন্দ্যোপাধ্যায় ও ভগবতী দেবীর সংসার। অতি দরিদ্র এই পরিবার। এমনই পরিবারে ১৮২০ সালের ২৬ সেপ্টেম্বর ঈশ্বরচন্দ্রের জন্ম হয়। কুলীন ব্রাহ্মণের পরিবার। পরিবারটি বংশানুক্রমে বিদ্যাচর্চায় উন্নত। বিদ্যাসাগরের প্রপিতামহ ছিলেন হুগলি জেলার বনমালীপুর গ্রামের লোক। তাঁর নাম হল ভুবনেশ্বর বিদ্যালঙ্কার। তাঁর পাঁচ ছেলে, যথাক্রমে : নৃসিংহরাম, গঙ্গাধর, রামজয় পঞ্চানন, রামচরণ। ভুবনেশ্বর ছিলেন সংস্কৃতজ্ঞ পণ্ডিত। তাঁরই তৃতীয় পুত্র রামজয় তর্কভূষণ হলেন ঈশ্বরচন্দ্রের পিতামহ।

ভুবনেশ্বর প্রয়াত হলে তাঁর বড়ো দুই ছেলে নৃসিংহ ও গঙ্গাধর সংসারের দায়িত্ব নিজেদের কাঁধে তুলে নেন। কিন্তু নানা পারিবারিক অশান্তি সৃষ্টি হতে থাকে। ফলে সংসার ভাঙতে শুরু করে। সাংসারিক অশান্তির কারণে রামজয় একদিন সব কিছু ফেলে নিরুদ্দেশ হয়ে গেলেন। অথচ সংসারে রয়ে গেছে তাঁর স্ত্রী দুর্গা, দু'জন ছেলে ও চার মেয়ে। পরিস্থিতি এমনই ঘোরালো হয়ে উঠল যে, দুর্গা তাঁর সন্তানদের নিয়ে বেশিদিন আর এই সংসারে টিকতে পারলেন না।

স্বভাবতই, সন্তানদের নিয়ে দুর্গা বীরসিংহ গ্রামে তাঁর বাপের বাড়িতে চলে এলেন। দুর্গার সংগে রয়েছে দুই পুত্র ঠাকুরদাস আর কালিদাস এবং চার কন্যা মঙ্গালা, কমলা, গোবিন্দমণি, অন্নপূর্ণা। দুর্গার পিতৃদেবও পণ্ডিত ব্যক্তি ছিলেন। তাঁর পিতা হলেন উমাপতি তর্কসিদ্ধান্ত। কিন্তু তাঁর বার্ধক্যের কারণে সংসারের দায়িত্ব সামলাচ্ছিলেন তাঁরই পুত্র এবং পুত্রবধূ। কিন্তু ভাই এবং ভাই-বউ, দুর্গা ও সন্তানদের ভরণপোষণের দায়িত্ব নেবেন কেন? এনিয়ে অশান্তি শুরু হতে লাগল।

উমাপতিও বিষয়টি বুঝতে পারছিলেন। তিনি বাড়ি থেকে সামান্য দূরে মেয়ে ও তাঁর সন্তানদের থাকার জন্য একটা কুঁড়ে ঘর বানিয়ে দিলেন। এখানেই দুর্গার সংসার শুরু হল। তিনি নিজে সুতো কাটতেন আর মাঝে মাঝে উমাপতি কিছু সাহায্য করতেন। কিন্তু এভাবে

১১। অসিতকুমার ভট্টাচার্য :
অক্ষয়কুমার দত্ত এবং উনিশ শতকের বাংলায় ধর্ম ও সমাজ চিন্তা, কলকাতা ২০০৭
১২। আশীষ লাহিড়ী :
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১৩। তাপস ভৌমিক (সম্পাদিত) :
বিদ্যাসাগর ও অন্যান্য ব্যক্তিত্ব, কোরক, কলকাতা ৫৯, জানুয়ারি ২০১৪
১৪। Songs of the Stormy Petrel :
Complete works of Henry Louis Vivian Derozio, Editors :
Dr. Abirlal Mukhupadhyay and others.
Published by Sri Kamal Mitra for Progressive Publishers,
Cal 73, February 2001.
১৫। অসিতকুমার বন্দ্যোপাধ্যায় :
বাংলা সাহিত্যে বিদ্যাসাগর, দে'জ পাবলিশিং, কলকাতা ৭৩, সংশোধিত পুণর্মুদ্রণ ২০০৫।
১৬। পল্লব সেনগুপ্ত :
অমিতা চক্রবর্তী (সম্পাদিত) : বিদ্যাসাগর একুশ শতকের চোখে, দি এশিয়াটিক সোসাইটি, কলকাতা ১৬, মে ২০০৩
১৭। গোলাম মুরশিদ :
আশার ছলনে ভুলি, আনন্দ পাবলিশার্স, কলকাতা ৯ চতুর্থ মুদ্রণ ২০১৩
১৮। প্রয়াণের শতবর্ষে বিদ্যাসাগর, সাহিত্য অকাদেমি, কলকাতা ৮৫, দ্বিতীয় মুদ্রণ, ২০০৫
১৯। আকাদেমি পত্রিকা (ষষ্ঠ সংখ্যা) পশ্চিমবঙ্গ বাংলা আকাদেমি, পশ্চিমবঙ্গ সরকার, মে ১৯৯৪।

ঈশ্বরচন্দ্র বিদ্যাসাগর
দুইশো বছরের নিঃসঙ্গ পথিক

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নির্মল দাশ রূপশ্রী দেবনাথ

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আগরতলা-৭৯৯ ০০১, পশ্চিম ত্রিপুরা

ঈশ্বরচন্দ্র বিদ্যাসাগর
দুইশো বছরের নিঃসঙ্গ পথিক

ISWARCHANDRA VIDYASAGAR : DUISHO BACHARER NISWANGA PATHIK

(a Collection of essays on Iswarchandra Vidyasagar)

By : Dr. Nirmal Das & Dr. Rupasree Debnath

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বাঙালির অন্যতম আইকন ঈশ্বরচন্দ্র বিদ্যাসাগর। [illegible] সংস্কার, কখনো রাজনৈতিক আঙিনায় তিনি [illegible] শাশ্বত বা আধুনিক দর্শন কোথাও তাঁকে [illegible] ফেলা যায় না। তবুও তিনি এখনও বাঙালি [illegible] করেন। বাঙালি আর্থ-সামাজিক প্রেক্ষাপটে [illegible] বহুমাত্রিক পর্যালোচনা করা হয়েছে এই সংকলনে। [illegible] সমাজ সংস্কারক, শিক্ষাবিদ, প্রকাশক ও [illegible] বিদ্যাসাগরের ভূমিকার আলোচনা করা হয়েছে। [illegible] শতাব্দীর সত্তর দশকে বঙ্গীয় 'নবজাগরণের' [illegible] বিদ্যাসাগরের তীব্র সমালোচনা ও মূল্যায়ন এই [illegible] করেছে। ফিরে দেখতে হবে তাঁর অবদান, [illegible] সীমাবদ্ধতাকে।

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দেবব্রত ঘোষ

বিদ্যাসাগর

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সম্পাদনা
দেবব্রত ঘোষ

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রবীন্দ্রনাথের দৃষ্টিতে বিদ্যাসাগর

রিন্টু দাস

রবীন্দ্রনাথ তাঁর *চারিত্রপূজা*-য় যে চরিত্রদের প্রতি শ্রদ্ধা নিবেদন করেছেন তাঁদের মধ্যে বিদ্যাসাগর অন্যতম একজন। রবীন্দ্রনাথ নিজের জীবনচরিত রচনা প্রসঙ্গে বলেছিলেন, "আত্মজীবনী লিখিবার বিশেষ ক্ষমতা বিশেষ লোকেরই থাকে, আমার তাহা নাই।"[১] তাছাড়া তিনি নিজের কবি-পরিচয়কেই বড়ো করে দেখেছিলেন। জীবনের সাধারণ সব ঘটনার মধ্য দিয়ে তাকে জানতে চাওয়া এক অর্থে বিড়ম্বনা বলে তাঁর মনে হয়েছে। আর তাই তাঁর প্রশ্ন, "কবিরে খুঁজিছ তাহারি জীবনচরিতে?"[২] আত্মজীবনী ও জীবনচরিত রচনার ক্ষেত্রে রবীন্দ্রনাথের সুনির্দিষ্ট কিছু বিধিনিষেধ ছিল। তাহলে প্রশ্ন, কাদের জীবনচরিত লেখা হবে? তারও উত্তর দিয়েছেন রবীন্দ্রনাথ: "যে মহাত্মা জীবনযাত্রার আদর্শ দেখাইয়াছেন তাঁহারই জীবনচরিত সার্থক; যাঁহারা সমস্ত জীবনের দ্বারা কোনো কাজ করিয়াছেন তাঁহাদেরই জীবন আলোচ্য।"[৩] তাঁর মতে, বিদ্যাসাগর সেইসব মহাত্মাদের মধ্যে অন্যতম, যিনি 'জীবনযাত্রার আদর্শ' দেখিয়েছেন। *চারিত্রপূজা*-য় 'বিদ্যাসাগরচরিত' দুটি পর্যায়ে আলোচিত হয়েছে। প্রথম অংশটি ১৩০২ বঙ্গাব্দের ১৩ শ্রাবণ বিদ্যাসাগরের স্মরণসভার বাৎসরিক অধিবেশনে এমারেল্ড থিয়েটার রঙ্গমঞ্চে তিনি পাঠ করেছিলেন। দ্বিতীয় অংশ ১৩০৫ বঙ্গাব্দে লিখিত হয়েছে। রবীন্দ্রনাথের দৃষ্টিতে বিদ্যাসাগরের যে চারিত্রিক মাহাত্ম্য ধরা পড়েছে তার স্বরূপ উপলব্ধি করতে গেলে আমাদের বিদ্যাসাগরের কর্মকাণ্ড ও কীর্তিকলাপের প্রতি আলোকপাত করতে হবে। পাশাপাশি, সামাজিক সংস্কার সাধন করতে গিয়ে সমাজের বিভিন্ন দিক থেকে যে বিরুদ্ধতার সম্মুখীন বিদ্যাসাগর হয়েছিলেন তার প্রতিও দৃষ্টি নিবদ্ধ রাখতে হবে।

সমাজকে যাঁরা নতুন করে গড়তে আসেন, যাঁরা সমাজকে বহুযত্নলালিত প্রাচীন সংস্কারের বন্ধন থেকে মুক্ত করতে উদ্যোগী হন, তাঁরা সমকালের থেকে

বাংলা ও সিন্ধি সাহিত্যে সুফি প্রভাব

সম্পাদনা
রিন্টু দাস
মলয় সেন

সূচিপত্র

পূর্বলেখ		
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PURVOTTARAN

THE RISE OF NORTH EAST:
Paradigms of Development in the **VUCA** World

Editors

Dr. Debarshi Mukherjee
Dr. Mahasweta Saha

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Training Needs Analysis for Increasing the Capacity of the Ministerial Staff under RD (Panchayat) Department: A Case in Tripura

Nirmalya Debnath[a*] and Sayanika Sengupta[b]

[a] *Assistant Professor, Department of Business Management, Tripura University, India*
[b] *Master's Student, Department of Business Management, Tripura University, India*
*E-mail: debnath.nirmalya@tripurauniv.in | *Corresponding Author*

Abstract

This research paper deals with the Training Needs Analysis for increasing the capacity of the ministerial staff under RD (Panchayat) department. In this study, we will get a glimpse of the problems that the ministerial staff is facing in the department due to a lack of training programs. The objective of thisstudy is to identify the training needs for the ministerial staff of the RD (Panchayat) departmentand also to design a training module by identifying the poorly performing areas. The study has been carried out by taking the interpersonal interviews with the ministerial staff withthe help of structured as well as an unstructured questionnaire. This research work has been carried out in Tripura. For collecting the data, District Panchayat Offices, Zilla Parishad, Panchayati Raj Training Institutions and some of the blocks of seven various districts have been visited. From this study, it has been found that the ministerial staff has not gone through any proper training until today and while doing work in the department in many areas they are facing the problem. So for that, it is very much required to provide them with training in the areas they are facing problems and they should be given refresher training every year.

Keywords: Training need, Rural department, Gram panchayat, Ministerial staff, Skill

Introduction

Training is necessary for each employee of the organization for developing and enhancing their skills. Proper training helps in improving the capability, capacity, and productivity of the individuals working in the organization. Training increases the productivity of the individual and organization both and helps to achieve the desired goal in a short period. Training needs analysis is the assessment that is needed to determine whether the training is required or not, without assessment if the organization will design a training program then they can miss out on some points the staff needs to go through. Training Needs Analysis exercise helps the newly recruited employees to learn quickly and also helps the old employees to brush up their knowledge. Training Needs analysis is done for improving the performance of the staff in the organization. Training Needs Analysis exercise will give exposure to the staff of getting wide experience in their work life. A trained person will provide better service to the organization than an untrained individual. Training will help the employees to adopt the changes in the organization quickly and the authority will get better outcomes from them.

PURVOTTARAN

THE RISE OF NORTH EAST:
Paradigms of Development in the **VUCA** World

Editors

Dr. Debarshi Mukherjee
Dr. Mahasweta Saha

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Factors that Influence Mobile Banking Behaviour of the Customers: A North East India Perspective

Dr. Nirmalya Debnath

Assistant Professor, Department of Business Management, Tripura University, debnath
*E-mail: nirmalya@tripurauniv.in | *Corresponding Author*

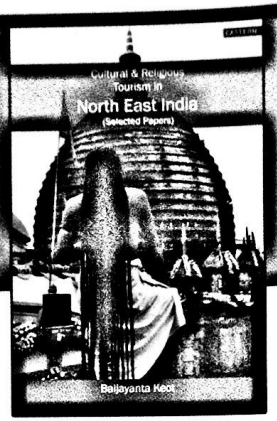
Abstract

Indian government for last several years trying hard to go cashless for reducing the level of corruption and make the citizens of the country feel to trust on the governance mechanism through the ethical and timely distribution of essential goods and services to the people. In terms of the distribution of financial services carried out by various private and public sector banks; internet technology has been playing a significant role in fulfilling the aim of cashless transaction. However, in the case of rural areas due to the unavailability or lack of availability of banking services facility; the mobile phone is playing a major role to connect with the banking services for undergoing financial transactions in less time and expenses. But the challenge lies in the mindset of the customers who had been undergoing a traditional mindset to avail the banking services in terms of their physical presence in the bank. Even though the rate of availing financial services through various banking channels is huge in number but in case of online banking especially when it comes to mobile; is quite negligible in percentage which is less than 3 per cent in the case of North East India (SBI, 2016). Banks are investing heavily in mobile banking technology to provide banking services ubiquitously. The adoption of mobile banking services might synergize the way people do banking today. It will not only save the time and cost of the users; rather it would suffice by providing some additional benefits like SMS alert, various scheme related information, booking of tickets, purchasing of goods and many more. However, if the banking customers do not realize the utility of such service; then it is very much essential to understand their views regarding this process of service delivery and to deeply analyze the psyche behind such behaviour; mostly to help the banking organizations to reap the benefit of investment in mobile banking services. It has been found that in the case of metropolitan cities the rate of adoption of mobile banking is higher as compare to tier 2 and tier 3 cities. In the present research tier 2 and tier 3 cities like Shillong (Capital of Meghalaya), Agartala (Capital of Tripura) and Silchar (Prominent business city in the state of Assam) which are belonging to The north-Eastern part of India has been considered. It is also require mentioning here that this region is very much isolated in its geographic location because the area is mostly based on a mix of tribal and non-tribal population and their views might differ with the people of the other part of the country. Hence to understand if there is any change of view prevails in the mind of such consumer belonging to this North-Eastern part of India; an attempt has been taken to find and analyse the factors responsible for the usage of mobile banking and also to understand if there is any difference in the behaviour towards mobile banking in terms of the various demographic profile of the users.

Keywords: Mobile banking, Cashless transaction, Mobile banking usage behaviour, North East India

The Book

Cultural and Religious Tourism in North East India- is a collection of selected research papers/ essays based on cultural and religious tourism in N E India. The contributors are deeply associated/ related with the domain of the themes of their respective papers. Tourism industry in North East India is expected to receive a positive addendum with the availability of this book. We hope that the chapters of the book would benefit the students of Tourism Management in Colleges and Universities of North East India. Native scholar's vision may unlock some hidden and untold stories related to particular place of tourists' interest. We are optimistic that both transitive and intransitive heritage of the indigenous people, their ethics and emotion would be justified once again. It is a moderate approach and leaves much space to rethink.



The Editor

Baijayanta Keot (b-1976), the founder Principal of Missamari Degree College, Missamari, is a poet, critic and researcher of folklore. He completed his Ph.D. in Folk Literature from Tezpur University. He also presented more than thirty research papers in National and International seminars and contributed in many publications of Social Sciences.

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Cultural & Religious Tourism in North East India

Keot

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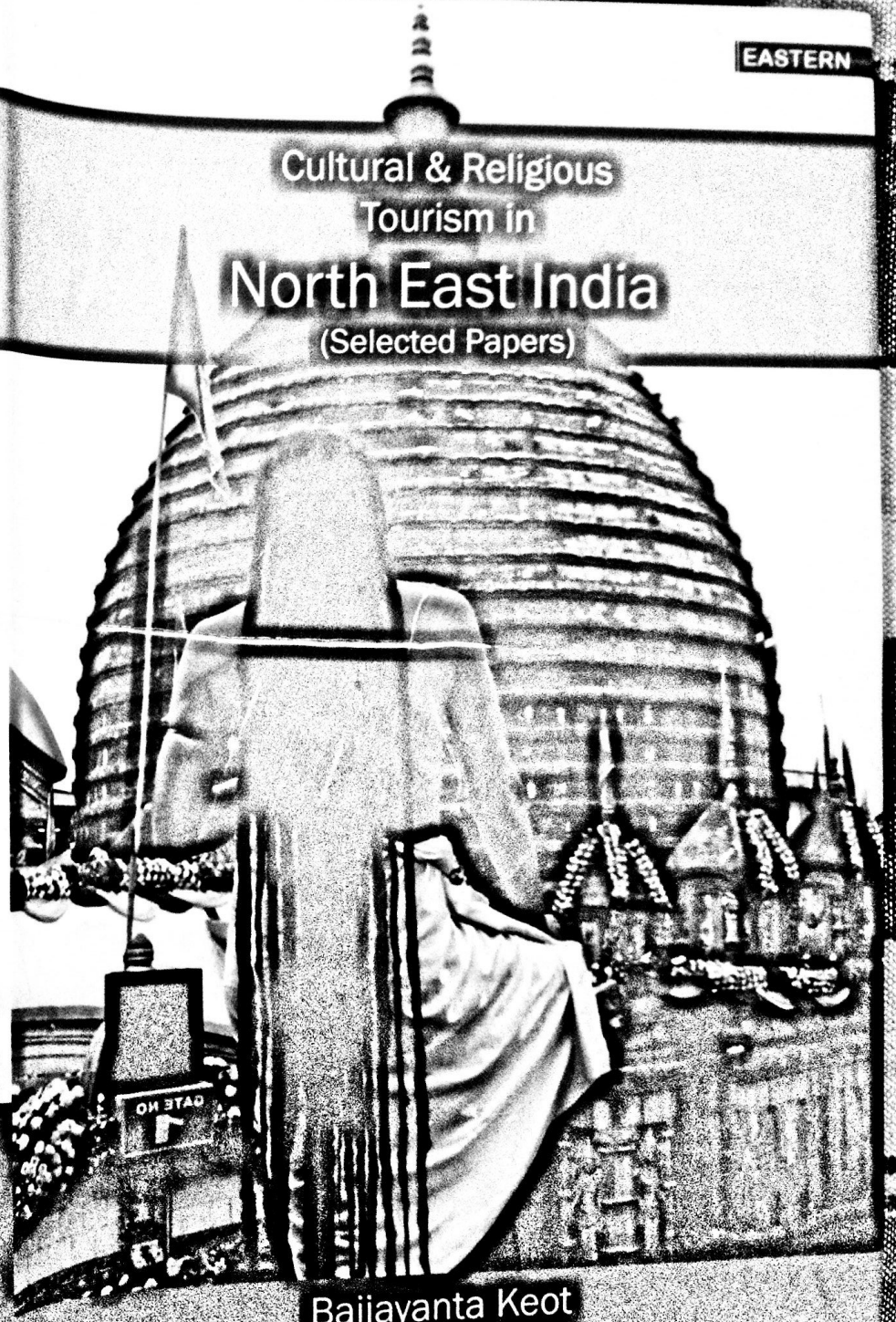
Cultural & Religious Tourism in North East India

(Selected Papers)



Baijayanta Keot

13

Brand Positioning Tourism in Tripura: Issues and Possibilities

Priyadarshi Bahinipati
Deepak Upadhyaya

Abstract

Tourism is an important socio-economic activity. It provides enormous scope for the economic development of a particular area. Tourism comprises the activities of persons traveling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business, and other purposes.Tourism planning in India started in the aftermath of independence. Concerted efforts have been made since then to make tourism a part of the planning process and evolve it as a tool of economic development in the Second, Third and Sixth Five Year Plans.North-East India, the easternmost region of India comprises the seven sisters states (Arunachal Pradesh, Assam, Manipur, Mizoram, Meghalaya, Nagaland, Tripura) and the Himalayan state of Sikkim. The region has a distinct culture and heritage of its own. It has been marred with several socio-political problems which retarded its all-round development in general and economic development in particular decades together after the independence of India. However, with ushering of the 21st century gradually the tempo of the progress and development is attaining the speed with the changing time and circumstances.Tripura was a princely state in the Indian Union and became a full-fledged state in 1972. Since the princely days of yore, Tripura is blessed with pilgrimage, archaeological and leisure tourism products. It is a conglomeration of Buddhist, Shakti, Saiva and several tribal religions and cults.

Keywords: *Tourism potential, skill development, Look East Policy, tourist destination, tourism environment, credible brand.*

The Book

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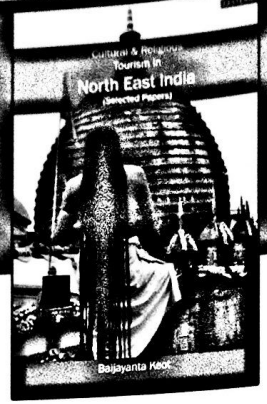

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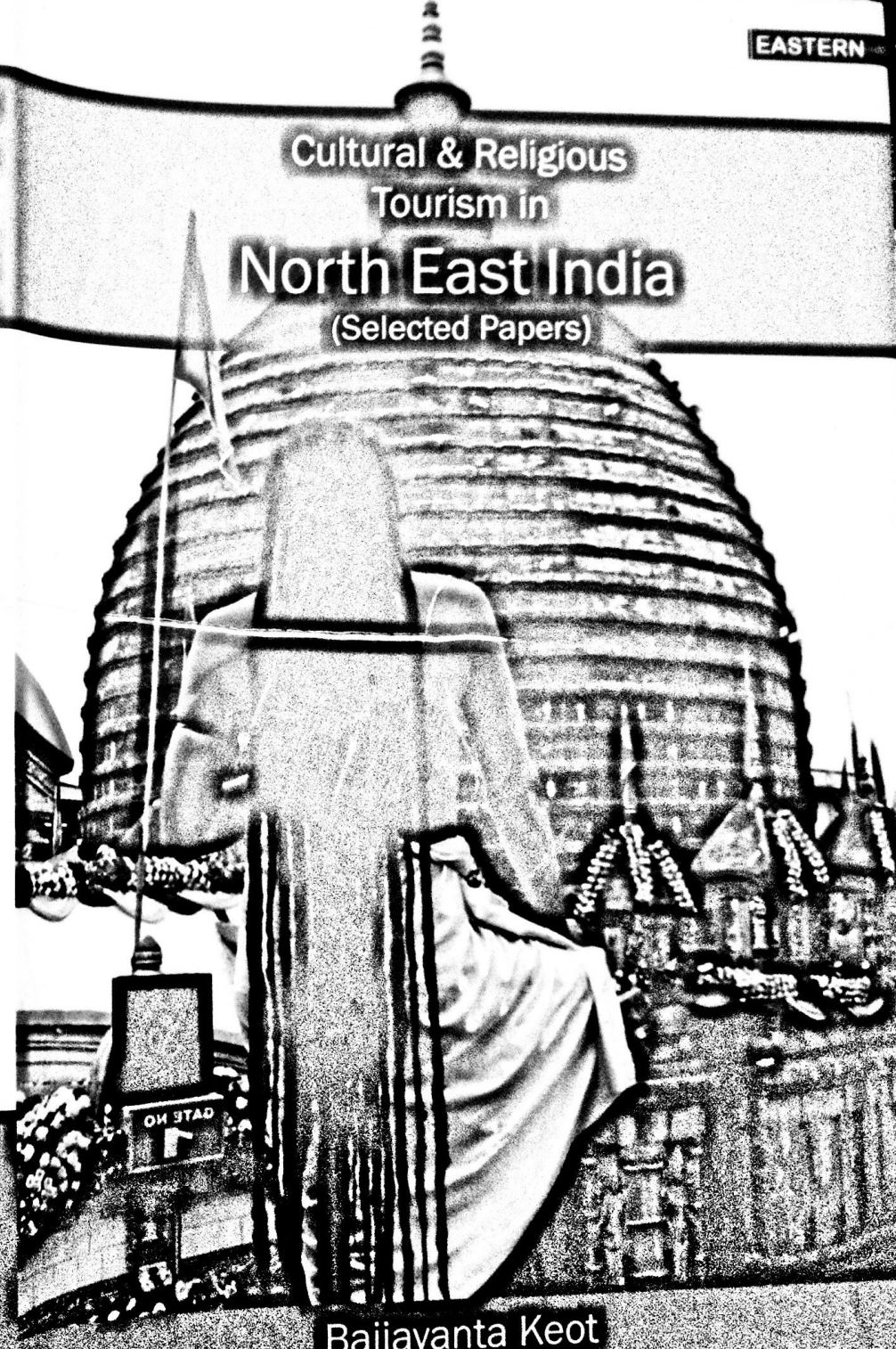

Baijayanta Keot

14

Jatra to Bhramyaman: The Journey of Mobile Theatre of Assam

Rashmi Das
Deepak Upadhyaya

Abstract

Assam is the most diversified state in India due to the long term migratory flow and for this reason; it presents a unique blend of ethnic and linguistic elements. The main objective of this study is to look into the transformation of *Jatra to Bhramyaman* theatre of Assam. This study tries to look at how theatre played a vital role in asserting the identity of the Assamese people. It will try to situate theatre in that period and how it brought a change in the lives of the Assamese people. The research methodology used in this study is a qualitative one. The method employed in this study is the ethnography method. The travelling theatre of Assam was not solely an Assamese theatre-drama group in the beginning. It emerged from the Bengali *Jatra* and gradually came into existence in the form of the biggest entertainment industry of Assam.

Keywords: *Assam, Jatra, Bhramyaman, Identity, Identity Assertion, Transformation.*

Introduction

Assam is situated in the extreme northeastern part of the country. The state is bounded by Bhutan and Arunachal Pradesh in the north, Nagaland, and Manipur in the east, Mizoram and Meghalaya in the south and Bangladesh and West Bengal in the west. Diversified in nature, Assam has been the hub of culture and performing arts for ages. The rich and sundry culture of Assam has always

India as a Tourist Destination in the South-Asian Region

Paramita Saha[a*] and Maumita De[b]

[a] *Associate Professor, Department of Economics, Tripura University*
[b] *Research Scholar, Department of Economics, Tripura University*
*E-mail: ectups@gmail.com; mau29maumita@gmail.com | *Corresponding Author*

Abstract

In countries with large population domestic tourism forms the basis of a sustainable and viable tourism industry. However, international tourism has potential to grow because of growing interest in intangible cultures of different countries. This paper notes that India is located in the South Asian region and shares the common culture and history of the region. Also a number of countries in this region have utilized tourism more effectively for economic development and employment creation. To develop a country through tourism, it needs to be developed strategically for regional cooperation. The objective of the paper is to develop a strategy for tourism development initiatives in India. The carrying capacity of a tourist destination and tourism impact are important for designing a strategy for cooperation among a group of countries. Thus, the index of tourism intensity is calculatedfor the eight South Asian countries to understand the impact of inflow of tourists in these countries. Tourist penetration rate is calculated to measure the carrying capacity of a destination.To identify the scope of destination development in India with respect to the countries of South Asian region, tourist penetration rate is calculated over time.

Keywords: *Tourism intensity, Tourism penetration, Regional cooperation, Destination, Strategy*

Introduction

India is a land of varied landscapes from northern range of hills to great plains,pleatues, deserts, coastal areas and islands. The country offers a wide-range of tourist destinations to cater to different types of tourist interests. The nature seeking tourist has a huge opportunity of enjoying natural beauty in hills, valleys and forests. The country has a rich historical and cultural heritage. Numerous places of religious, historical and culturalsignificanceattract tourists having historical and cultural interests and tourists on pilgrimage.India is the largest country in this regionwhich comprises of Pakistan, Nepal, Bangladesh, Bhutan, Maldives, Iran, Sri Lanka in addition to India as per UNWTO classification.India has a shared culture and history with the South Asian countries. This makes India a potentially attractive tourist destination for South Asian tourists. The South Asian countries have a common culture whichattracts tourist inflow in India from other South Asian countries. Many countries in this region havedeveloped their economy through tourism activity and India may benefit from tourism as well. It is noted in the literature that tourism growth in one regionpositively influences tourism development in the neighboring regions (Silva, Herrera, Rosina, Barranco, Schiavina, 2018).

Free Space Optical Communication Channel Modelling with PIN Receiver

Suman Debnath, Bishanka Brata Bhowmik and Mithun Mukherjee

Abstract Free space optical (FSO) communication is a mode of optical communication, where the data transmission channel is established via free space, rather using conventional optical fibre in optical communications. The transmission uses the free space (e.g. air) as the medium, a low-power light amplification by stimulated emission of radiation (LASER) as a transmitter and a semiconductor as the receiver. As the channels in optical fibre communication (OFC) and FSO communication are different, the losses and noises are also different in both cases. The quality of optical signal transmission through wireless depends on the atmospheric characteristics, like rain, wind, snowfall, fog, temperature, sunlight, light from other sources and turbulence. The aim of this publication is to model the channel for the optical signals through the air by considering all the losses and noises over the medium. The noises in the receiver, e.g. shot noise and thermal noise, are also analysed with on–off keying and direct detection method and have shown the effects on the output electrical signal. Bit error rate (BER) versus distance is obtained considering the above noises and losses over the channel and at the receiver. Finally, a complete FSO system is simulated by combining both the channel losses and noises at receiver.

Keywords Free space optical communication · Channel modelling · Atmospheric losses · Turbulence · On–off keying · Pin photodetector · Receiver noise

S. Debnath (✉) · B. B. Bhowmik
Department of Electronics & Communication Engineering,
Tripura University, Suryamaninagar, Tripura 799022, India
e-mail: neel.debnath1@gmail.com

B. B. Bhowmik
e-mail: bishankabhowmik@tripurauniv.in

M. Mukherjee
Guangdong Provincial Key Lab of Petrochemical Equipment Fault Diagnosis,
Guangdong University of Petrochemical Technology, Maoming, China
e-mail: m.mukherjee@ieee.org

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1 Introduction

Free space optical (FSO) [1] communication or optical wireless communication (OWC) [2] is an advanced and low-cost communication technique in the modern era. This transmission overcomes several drawbacks in traditional data transmission system. For example, it omits the usage of wired channel, having high data rate (10 Gbps) with low bandwidth occupations and less link interference. This technique is a powerful alternative to radio frequency (RF) and optical fibre communication (OFC) [3].

In FSO communications, light amplification by stimulated emission of radiation (LASER) transmitters are used for high-speed communication, whereas light sources like light-emitting diodes (LEDs) are used as the transmitter for low speed (10 mbps). Typically, FSO communications operate in tera-Hertz (wavelength 800–1600 nm) unlicensed spectrum band. As a result, a huge bandwidth of light beam allows faster transmission. FSO technique widely used the line-of-sight (LOS) transmission. CAPANINA [4] is a project where a downlink transmission from a stratospheric platform of distance 60 km was established and a link length of 150 km established between two Hawaiian Islands [5]. In an indoor system, FSO can be possible with non-LOS transmission by reflecting the light from the wall to the receiver.

In addition, FSO communication provides an extreme security over data transmission as it uses a very narrow light beam and travels in a LOS path which is impossible to detect with a spectral analyser or RF meter. The receiver must be perfectly aligned to the beam, and the combination of transceiver must match with the system; then, the transmission path will be completed. In addition, FSO system (Fig. 1) exhibits the advantages of OFC systems, such as high data rate, no interference with the other electromagnetic wave like microwave, radio system and ease of installation. Moreover, the cost per bit is even lower than a traditional OFC system. On the other side of this technique, it is very much dependant on the quality of the medium, e.g. air. Bad weather degrades the transmission. The rain, wind, fog, sunlight or light from another source can affect the transmitted light beam and make it attenuated and noisy. Noises also add to the light beam due to the turbulence of air, and the loss due to it is called scintillation loss (fluctuation of the intensity). Beam wandering, beam broadening, and angle fluctuations are also caused due to turbulence [3]. As this system is LOS, objects, e.g. tree and building, in the path of the transmission also block the light beam to reach the receiver.

In this work, we study the effects of weather on the optical signal in FSO system. We have simulated the rain loss, fog loss, geometric loss and turbulence effects which cause a significant degradation to the FSO transmission quality.

In the case of the receiver, generally, two kinds of detectors are used in FSO system, PIN photodetector and avalanche photodetector (APD). These detectors also generate current noises while receiving the optical signals. The noises are shot or quantum noise, thermal or Johnson noise and dark current (exclusively in APD). So the quality of electric signal retrieved from optical signal also depends on the quality of the receiver. Here, in this work, we use a PIN photodetector.

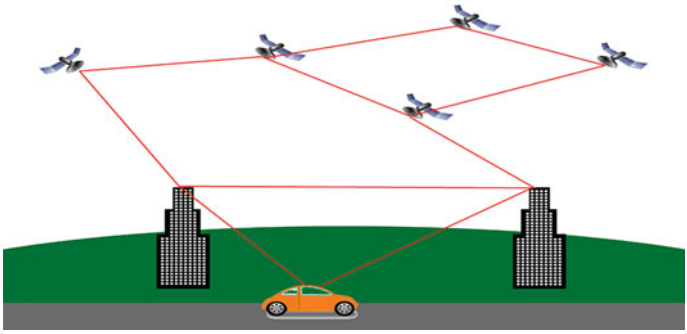

Fig. 1 A typical FSO communication system

1.1 Contribution

The objective of the paper is to study a complete FSO system combining the effects of all the losses and noises over the channel as well as at the receiver. FSO communication has been studied extensively and has simulated the noise effects on the optical signal, but we tried to combine all the atmospheric loss and noises in the receiver end and simulate the final electrical output of the whole FSO communication system. The rest of the paper is organised as follows. Section 2 discusses the losses and noises over the channel. The losses and noises at the receiver are presented in Sect. 3. The simulation results are shown in Sect. 4, and the conclusion is drawn in Sect. 5.

2 Losses Over the Channel

Losses in the atmosphere play a vital role in the degradation of the FSO transmission. The attenuation mainly occurs by scattering and absorption of light. In this work, we model the channel considering the rain loss, snow loss, geometric loss and scintillation loss.

2.1 Geometric Loss

The geometric loss is a transmission loss due to the deviation of light. This loss depends on the diameter of both transmitter and receiver and the angle of deviation.

So, more field of view (FOV) results in more geometric loss. This loss is independent of the weather conditions of atmosphere and is expressed as [6]

$$P_{\text{geo}} = -20 \log \left[\frac{d_{\text{receiver}}}{d_{\text{transmitter}} + (l \times \theta)} \right] \tag{1}$$

where P_{geo} is the geometric loss (in dB), d_{receiver} and $d_{\text{transmitter}}$ are the receiver and transmitter diameters (in m), respectively, l denotes the length of the link (in m), and θ represents the angle of beam FOV (in rad).

2.2 Turbulence and Scintillation Loss

Different studies are done, and various theoretical models have been proposed on signal degradation and intensity fluctuation due to turbulence [7–16]. The turbulence (C_n^2) occurs due to simultaneous changes in pressure, temperature and velocity in the air. Generally, the turbulence ranges from 10^{-13} to 10^{-16} $\text{m}^{-2/3}$ [17]. Due to the turbulence, the molecules distribute randomly, and as a result, the light beam has to face a fluctuation in its intensity which is called scintillation. The scintillation variance is expressed as [18]

$$\sigma_s^2 = 23.16 \; C_n^2 \, K^{7/6} \, L^{11/6} \tag{2}$$

where C_n^2 is turbulence ($\text{m}^{-2/3}$), $K = 2\pi/\lambda$ is optical wave number, and L is the link distance (in m). The above calculation is based on the spectrum of the refractive index fluctuation by Kolmogorov [19].

2.3 Fog Loss

Theoretically, the fog attenuation on light is based on Mie scattering [20]. But the popularly used two models to determine the fog loss are Kim model and Kurse model [21]. These models are based on the visibility of air through fog. The fog attenuation (in dB) is calculated as [6, 22]

$$P_{\text{fog}} = \frac{10 \log V_{\%}}{V} \left(\frac{\lambda}{\lambda_0} \right)^{-q}, \tag{3}$$

where $V_{\%}$ is percentage air drop transmission, V is visibility (in km), λ is transmitted light wavelength (in nm), λ_0 is visibility reference wavelength (in nm), and q is wavelength dependency.

The wavelength dependency expressed in both Kim and Kurse models, respectively, is as follows [6, 22, 23].

$$q = \begin{cases} 1.6 & \text{if } V > 50\,\text{km} \\ 1.3 & \text{if } 6\,\text{km} < V < 50\,\text{km} \\ 0.16V + 0.34 & \text{if } 1\,\text{km} < V < 6\,\text{km} \\ V - 0.5 & \text{if } 0.5 < V < 1\,\text{km} \\ 0 & \text{if } V < 0.5\,\text{km} \end{cases} \tag{4}$$

$$q = \begin{cases} 1.6 & \text{if } V > 50\,\text{km} \\ 1.3 & \text{if } 6\,\text{km} < V < 50\,\text{km} \\ 0.585V^{1/3} & \text{if } V < 6\,\text{km} \end{cases} \tag{5}$$

2.4 Snow Loss

Snow fall consists of two types of snows, namely dry snow and wet snow. Therefore, the snow loss is determined based on types of snow [21]. The snow loss (in dB/km) is calculated as

$$P_{\text{snow}} = a \times S^b \tag{6}$$

In the case of dry snow,

$$a = 5.42 \times 10^{-5}\lambda + 5.4958776 \quad b = 1.38 \tag{7}$$

and in the case of wet snow,

$$a = 1.023 \times 10^{-4}\lambda + 3.7855466 \quad b = 0.72, \tag{8}$$

where S is snow rate (in mm/h).

2.5 Rain Loss

Rain loss is also a significant attenuation in the FSO system. The loss (in dB) due to rain is calculated as [23]

$$P_{\text{rain}} = 1.076\,R^{2/3}, \tag{9}$$

where R is rain rate (in mm/h).

3 Noises in the PIN Receiver

We have used the OOK modulation technique for simulation, so the received optical field envelop of power $P_r(t)$ can be written as

$$P_r(t) = \begin{cases} P_{t_1}(t) + a(t) \text{ for bit 1} \\ P_{t_0}(t) + a(t) \text{ for bit 0} \end{cases} \tag{10}$$

and

$$a(t) = \Delta a(t) - A \tag{11}$$

where $P_{t_1}(t)$ and $P_{t_0}(t)$ are transmitted optical power for bit 1 and bit 0, respectively, $a(t)$ is the channel noise, A is the attenuation due to rain, fog, snow and geometric loss, and $\Delta a(t)$ is scintillation noise due to turbulence.

So assuming the responsivity of the receiver is unity, the photocurrent $I_p(t)$ is [24]

$$I_p(t) = \frac{P_r(t)\eta q}{h\nu} \tag{12}$$

where η is the quantum efficiency, q is the electron charge, and $h\nu$ is the energy of proton.

3.1 Shot Noise

Shot or quantum noise develops when the photodetector converts the photons of light to photoelectron. The fluctuations in the amount of photons create a discrete flow of electron in photodetector which leads to the shot noise [25]. This noise development in photodetector follows the Poisson process [24]. The shot current noise (in Ampere) is calculated as

$$\sigma_{sn}^2 = 2qI_p(t)B \tag{13}$$

where q is the charge of electron (in Coulomb), $I_p(t)$ is receiver photocurrent (in Ampere), and B is the bandwidth of the receiver.

3.2 Thermal Noise

For all electrical circuitry, load resistance creates a noise calls thermal or Johnson noise. This noise can be reduced with a large load resistor which fulfils the requirement of receiver bandwidth [24]. The thermal noise variance (in Ampere) is described as

Table 1 Simulation parameters

Parameters	Values
Transmitted power	–10 dBW
Bit rate	2.5 Gb/s
Wavelength (λ)	1550 nm
Turbulence (C_n^2)	High (10^{-13} to $10^{-14}\mathrm{m}^{-2/3}$)
Rain rate (R)	20 mm/h
Snow rate (S)	0 mm/h
Receiver diameter (d_{receiver})	13 cm
Transmitter diameter ($d_{\text{transmitter}}$)	1 mm
Angle of deviation (θ)	5 mrad
Pseudorandom bit sequence (PRBS)	$10^{10} - 1$
Visibility (V)	5 km
Visibility reference wavelength (λ_0)	550 nm
Percentage air drop transmission ($V_{\%}$)	5%

$$\sigma_{tn}^2 = \frac{4K_B T}{R_L} B \tag{14}$$

where K_B is Boltzmann's constant, T is absolute temperature (K°), R_L is load resistance of 500Ω, and B is the receiver bandwidth of 50 GHz.

4 Simulation Results

In this work, we have studied an FSO system combining all the attenuation and noises due to atmospheric conditions and the receiver quality. A pseudorandom bit sequence of 25×2^{12} bit has been sent from the transmitter. In Fig. 2a, the total loss(dB) of the optical signal is shown up to a link distance of 5 km. From the simulation, we get that the major loss of optical power is due to geometric loss. If the system is perfectly aligned with a transmitter, having low FOV can enhance the quality of transmission. The optical power degradation against distance up to 5 km is shown in Fig. 2b.

Using the on–off keying (OOK) modulation, we calculated the bit error rate (BER) against the transmission distance from 100 m up to 5000 m in Fig. 3a. The BER values are estimated when the number of error bits was more than or equal to 100. This ensures the 95% confidence interval with ±0.15 dB for estimating the optical signal-to-noise ratio (OSNR) [26]. The sent bit sequence from the transmitter is compared by performing XOR operation with the bit sequence of output electrical signal at the receiver to detect the number of erroneous bits. From the BER graph, it is observable that with all channel and receiver noises and attenuation in given conditions, we can retrieve the optical signal by photodetector up to link distance 800 m. But beyond the

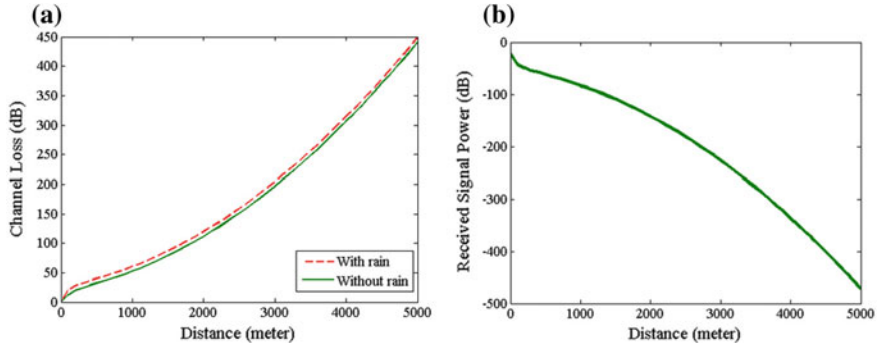

Fig. 2 **a** Loss profile of the channel, **b** received power at receiver with respect to distance when transmitted power is −10 dBW

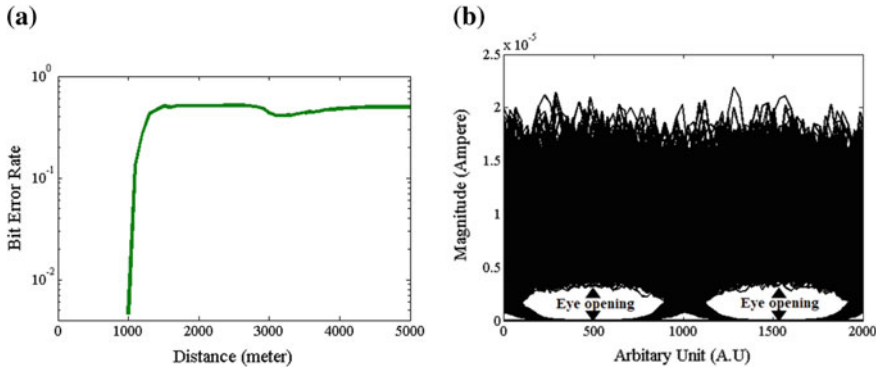

Fig. 3 **a** Performance of BER with different distance, **b** eye diagram of electrical signal when link length 500 m

distance, a major degradation of the quality of optical signal occurs. Also keeping the transmission distance of 500 m, we have taken the eye diagram of the electrical signal from the receiver in Fig. 3b. The fluctuations in the eye diagram shown are due to the turbulence in the air, and the eye-opening reduces very rapidly due to this turbulence.

In this simulation, we also observed the effects of receiver noise in the electrical signal. Omitting the channel noises in the optical signal, two eye diagrams of the electric signal at are taken—one is without the receiver noise Fig. 4a and another with receiver noise Fig. 4b to distinguish the effects of receiver noise on electrical signal at the receiver. The transmitted power and the link distance, in this case, were −10 dBmW and 10 km, respectively.

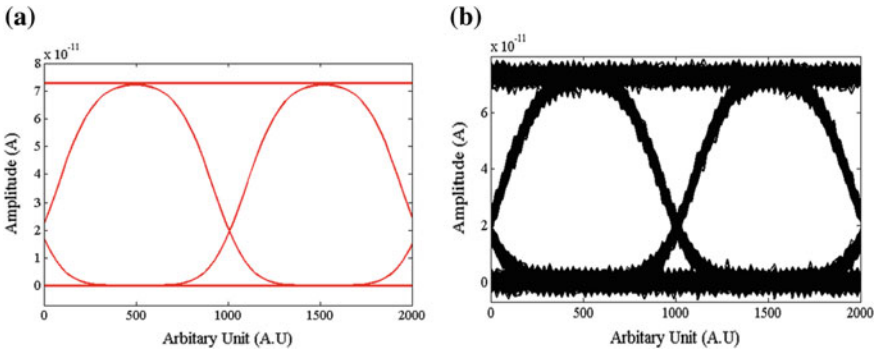

Fig. 4 **a** Eye diagram of current signal without receiver noise, **b** eye diagram of current signal with receiver noise

5 Conclusion

Atmospheric quality plays a vital role in FSO transmission. In this paper, we have analysed and combined most of the atmospheric loss and noises and modelled a transmission channel in simulation level. It is also observed that even in high turbulence the BER is very good up to transmission distance of 800 m and rain causes a significant loss of optical signal. The PIN receiver noises also took account of the simulation, and also it is observed that a good photodetector with low noises can have better sensing of the received optical signals. Overall, an FSO system has been modelled to observe the noise effects on FSO system which helps to understand and to implement this system at physical level.

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Design of a Low-Cost Li-Fi System Using Table Lamp

Suman Debnath and Bishanka Brata Bhowmik

Abstract This paper presents a designing of a Li-Fi working model to send information in a unidirectional path via visible light to a receiving device across free space. The communication link will be set up between a mobile device and a PC using a modified table lamp to transmit data serially via USB COM port.

Keywords Light fidelity (Li-Fi) · Visible light communication (VLC) · Radiofrequency (RF) · Universal asynchronous receiver/transmitter (UART) · COM (communication) port

1 Introduction

A rapid evolution in technology is not only helping the society to progress, but it also opens the door of a new era of creative thinking for future innovations. Li-Fi is one such emerging technology in the subset of visible light communication (VLC) where the data communication is done wirelessly by modulating the output intensity of the light-emitting diodes (LEDs) with respect to the binary information, whereas a photo-detector is used at the receiver end to recover the transmitted signal.

Li-Fi was coined by a German professor Harald Hass that stands for *Light Fidelity*. He demonstrated this concept of optical wireless communication (OWC) at the TED Global Talk in Edinburgh in 2011 [1]. The concept of using light as medium of transmission dates back to the ancient times when light is being used in various forms like smoke signals or beacon fires to convey messages [2]. Over the years, optical communication has been evolved to a more advanced form where data nowadays is being sent wirelessly via optical medium that proved to be a complementary technology to the existing radio-frequency (RF) communication [3]. Li-Fi uses license-free visible

S. Debnath (✉) · B. B. Bhowmik
Department of Electronics and Communication Engineering, Tripura University, Suryamaninagar, Agartala 799022, Tripura, India
e-mail: debnathsuman91@gmail.com

B. B. Bhowmik
e-mail: bishankabhowmik@tripurauniv.in

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light spectrum (375–780 nm) to provide a short-range wireless link for data communication. The concept was first proposed by the Japanese researchers in the form of VLC. It was in the year 2000 a group of researchers from Japan proposed and simulated successfully the concept using a LED-based indoor wireless transmitting station [4]. From then on, this field attracts a lot of attention across the globe.

Till date, a few start-up companies are offering products based on this technology. Among them, PureLi-Fi [5], Ledcomm [6], Velmenni [7], etc., are prominent who tested and came up with some good solutions for practical approach to implement the technology. PureLi-Fi introduced the Li-Fi-XC a USB dongle capable for full bi-directional multiuser communication via light. Currently, they are working on various components like Gigabit Li-Fi and Li-Fi ASIC [7]. Li-Fi MAX, GEOLi-Fi OEM modem, etc. products are offered by Ledcomm.

This paper demonstrates a working model of a light-based communication link between two devices via serial port. A detailed explanation of a Li-Fi transmitter along with the receiver has been shown.

2 Working Principle

Li-Fi is a type of visible light communication (VLC) that works on the principle of modulating a light source to convey information which is detected by a photo-detector and processing circuitry stationed at the receiving end to recover the original information [8]. Low-cost low–power-consuming LEDs are used as the light source that gives very bright luminescence modulated by switching it on and off with the help of a driver circuit at a high frequency [9].

The modulation of the LEDs is carried out by various modulation techniques. If the modulation is done based on the technique such that the LEDs remains on if the binary bit is ‘1’ and turns off for binary bit ‘0’, then it is working on OOK (on-off keying) modulation format. It is a widely used single-carrier modulation (SCM) scheme for its easy implementation [10]. In comparison to SCM, multicarrier modulation (MCM) schemes are used for high-speed multiuser applications. MCM schemes are more efficient in terms of energy and bandwidth. A widely used MCM technique known as orthogonal frequency division multiplexing (OFDM) can also be used to transmit data streams simultaneously in parallel with the help of different orthogonal subcarrier.

The transmitted data that is passed through the optical medium falls on the sensitive area of the optical detector circuitry. The circuitry consists of a photo-sensitive element or sensor to detect the modulated light signal. The sensor converts the light in the form of current proportional to it, and hence, the light gets detected at the receiving end. Depending upon the modulation used at the transmitting side, the receiving circuitry is designed that can demodulate the receiving signal to the original data [11]. Generally, photo-sensitive element like a light-dependent resistor (LDR) or a photo-diode or a photo-transistor can be used to detect the incoming light signal.

After the detection, the signal is feed to a transimpedance amplifier circuitry before demodulation to recover the information.

3 Design of a Li-Fi System

In this section, a detailed explanation of the working model of the Li-Fi system is presented. The model consists of a transmitter and a receiver circuitry.

3.1 Transmitter Circuitry

Li-Fi transmitter converts the digital data into visible light. For the light source, white high-brightness LEDs were used. The transmitter modulates the LEDs on the basis of the incoming data to be sent. The modulation format used here is the OOK modulation. Based on this format, the circuit turns on the LEDs to transmit logic one and it turns off the LEDs to transmit logic zero.

The data transmission is done via serial port, so a serial device is used. Figure 1 shows the designed transmitter. The serial device is connected to the COM port of the transmitting device via USB. The connected device is a Silicon Labs CP2102 USB to TTL UART converter. The output TX pin of the serial converter is feed to the base pin of a switching transistor (2N2222A) that drives the SMD LEDs.

The LEDs are connected to the 5 V optional output power pin of the TTL converter. In this way for an incoming bit high or low, the variation of the TX pin output will change the state of the transistor to turn on and off the LEDs.

3.2 Receiver Circuitry

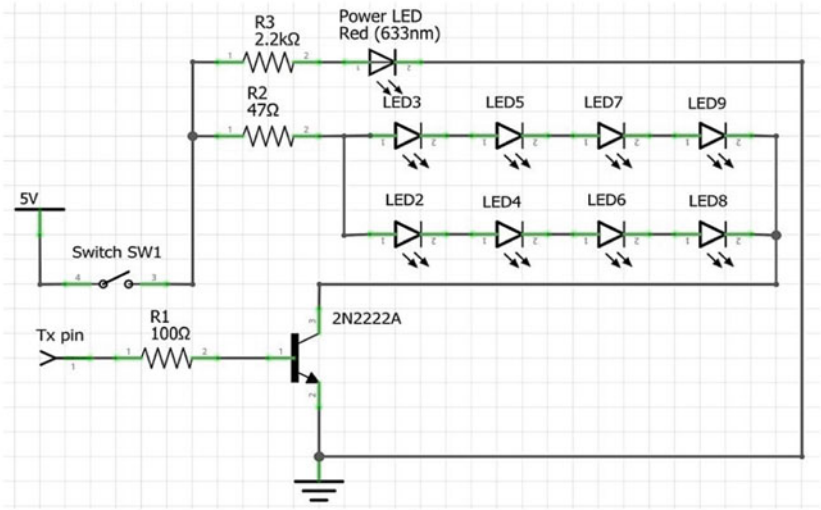
The receiver circuit detects the incoming light signal, amplifies, and compares it to get the desired output.

Figure 2 shows the receiver circuitry. A low-cost light-dependent resistor (LDR) device is used to detect the light signal which is connected to achieve a potential divider circuit. The potential divider output is then feed to the non-inverting terminal of the dual op-amp LM358 IC, while a 10 K potentiometer is connected to the inverting terminal of the same op-amp IC. Thus, the op-amp works as a comparator that compares and amplifies the voltage difference of the two input terminals to produce the output.

A LED is connected across the output terminal of the op-amp to indicate the output sequence. The output of the op-amp 1 is feed to the op-amp 2 that acts as a buffer circuit, and the final output is obtained from the op-amp 2.

The circuit diagram of the receiver circuitry is shown in Fig. 3. The distance

(a) (b)



(c)

Fig. 1 **a** Transmitter unit connected to PC, **b** transmitter internal construction, and **c** transmitter circuit diagram

between the light source and the LDR can be adjusted with the help of the potentiometer. A CP2102 USB to TTL UART converter is used in which the output is connected to the RX pin to convert the incoming bits back to the USB standard. The converter is then connected to the USB port of the receiving device where it will be detected as a specific COM port device.

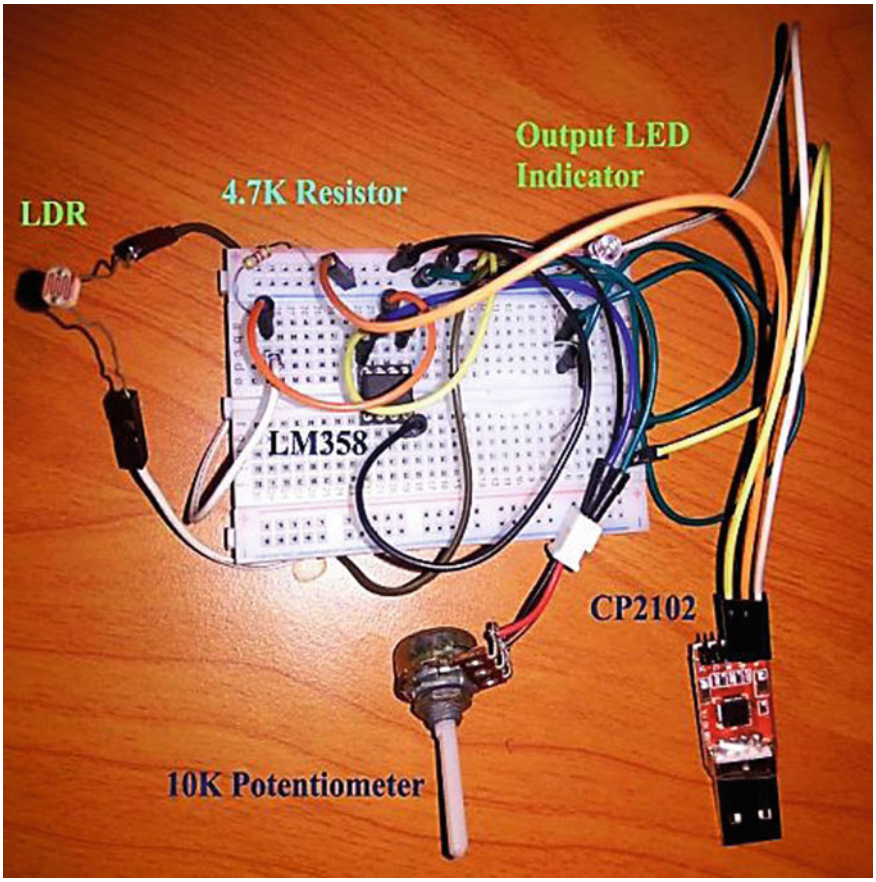


Fig. 2 Receiver circuitry

3.3 Software

The communication link has been set up between a mobile and a PC device using visible light. For this, open-source software like *Serial USB Terminal* and *Tera Term* have been used for demonstrating the transfer of text contents between these devices via serial port. The software automatically detects the transmitter and the receiver connected to the COM port. After setting up the connection between the COM ports with the software, the serial port has been manually configured to adjust the baud rate, data, parity, and stop bits.

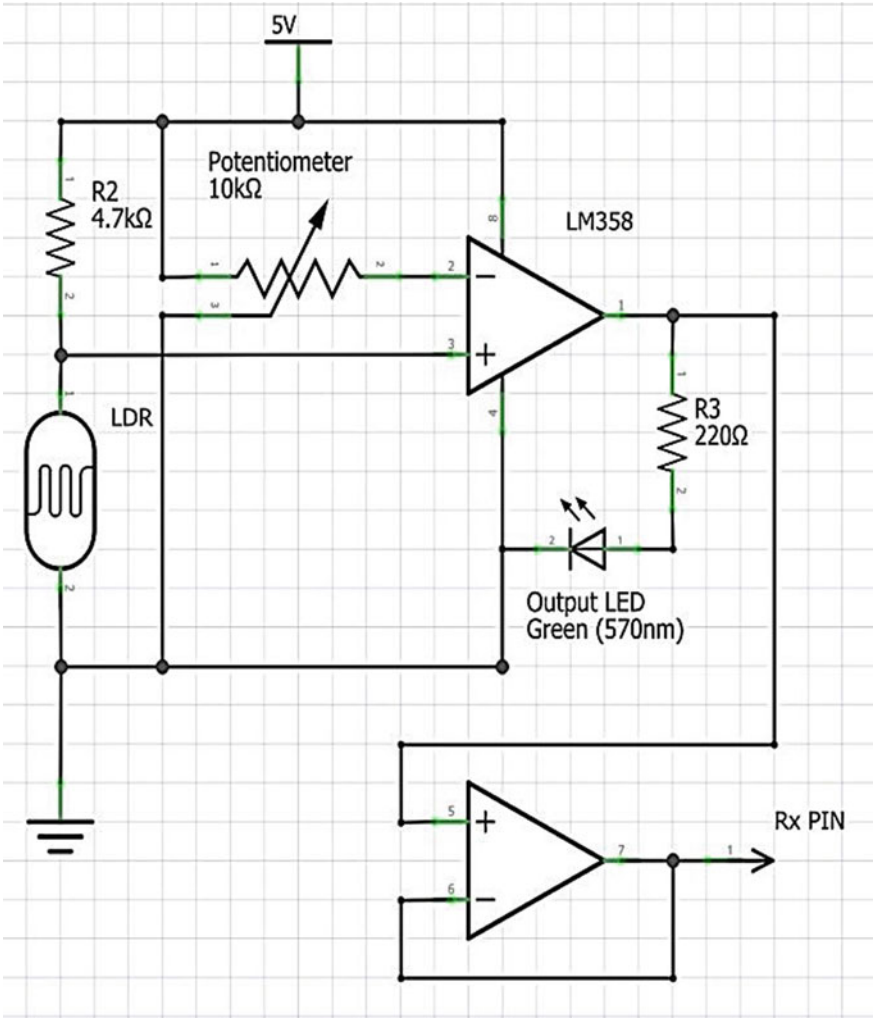


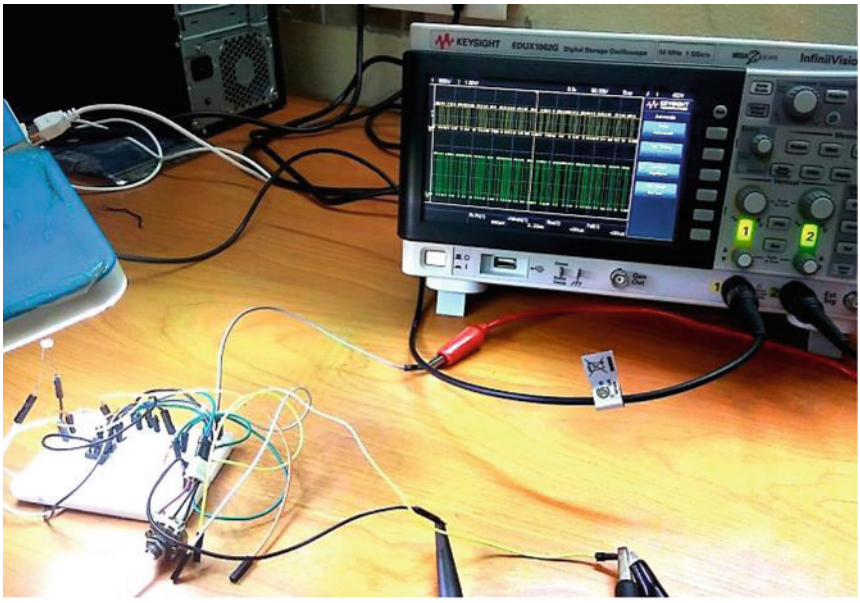
Fig. 3 Receiver circuit diagram

4 Results

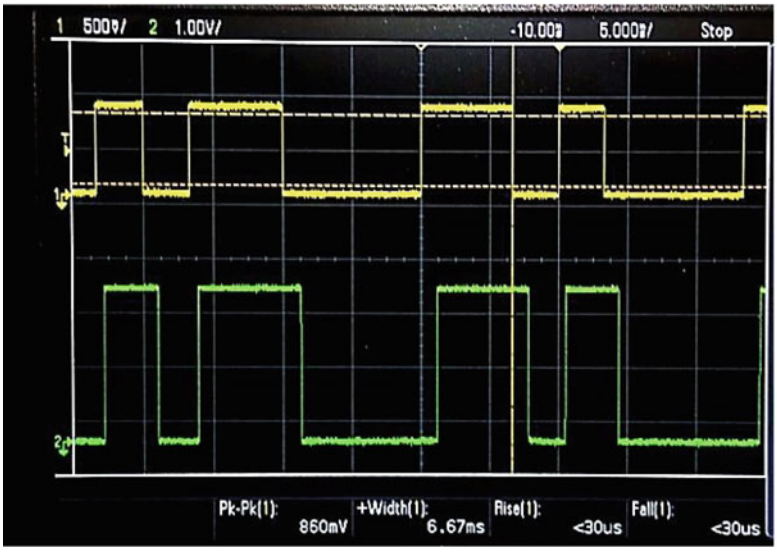
The transmitter and receiver results of the Li-Fi communication link are shown in Fig. 4.

Figure 4 shows the waveforms of the transmitted and the received signals. The received signal is obtained after amplifying the sensor output. Though the waveforms obtained are almost identical in nature, there exists a small difference in phase and duty cycle between them. This shows that the data transmission is feasible.

The figures of the serial terminals are shown in Fig. 5. A string of data is trans-



(a)



(b)

Fig. 4 **a** Hardware setup for testing in DSO, and **b** transmitted and received signals obtained

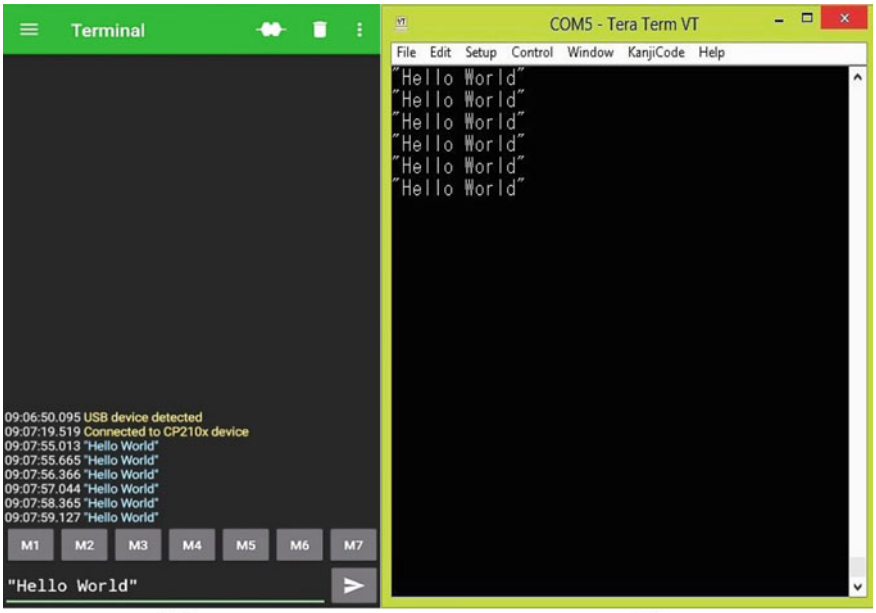


Fig. 5 **a** Data string transmitted from mobile to PC and **b** received data string on PC

mitted from the mobile to pc using *Serial USB Terminal* application with the help of the designed transmitter. The data is received at the receiving end and finally been displayed at the *Tera Term* terminal monitor screen. A saved text file can also be send via this setup.

5 Conclusion

In this paper, a working model of a Li-Fi-based communication link has been successfully demonstrated. The transmitter and receiver model has been presented in detail. The model has been used to transmit and receive data strings over visible light using LEDs. The communication is done by modulating the light intensity using on-off keying technique. From the experimented demonstration, it is shown that the feasibility of data transmission using visible light is possible. The model designed has some limitations also like speed, accessibility, and direction of propagation. The design does not support multiuser bi-directional access. Further, if the receiver is not placed at a required distance and also not in the line of sight of the transmitter, the data transmission gets affected. Though the paper aims to present an easy, compact, and low-cost Li-Fi communication link, the speed and distance between the transmitter and the receiver can be further increased with the help of high-speed devices.

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e-mail: debnathsuman91@gmail.com

B. B. Bhowmik
e-mail: bishankabhowmik@tripurauniv.in

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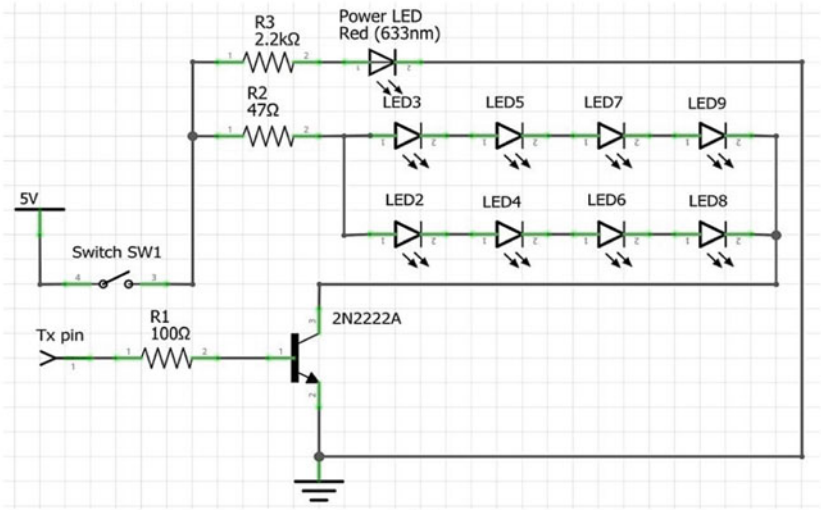

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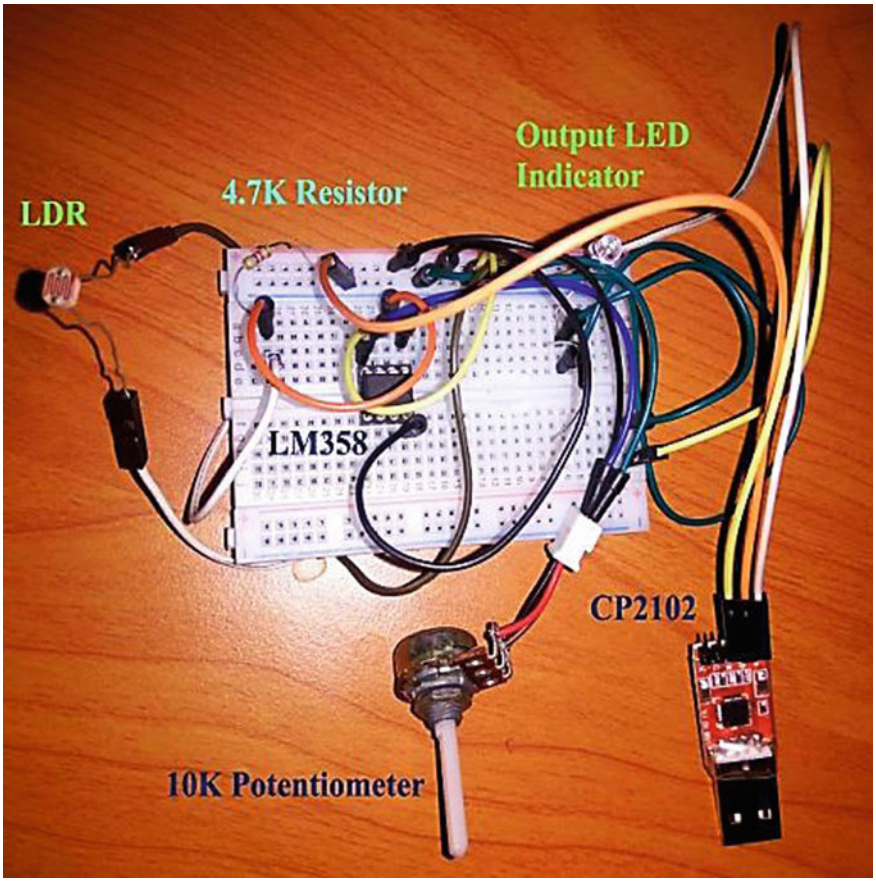


Fig. 2 Receiver circuitry

3.3 Software

The communication link has been set up between a mobile and a PC device using visible light. For this, open-source software like *Serial USB Terminal* and *Tera Term* have been used for demonstrating the transfer of text contents between these devices via serial port. The software automatically detects the transmitter and the receiver connected to the COM port. After setting up the connection between the COM ports with the software, the serial port has been manually configured to adjust the baud rate, data, parity, and stop bits.

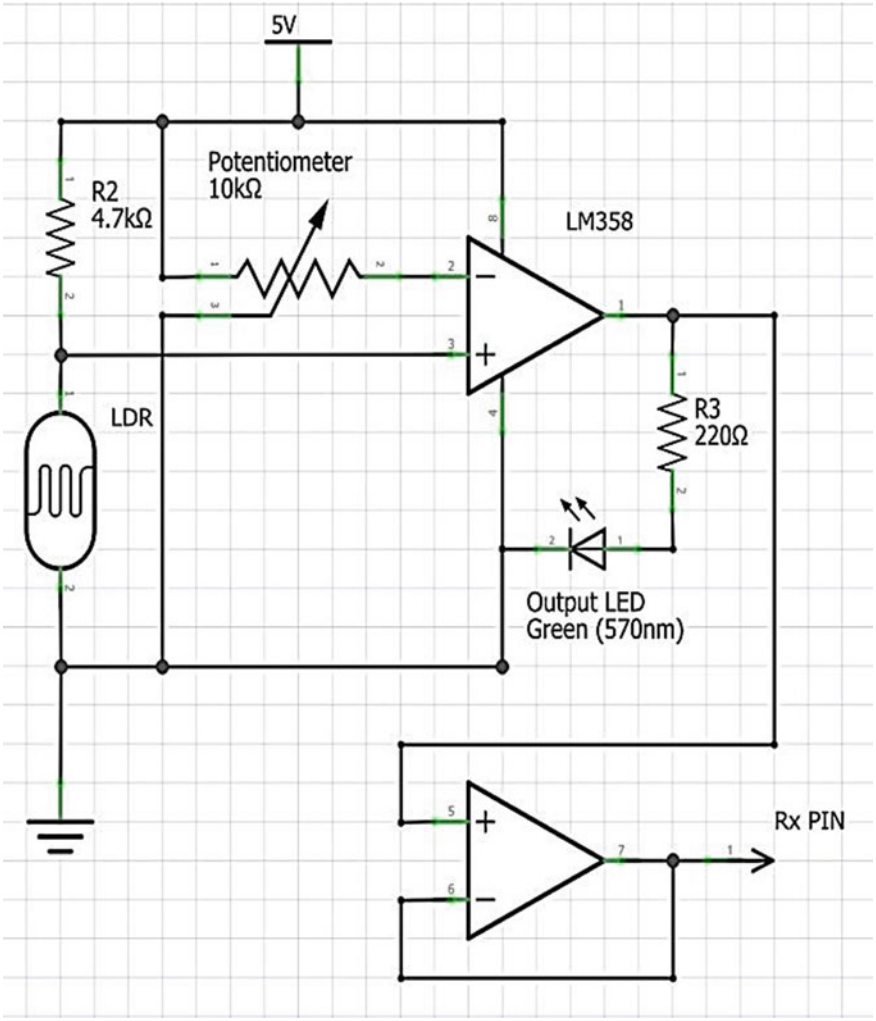


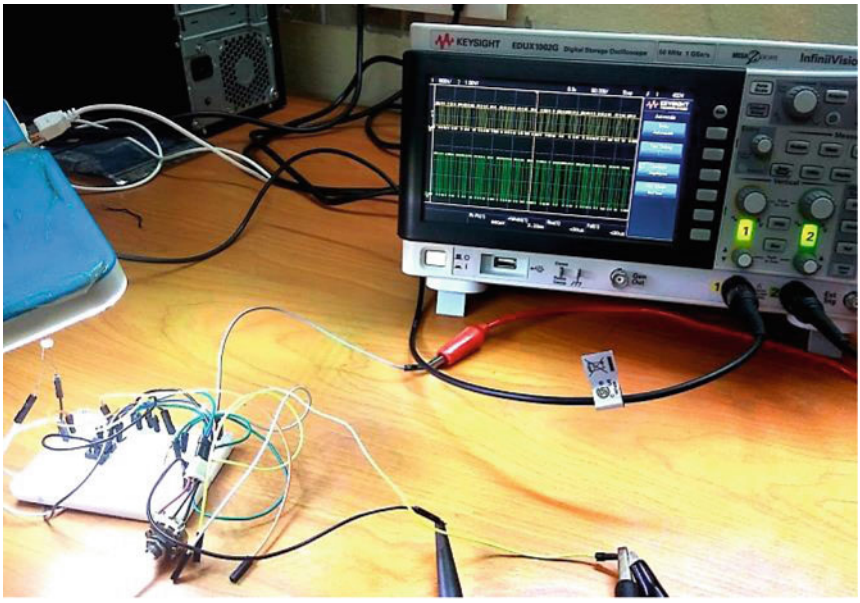
Fig. 3 Receiver circuit diagram

4 Results

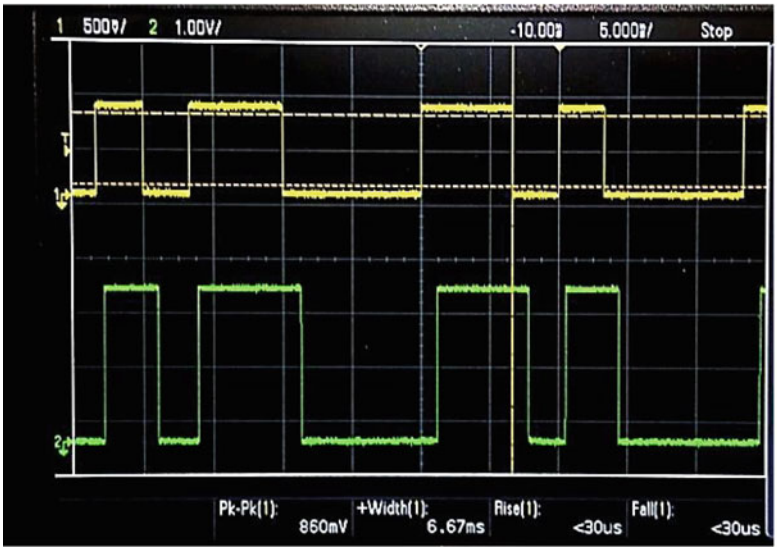
The transmitter and receiver results of the Li-Fi communication link are shown in Fig. 4.

Figure 4 shows the waveforms of the transmitted and the received signals. The received signal is obtained after amplifying the sensor output. Though the waveforms obtained are almost identical in nature, there exists a small difference in phase and duty cycle between them. This shows that the data transmission is feasible.

The figures of the serial terminals are shown in Fig. 5. A string of data is trans-



(a)



(b)

Fig. 4 **a** Hardware setup for testing in DSO, and **b** transmitted and received signals obtained

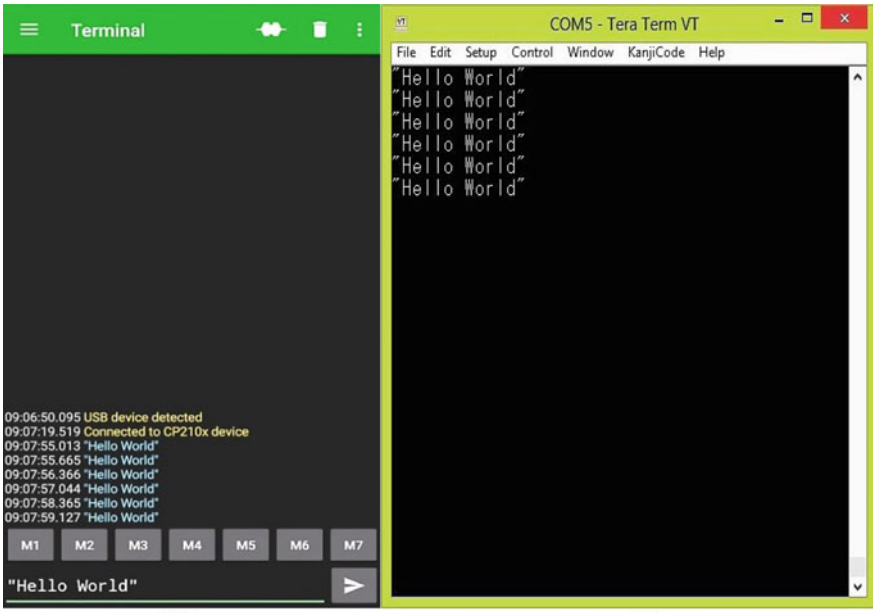


Fig. 5 **a** Data string transmitted from mobile to PC and **b** received data string on PC

mitted from the mobile to pc using *Serial USB Terminal* application with the help of the designed transmitter. The data is received at the receiving end and finally been displayed at the *Tera Term* terminal monitor screen. A saved text file can also be send via this setup.

5 Conclusion

In this paper, a working model of a Li-Fi-based communication link has been successfully demonstrated. The transmitter and receiver model has been presented in detail. The model has been used to transmit and receive data strings over visible light using LEDs. The communication is done by modulating the light intensity using on-off keying technique. From the experimented demonstration, it is shown that the feasibility of data transmission using visible light is possible. The model designed has some limitations also like speed, accessibility, and direction of propagation. The design does not support multiuser bi-directional access. Further, if the receiver is not placed at a required distance and also not in the line of sight of the transmitter, the data transmission gets affected. Though the paper aims to present an easy, compact, and low-cost Li-Fi communication link, the speed and distance between the transmitter and the receiver can be further increased with the help of high-speed devices.

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Traditional Agroforestry Systems of Northeast India

Sourabh Deb

Abstract Traditional agroforests, as one of the integrated approaches to environmental conservation has been considered as a superior system that permits significant and ecological interaction between the woody and non woody components. These traditional systems have been widely practiced by the people of Northeast India since time immemorial. A study has been conducted among three communities viz., Kalita (Assam) and Nyishi and Apatani (Arunachal Pradesh) of Northeast India to understand the structure, economy, soil quality and management aspects of traditional agroforestry systems. The study revealed that the systems have the potential to preserve the plant and animal diversity in different climatic zones of the region. Different plant species grown in these multistoried agroforestry systems are confounded by the livelihood requirements and traditional knowledge. The most prevalent agroforestry systems in Northeast India observed during the study are Agri-horti-silvi-pisciculture, Agri-horti-silviculture and Horti-silvi-pastoral systems. The systems have also been categorized on the basis of economic output viz., Subsistence-based agroforestry system, Semi-commercial agroforestry system and Commercial agroforestry system. Species composition of the traditional agroforestry systems also varied with residue management, soil and climate of the sites. The soil nutrient status of Agri-horti-silvi-pastoral systems shows more favourable soil physical, chemical and biological properties in comparison to other agroforestry systems. An understanding of indigenous practices, therefore, offers excellent opportunities for finding solutions to the problems of self reliance in agricultural development of the region.

Keywords Indigenous · Tradition · Management · Agroforestry · Economic aspect

S. Deb (✉)
Department of Forestry and Biodiversity, Tripura University,
Suryamaninagar, Tripura 799022, India
e-mail: drsourabhdeb@gmail.com

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Sustainable Development of Reang Culture in Tripura: Role of Bru Socio-Cultural Organization (BSCO)

Dr. Lincoln Reang

Assistant Professor, Deptt. of History, Tripura University

1. INTRODUCTION

Tripura with an area of 10,486 sq.km has always been a multi-ethnic state like most other Northeastern state of India. There are 19 Scheduled tribes in Tripura, namely the Tipras/ Tripuri, Riang (Bru), Jamatia, Noatia, Lushai, Uchoi, Mog, Kuki, Chakma, Khasi, Garos, Halam, Bhutia, Bhil, Munda, Orang, Lepcha, Santhal and Chaimal.

The Reangs (Bru) are basically a semi-nomadic tribe who practice *jhum* (slash and burn) or shifting method of cultivation on the hill sides. This makes them to move from one place to another place after a gap of few years. The possible causes of their migration and movement lay in their traditional life patterns characterized by shifting cultivation, primitive tools, semi-nomadic settlement, inter-tribal feuds, etc. The Reang (Bru) basically belonged to the Mongoloid group and speaks the Tibeto-Burmese language 'Kau Bru'. The Reang (Bru) inhabited almost in all the district of Tripura and with small populations in the neighbouring States of Mizoram and Assam.

The Reang usually call themselves as 'Bru', but the term 'Reang' is used as an appellation to denote the tribe. The term 'Reang' has been derived and used from the name of the last Kaskau (Community Chief) *i.e.,* Reang Kaskau. In the *Bru* or Riang/Reang Community there are 12 Clans/*Panjis,* namely *Molsoi, Tuimui, Msha, Taumayakcho, Apeto, Wairem, Meska, Raikchak, Chorkhi, Chongpreng, Nouhkham* and *Yakstam.* The Reang (Bru) has been identified as the "Primitive Group" by the Ministry of Home Affairs, Government of India on the basis of their pre-agricultural level of technology, extremely low level of literacy, declining or stagnant population.

At present, the Reang (Bru) communities basically are found to reside in twenty-eight out of fifty-eight blocks in eight districts of Tripura. In North and Unakoti district, they reside in Kumarghat, Gournagar,

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Dasda, Pecharthal, Laljuri, Damcherra, Jampui Hill, Yuvrajnagar and Kadamtala blocks. In Dhalai and Khowai district, they reside in Ambassa, Manu, Chawmanu, Dumburnagar, Ganganagar, Salema, Durga Chowmuni, Tulasikhar and Mungiakami blocks. In South and Gomati district, they reside in Matabari, Amarpur, Karbook, Ompi, Bokafa, Jolaibari, Hrishyamukh, Bharat Ch.Nagar, Kakraban and Rajnagar blocks.

2. CULTURAL SPECTRUM

Tripura encloses a rich cultural heritage of songs, dance and music. Due to its numerous and diverse ethno-linguistic groups, a composite culture has emerged on the whole in Tripura. Actually, Tripura has traditionally been the home of different cultures and people. The tribal culture and their traditions and practices pervade almost all of the aspects in the society. The distinctiveness of the tribes lays in their rituals, cultures, beliefs and above all the harmony in which they survive in unison with nature. The Reang (Bru) community has a rich and vibrant material culture. Their custom depicts their belief in simplicity. The diversity of culture across tribal groups is reflected in the diversity of songs, music, instruments and techniques.

2.1 DRESS AND ORNAMENTS

Simplicity and plainness are the twin characteristics of the dress of the Reang (Bru) people. The traditional dress of the Reang (Bru) community is simple and plain. Traditionally, the men wear a hand woven loin cloth and a piece of hand woven cloth '*Kutai ritrauh'* as a wrapper for upper portion. The women wear a long cloth called *Rnai*, a wraparound; from the waist to down to the knees. A *Rsa*, covering the chest, and *Rikatouh* for covering the whole upper half of the body. These are woven by the Reang (Bru) women, which are colourful and very beautiful. But nowadays the educated masses are wearing all the modern dresses like any other part of the world. The Reang (Bru) women are very fond of personal decoration and take much care for their makeup and hair-do. They love ornaments, flowers, and cosmetics. Silver ornaments especially the necklace of silver coins '*Rangbauh'* have a pride of place and status. Some of the important ornaments that the Reang (Bru) maiden adorns are *Sangai* (For Hair), *Srang* (For Hair), *Wareigh* (For Hair), *Wakhom* (For Ear), *Nabak* (For Ear), *Lukoigh* (For Neck), *Kanth*i (For hand), *Rangbak sanang* (For Neck), *Tar* (For hand), *Tro* (For hand), *Mathia* (For Hand-Male) and

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*Beng*i (For Leg). Undoubtedly, the credit for the Tripura's traditional costumes act of being attractive while being simple at the same time goes to the much talented natives.

2.2 FOLK SONGS, MUSIC AND DANCE

Music plays a major role in Reang (Bru) societies and is intimately linked with a person's ancestry and country (the animals, plants and physical features of the landscape). It is traditionally connected with important events such as the bringing of rain, healing, harvesting, etc. Reang (Bru) music is learnt and carried on to later generations by performing it. It is not seen as fixed but rather is something that is varied or built upon in successive performances. There is usually a large number of participants and is performed communally. Narrative verse looms large in the traditional music of Reang (Bru) cultures. This encompasses such forms which were meant originally for oral performance, sometimes accompanied by instruments. Hymns and other forms of religious music are often of traditional origin. Work songs frequently feature on call and response structures, and are designed to enable the laborers' who sing them to coordinate their efforts in accordance with the rhythms of the songs. They are frequently, but not invariably, composed.

Music has been an integral part of the Reang (Bru) lifestyle. Some of the aboriginal instruments, developed in Tripura and with respect to Reang (Bru) community are *Dandu* (Musical instrument played by mouth), *Wathop* (bamboo musical instrument), *Srenda* (violen), *Kham* (Drum), *Chongpreng* (Guitar), and *Ksumu* (Flute). Be it the occasion of marriage, religious ceremony or other festival, songs and music are sung and played to commemorate each event among the community. Dance has also been a vital constituent of the Reang (Bru) way of life. The different varieties and style of dance forms like *Dailo, Hodaigri or Menpati, Goroia, Taoktuma*, etc are exclusive to one or the other occasions.

2.3 *HODAIGRI* DANCE

The Reang (Bru) songs and dances reflect their social lifestyle. Joy and sorrow are given a musical colour through their songs sung in style befitting the occasions. The *Hodaigri* dance amongst the Reang (Bru) was usually performed on the occasion of *Maikhlungmo* rituals i.e. worship of Goddess of food grains and

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cotton especially during the month of September-October after the successful completion of *Huk* or Jhum harvesting. *Maikhlungmo* rituals consist of four varieties viz. *Mainokma*, *Khunokma*, *Maiktama* and *Maikchamma*. On the particular day of the rituals, i.e. in the morning some fowls (03 Nos.) would be sacrificed along with some other ingredients. Some well-to-do families sacrifice Pig and Buffalo, wherein all the villagers would be invited for the feast. During the earlier days the well-to-do families would usually be from the rank of village *Choudhry* (Head-Man), etc. The feast would continue throughout the day and as night approaches the *Hodaigri* dance would be performed, which continues throughout the night. It is believed that the dance originated on the occasion of the *Maikhlungmo* rituals so as to receive blessing from the mother goddess. *Hodaigri* basically indicates the 'night of the feast or merry-making' on the occasion of *Maikhlungmo* rituals. All the villagers would enjoy *Awaing thai* (A rice cake wrap with special kind of wild flower leaves) and drink *Arag* (locally made rice beer). In a *Hodaigri* dance, the Reang (Bru) maiden would expose their dance expertise and skills of various techniques. The dancer would start dancing by standing on the pitcher by balancing the plate and simultaneously balancing a round shaped bamboo tray in their hands and also keeping the local beer bottle attached with a burning lamp on top of their head, and simultaneously moving their body in a harmonious rhythm to the beats of musical instruments like drum, flute and folk songs. The equipments required for this dance are earthen pitcher, small oil lamps, bottle, handkerchiefs or flowers, *Baileing* (sort of a big plate made of bamboo), metal plates and different ornaments and coulouful dresses. This is basically a female oriented dance but men assist the female artistes by providing musical beats for the dance. *Hodaigri* is also known by other names like *Medol Msamung* and *Menpati*.

3. THE BRU SOCIO-CULTURAL ORGANIZATION (BSCO)

The Bru Socio-Cultural Organization (BSCO) is one of the largest Non-Governmental Organization of the Reang (Bru) Community of Tripura. It was established in 1980 with an aim to develop and uplift the Reangs (Bru) Socio-Cultural, Economic and Education. The structure of the BSCO comprised the Central Executive Committee Members at the apex with ten regions namely Amarpur, Damcherra-Khedacherra, Kanchanpur, Belonia-Santirbazar-Udaipur-Sonamura, Manu-Mongang, Delwai-Tuiksama, Gandacherra, Unakoti, Karbook and Tuikchoma Region. Also, there comprised several Primary Committee based on different cluster of villages under the respective Regions.

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The BSCO General Conference are held generally every year since 1981 but now it was held once in every three years to help motivate and entails more time for the upliftment of the Society. The BSCO also organized the popular *Hodaigri* festival since 1993 in association with different departments of the State Government and the Tripura Tribal Area Autonomous District Council (TTAADC).

Apart from organizing the *Hodaigri* festival, the BSCO has been engaging with various social-cultural related awareness among the Reang (Bru) community of Tripura. The BSCO had been organizing various educational, health camp awareness, traditional games and sports events and making documentaries on the social-cultural life of the Reangs (Bru), on safe drinking water, malaria and education, religion, games & sports, marriage system, etc.

3.1 AIM AND OBJECTIVES

1. Protection, promotion and advancement of the cultural heritage and tradition that distinctly establishes our affinity to the membership of the Bru Tribe.
2. Protection and promotion of traditional folk dances, songs and music.
3. Protection and development of Bru language (Kau Bru) and literature by way of compilation of vocabularies, proverbs, folk tales, and their documentation and also of organizing seminars/ conventions on language and literature.
4. To restore dignity and sanctity to the customary laws and practices which are consistent with natural justice as well as modern concept of justice and to initiate reforms where necessary and approach the appropriate authority for codification of law.
5. To fight the harmful superstitious belief and practices wherever and in whatever form they are found in our society.
6. To advance and protect the all round interests of all sections of the Bru society in the field of education, employment and finance.
7. To build up a network of relationship for closer contact among the Brus in Tripura in particular and the Brus outside Tripura throughout India in general by mutual exchange of views and opinions on matters affecting their common interests.
8. To organize and extend relief for the victims of natural calamities of serious nature and for displaced families due to other reasons meriting relief of humanitarian grounds.

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9. To bring to the notice of the appropriate authority any difficult problem, crisis or violation of human rights faced by the Brus as well as members of other communities and to seek from appropriate authority immediate redresses of such difficult problem, crisis or violation of human rights affecting the Brus in particular and other communities in general.

10. To organize awareness programme on sanitation and health.

11. To draw up action plan for tying up selling of traditional dress/ costumes, handicrafts etc. with observance of traditional festivals and festivals of the religious groups.

12. To initiate programme for skill development, capacity building and economic empowerment of the weaker sections of the society.

13. To acquire by purchase or lease or otherwise, land and buildings and establish offices of the society and cultural centers for pursuit and promotion of cultural activities.

14. To systematically and effectively contribute to the advancement of the Bru tribe to the nationality.

15. To collect subscriptions and donations from members and others and accept gift, bequeath and endowment for attainment of the objects of the society.

3.2 ORGANIZATIONAL CHART OF THE BRU SOCIO-CULTURAL ORGANIZATION (BSCO), TRIPURA

CENTRAL EXECUTIVE COMMITTEE

The Central Executive Committee (CEC) is at the apex. The CEC consist of 13 members. They are the President, Vice-President, General Secretary, Asstt. General Secretary (South), Asstt. General Secretary (North), Finance Secretary, Office-cum- Organizing Secretary, Secretary for Customary Law & Practices, Literary Affairs, Cultural Affairs, Educational Advancement, Economic Development, Youth Affairs & Traditional Games and Women Welfare. The tenure of the committee is three years.

REGIONAL COMMITTEE

There is ten Regional Committee spread all over Tripura. The members of the Regional Committee are formed from among the Primary Committee members.

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1. Damcherra-Khedacherra Region, North Tripura North
2. Kanchanpur Region, North Tripura
3. Manu-Mongang Region, Dhalai Tripura
4. Delwai-Toiksama Region, Dhalai Tripura
5. Gandacherra Region, Dhalai Tripura
6. Amarpur Region, Gomoti Tripura
7. Udaipur-Santirbazar-Belonia Region, Gomoti-South Tripura
8. Unakoti Region, Unakoti Tripura
9. Tuikchoma Region, Khowai Tripura
10. Karbook Region, Gomoti Tripura

PRIMARY COMMITTEE

There are as many Primary Committees under each Region. The Primary Committees are usually formed from among a single or a group of village hamlets.

MAJOR PROGRAMMES/ACTIVITIES OF BSCO IN TRIPURA

Sl. No.	Programmes/Activities	Collaboration/Sponsored	Period/Year
1	Hojagiri (*Hodaigri*) Festival	TRP & PTG, TWD, ICA, Govt. of Tripura, TTAADC, NZCC, etc.	Yearly since 1993
2	Health Awareness Camp	TRP & PTG, TRCI, Govt. of Tripura & Self	Yearly
3	Educational Awareness Camp/ Literacy Campaign	TRP & PTG, TRCI, Govt. of Tripura & Self	Yearly
4	Cultural Awareness Camp	TRCI, Govt. of Tripura & Self	Yearly
5	Traditional Games & Sports Events	TRP & PTG, TRCI, Govt. of Tripura.	2014-2016
6	Documentary on the Reangs on	TRP & PTG, Govt. of Tripura,	2012-2015

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	subject relating to Health Awareness, Hygiene, Games & Sports, Marriage System, Religion and Culture.	TRCI, Govt. of Tripura & Self	
7	Merit Award	Self	Yearly
8	Village Awareness Camp	Self	Yearly
9	Organizing Cultural Programme	Self	Yearly
10	Organizing Workshop on Culture/Traditional Sports and Customary Laws.	TRCI, Govt. of Tripura & Self	Yearly, Customary Law (2003, 2008, 2016)
11	Printing of Calendar and Souvenir	Self	Yearly
12	Unique ID NGO partnership		
13	Website/ E-mail		
14	Research Project on Reang	TRCI, Govt. of Tripura	2014-15
15	Reang Feature Film & Video Album *Gregchungma*	TRCI, Govt. of Tripura & Self	2012 Onwards
16	Customary Law to TTAADC		
17	Reang/Riang to TRCI		
18	Hodaigri Academy at Tuikarmaw		
19	Bru Census 2015		

*TRP & PTG- Tribal Rehabilitation in Plantation and Primitive Tribal Group.

*TWD- Tribal Welfare Department.

*TRCI- Tribal Research & Cultural Institute.

4. EVALUATION FRAMEWORK AND APPROACH

The BSCO proposed to assess and document qualitative and quantitative evidence for achieving sustainable development. Major objectives of the BSCO are as follows:

(i) End poverty in all its forms,

(ii) Achieve gender equality and empowerment of all women and girls,

(iii) Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all,

(iv) Promote peaceful and inclusive societies for sustainable development and

(v) Provide access to justice for all and build effective, accountable and inclusive institutions.

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5. CONCLUSION

The Bru Socio-Cultural Organization (BSCO), Tripura since its inception in 1980 had been working for the upliftment of the Bru community of Tripura. The activities area covered by the BSCO includes in the field of Socio-cultural, economic and literacy. The support from the community had been tremendous for the BSCO while delivering its duty of societal upliftment. The work of BSCO in collaboration with the Government of Tripura have being instrumental in bringing development in various field.

The BSCO, Tripura further plan to earnestly work for the development of the Bru society especially with regards to literacy. It tends to extend its work activities to the remotest of the Bru villages in Tripura through its regional and primary committee members. The BSCO, Tripura is therefore earnestly pursuing for the development of the society by taking various responsibility irrespective many difficulty prevailing on its path.

Reang (Bru) Population Status in Tripura

No. of RD Blocks	No. of Gram Panchayat/ Village Council	No. of Hamlet/ Villages	Total Family	Male	Female	Total Population
28	**189**	**935**	**50567**	**111635**	**109760**	**221395**

Hojagiri (*Hodaigri*) Festival held in Tripura

Sl. No.	Year	Venue	District
1	1993	Gachhirampara	North
2	1994	Bokafa	South
3	1995	Karbook	South
4	1996	Shikaribari	Dhalai
5	1997	Nepaltilla	North
6	1998	Lukhu	South
7	1999	Ananda Bazar	North
8	2000	Tuikormo	South
9	2001	Karbook	South
10	2002	Gachhirampara	North
11	2003	Bokafa	South
12	2004	Nepaltilla	North
13	2005	Tuikormo	South
14	2006	Khedacherra	North

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15	2007	Lukhu	South
16	2008	Gandacherra	Dhalai
17	2009	Karbook	South
18	2010	Uricherra	North
19	2011	Nepaltilla	Dhalai
20	2012	Bokafa	South
21	2013	Upanagar	Dhalai
22	2014	Ananda Bazar	North
23	2015	Paharpur	Gomati
24	2016	Gandacherra	Dhalai
25	2017	Gachhirampara	North
26	2018	Bokafa	South
27	2019	Nepaltilla	Dhalai
28	2020	Karbook *(Proposed)*	Gomati

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Biodiversity status, threats and conservational measures in Rudrasagar lake, a Ramsar site of Northeast India In : *Biological Sciences: Impacts on Modern Civilization, Current and Future Challenges* by *Anupam Guha* © New Delhi Publishers, New Delhi: 2020, 71-84. ISBN: 978-81-947417-9-4, DOI: 10.30954/ndp.bio.2020.6

6
CHAPTER

Biodiversity status, threats and conservational measures in Rudrasagar lake, a Ramsar site of Northeast India

Moitree Taran, Prabir Barman, Yapri Jamatia, Sajib Das and Sourabh Deb*

Department of Forestry and Biodiversity, Tripura University
Suryamaninagar, Tripura, India
E-mail: drsourabhdeb@gmail.com

Abstract: Rudrasagar lake, a Ramsar site situated in Tripura, Northeast India offers a range of ecosystem services. The contribution of Rudrasagar lake to the humanity has not been estimated so far. The preliminary study aims to assess the biodiversity status and ecosystem services of Rudrasagar lake. The main provisional services provided by the lake are food (aquatic plants and fishes), fuel wood and timber whereas, the cultural services provided are boat raiding, tourism and recreational activities due to its historical importance. The main intimidations to the wetland are increasing silt loads due to deforestation, expansion of agricultural land and land conversion due to population pressure. To reduce stress on the lake, better monitoring, planning, restoration and management are essential. Different restoration activities like awareness programme, consultation and capacity building activities were conducted in the area. Restoration activities like *Hydrilla* based fish feed was introduced in the waterbody which becomes a good alternate source of food for many edible fishes. The water hyacinth based craft preparation was conducted for improving the livelihood of the common people. Proper conservation by restoration and sustainable management will help to enjoy the various services of the lake in a sustainable way.

Keywords: Biodiversity, Ecosystem services, Threats Management, Restoration.

Rudrasagar is a natural wetland located in Melaghar block, Sonamura subdivision under Sepahijala district of Tripura. Rudrasagar Lake is productive because of its ecological diversity and socio-economic importance [1]. It is designated as a Ramsar site in the year 2005 as the lake complies with the criteria's of the wetland and considered as a national as well as of international importance. Criteria 2, 3 and 8 suggest that the wetland should support endangered, threatened species, animal and plant species which maintains biological diversity and important source of food for fishes respectively [2]. It

सुख्यात
बांग्ला
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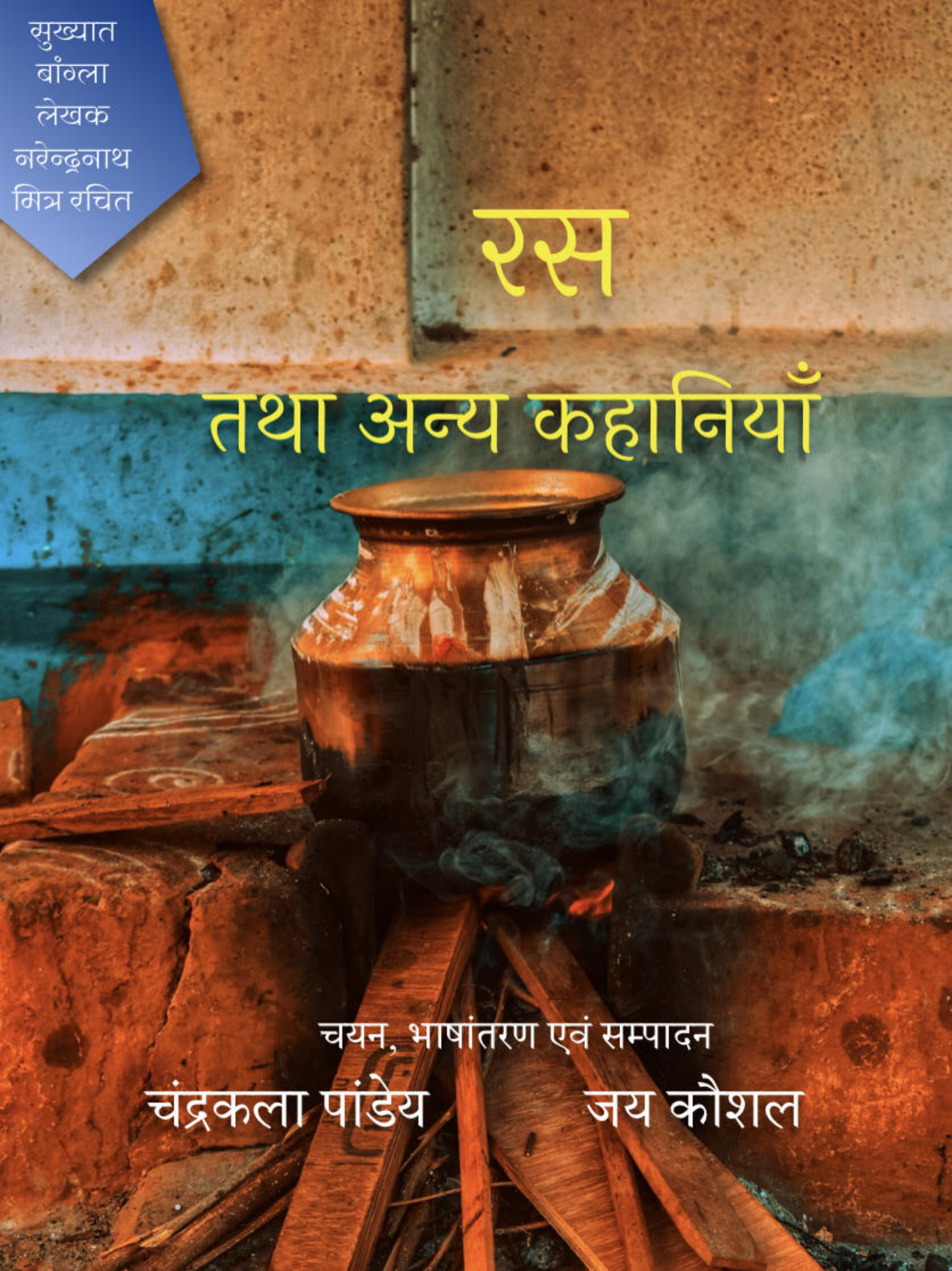
तथा अन्य कहानियाँ



चयन, भाषांतरण एवं सम्पादन

चंद्रकला पांडेय

जय कौशल

सुख्यात बांग्ला लेखक नरेन्द्रनाथ मित्र रचित

रस तथा अन्य कहानियाँ

चयन, भाषांतरण एवं संपादन

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हमारी ओर से....

बंग साहित्य की कहानियाँ विश्व-साहित्य में अपना अन्यतम स्थान रखती हैं और इसमें नरेन्द्र नाथ मित्र जैसे लेखकों की भूमिका बेहद विशिष्ट है। चार दशकों के लेखन-काल में चार-सौ से अधिक कहानियाँ लिखने वाले नरेन्द्र नाथ मित्र की हर कहानी किसी न किसी दृष्टि से मन में आलोड़न जगाने वाली है। ये भिन्न-भिन्न जीवन स्थितियों, भावबोधों से गुजरते हुए जो एक चीज अत्यन्त सूक्ष्मता से सामने ले आती है, वह है जीवन के प्रति गहरी संवेदनात्मक परख ।

कुछ वर्ष पहले फ्रेंच में समकालीन भारतीय कहानियाँ शीर्षक से एक पुस्तक प्रकाशित हुई थी। इस संग्रह में भारतीय भाषाओं की प्रतिनिधि के रूप में नरेन्द्र नाथ मित्र की 'हेडमास्टर' को चुना गया था। इस पर समकालीन बंगला कथाकार सन्तोष कुमार घोष ने लिखा था कि, 'कहानी को कहानी की तरह कहना साथ ही शिल्प के सूक्ष्मतम गुणों को तृण शीर्ष पर झिलमिलाते शिशिर बिन्दु की तरह चुनकर यत्न से संजोना', इसे हम नरेन्द्र नाथ की जादूगरी कहें या रचनाशक्ति, पर यह गुण उनमें अनायास ही दिखाई पड़ता है। इस रूप में वे विश्व के महान कहानीकारों यथा ओ हेनरी, चेखव और रवीन्द्रनाथ के समकक्ष खड़े दिखाई देते हैं।'

वे बंगला समाज के बुनियादी जीवन-मूल्यों और मानवीय सम्भावनाओं के अप्रतिम चितेरे हैं। उनके कथा साहित्य में उपस्थित अनेक चरित्र सामान्य-से होकर भी अपनी गहरी छाप छोड़ते हैं, इसीलिए दि सेंटिनल ने उनके लिए लिखा था- छोटो गल्पेर बड़ो लेखक' कहा था। स्वयं लेखक ने 'गल्प लेखार गल्प' में अपनी कहानियों के संदर्भ में कहा है, 'मेरी कहानियाँ विशुद्ध प्रेम की कहानियाँ हैं।' हम कह सकते हैं, यह प्रेम एक विराट दायरे का प्रेम है। प्रेम मानवता से, प्रेम वंचित और बेसहारा पारम्परिक नारी की मुक्ति से, उसकी सांगठनिक शक्ति और उसकी अस्मिता की रक्षा से।

नरेन्द्रनाथ मित्र बंगला फ़िल्म निर्देशकों के प्रिय लेखक रहे हैं। उनकी अनेक रचनाओं का आधार लेकर फ़िल्में बनाई गई हैं, जैसे सत्यजीत राय ने 'महानगर' पर इसी नाम से, अग्रगामी ने 'विलंबित लय' और 'हेडमास्टर' पर इन्हीं नामों से, नरगिस अख्तर ने उनकी 'पौष माशेर पिरीत" पर, बुद्धदेब दासगुप्ता ने 'फेरा' पर

और राजेन तरफ़दार ने 'पर्यंक' पर फ़िल्में बनाईं। हिन्दी में अमिताभ बच्चन और नूतन द्वारा अभिनीत फ़िल्म 'सौदागर' हम सबने देखी हो होगी, जो कि नरेन्द्रनाथ मित्र की 'रस' कहानी पर आधारित है। इस पुस्तक का शीर्षक भी इसी कहानी को ध्यान में रखकर चुना गया है। बहरहाल,

हमने नरेन्द्रनाथ मित्र की कहानियों का चयन करके उनका भाषांतरण किया है। हम स्वगीर्य श्री नरेन्द्र नाथ के परिवार के आभारी हैं, जिन्होंने बड़े ही स्नेह से हमें अनुवाद का अधिकार दिया। आशा है, भविष्य में भी यह सौजन्यता बनी रहेगी।

चन्द्रकला पांडेय

जय कौशल

रचनाकार का परिचय

किसी भी मनुष्य के जीवन पर कुछ चीजों का प्रत्यक्ष प्रभाव देखा जा सकता है- जन्मभूमि, परिवार, देश-काल और परिस्थिति। ये मिल-जुलकर ही किसी के व्यक्तित्व का निर्माण करते हैं।

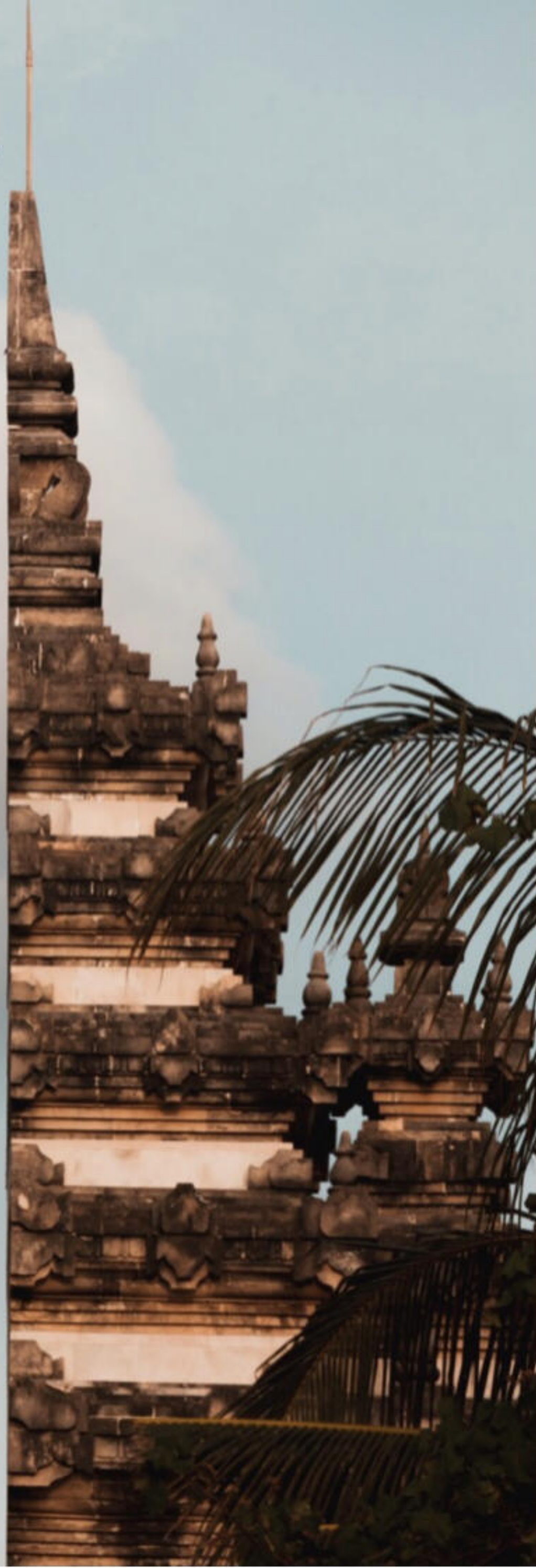
कुमार नदी के किनारे फ़रीदपुर जिले के अंतर्गत एक छोटा सा गांव था- सदरदी। नरेन्द्रनाथ मित्र के पूर्वज इसी गांव के निवासी थे। एक बड़े संयुक्त परिवार, जिसके कर्ता-धर्ता नरेन्द्रनाथ के पिता महेन्द्रनाथ थे। नरेन्द्रनाथ का जन्म 30 जनवरी, 1916 को हुआ था। उनके जन्म के तुरन्त बाद एक घटना घटी थी, जो इनके जीवन में बहुत महत्वपूर्ण पड़ाव बनी। निस्संतान जगतमोहिनी के दु:ख को दूर करने और परिवार की शांति को कायम रखने के लक्ष्य से कुलगुरू के निर्देश पर उनकी जन्मदायिनी बिराजबाला ने अपनी पहली संतान नरेन्द्रनाथ को अपनी सौत जगतमोहिनी को दान कर देना पड़ा। होश संभालने के बाद उन्होंने जगतमोहिनी को ही अपनी माँ के रूप में जाना। बचपन में उन्हें कभी यह अहसास ही नहीं हुआ कि वे जगतमोहिनी की कोख से नहीं जन्मे। नरेन्द्रनाथ के अलावा एक भाई और एक बहन के बाद बिराजबाला की मृत्यु हो गई। उस समय तो इन्हें माँ को खोने का कोई गम ही नहीं हुआ। अपनी असली माँ के बारे में इन्हें बहुत बाद में पता चला लेकिन इन्होंने जगतमोहिनी से जो स्नेह पाया, वह दुर्लभ था। अपने बचपन की छोटी-छोटी घटनाओं को लेकर भी उन्होंने कुछ कहानियां लिखी हैं, जो इनकी लेखकीय प्रतिभा की परिचायक हैं।

सदरदी गांव विस्तृत धान-खेत, नदी और हरे-भरे मैदानों से घिरा था। बरसात में नदी जब भर जाती थी, तो नालों से होता हुआ पानी इनके दरवाजे तक आ जाता था। यातायात के लिए केवल नाव ही एकमात्र सहारा होती। उनकी प्रारम्भिक रचनाओं में स गांव और इसके निवासियों की कथा उभरकर आई है। उन्होंने एक जगह लिखा है- 'इस गांव में खेतिहर मुसलमान, धोबी, नाई, बढ़ई, कुम्हार छोटे-मोटे व्यवसायी, जुलाहे, मछेरे तथा अन्य कई पेशों से जुड़े लोग रहते थे। इनमें से हर व्यक्ति, हर समुदाय के लोगों से मेरी घनिष्ठता तो नहीं थी, लेकिन जाने-अनजाने यह पृष्ठभूमि कब मेरी मानसभूमि में उद्बुद्ध हो गई, नहीं बता सकता।

हाफ़ ए लाइफ़

नोबेल पुरस्कृत
वी.एस. नायपॉल
के चर्चित उपन्यास
'Half A Life'
का हिंदी अनुवाद

अनुवाद:
जय कौशल



हाफ़ ए लाइफ़

(नोबेल पुरस्कृत वी.एस. नायपॉल के चर्चित उपन्यास 'Half A Life' का हिंदी अनुवाद)

अनुवाद

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अपनी बात

अनुवाद की दुनिया में विवाद बहुत हैं. कोई कहता है अनुवाद को अनुवाद जैसा लगना चाहिए तो कोई उसे अनुसृजन मानता है. किसी को वह कला, विज्ञान या फिर शिल्प लगता है तो किसी को उसमें तीनों रूप नज़र आते हैं. अनुवाद और अनुवादकों को लेकर भी विभिन्न कटूक्तियाँ प्रचलित हैं, जैसे- 'अनुवादक प्रवंचक होता है.' 'जो मौलिक नहीं लिख सकता वही अनुवाद करता है.' 'अनुवाद किसी स्त्री की तरह है जो या तो सुन्दर होगी या फिर वफादार.' 'अनुवाद दोयम दर्ज़े का काम है' आदि.आदि. इसलिए शुरुआत में मैं थोड़ा डरा हुआ था.

वैसे तकनीकी स्तर पर देखें तो अनुवाद-कर्म भौतिक विज्ञान की किसी कक्षा में बैठने की तरह है, जहाँ पहले नियम खोल-खोलकर समझाए जाते हैं और फिर प्रयोगशाला में उनका अनुप्रयोग कराया जाता है. भौतिकी में प्रयोक्ता को उन्हीं नियमों के अनुसार चलना पड़ता है ताकि वांछित उद्देश्य सिद्ध हो सके. प्रथमदृष्टया अनुवाद भी रचनात्मक होता हुआ अपनी प्रक्रिया में तकनीकी लग सकता है लेकिन इसकी रचनाशाला में घुसते ही सारे औपचारिक एक नियम किनारे हो जाते हैं- रह जाती है वांछित भाव या अर्थ प्राप्ति की एक अभिलाषा.

अनुवाद जब यंत्रवत अभ्यासमूलक कार्य मान कर किया जाता है तो यह न केवल जटिल बल्कि बोझिल जान पड़ता है क्योंकि इसमें शब्द से लेकर अर्थ, वाक्य.संरचना, संदर्भ, मुहावरों, पर्यायों, संस्कृति और शैली आदि सबका ध्यान रखना पड़ता है. मलयाली कवि के. सच्चिदानंदन की एक पंक्ति है- अनुवादक ढोता है अपने कंधों पर किसी और का सिर. इसलिए दोनों भाषाओं का विद्वान होने के साथ.साथ अनुवाद.कर्म में रुचि भी आवश्यक है. तभी अनुवादक सही अर्थ के लिए सही शब्द का संधान कर सकेगा.

वी.एस.नायपॉल कृत 'हाफ़ ए लाइफ़' को चुनने के पीछे कई कारण रहे. इनके बारे में लगातार सुनता आ रहा था, हमेशा विवादों में घिरा रहनेवाला एक लेखक. विख्यात और कुख्यात दोनों. देखा जाए तो कुख्यात ज्यादा- उसे 'भारत विरोधी', 'मुस्लिम विरोधी', 'धर्म विरोधी', 'प्रतिक्रियावादी', 'घटिया मित्र', 'महिला प्रेमी', 'गोरों का निग्गर' और भी न जाने क्या-क्या अप्रिय संज्ञा और संबोधनों से पुकारा गया.

लेकिन किसी व्यक्ति अथवा विचार को स्वीकारने या ख़ारिज करने से पहले उसके बारे में जानना बेहद जरूरी है. हमें शहाबुद्दीन की तरह नहीं होना चाहिए कि 'सैटनिक वर्सेज़' को पढ़े-जाने बिना, केवल सुनकर ही कि उसमें मुसलमानों के ख़िलाफ़ लिखा गया है, सलमान रूश्दी के लिए फाँसी की माँग करने लगे.

तो, स्वीकारने या ख़ारिज करने से पूर्व जानने के लिए नायपॉल को चुनना पहली वजह रही. दूसरे, वह भारतीय मूल के लेखक हैं- एक वजह यह भी थी.

लेखक चुनाव के बाद बारी आई कृति चयन की. नायपॉल ने अब तक चौदह कथात्मक (2004 में प्रकाशित मैजिक सीड्स सहित) और बारह ग़ैर कथात्मक कृतियों की रचना की है जिनमें विस्थापन और अलगाव की पीड़ा अपने आत्यंतिक रूप में दर्ज है. कथात्मक कृतियों में 'ए हाउस फार मिस्टर बिस्वास' के बाद 2001 में प्रकाशित उनकी नवीनतम कृति 'हाफ़ ए लाइफ़' ही सर्वाधिक प्रसिद्ध मानी जा रही थी. उनके पाँच दशकों के लेखन में यह पहली पुस्तक है जिसकी पृष्ठभूमि भारत है. इसमें विभाजित व्यक्तित्व और विभाजित समाज की दास्तान अभिव्यक्त हुई है. ब्राह्मण पिता और बैकवर्ड (दलित) माता से उत्पन्न 'संकर' पुत्र (उपन्यास का नायक) किस तरह अपनी पहचान के प्रति चिंताग्रस्त रहता है. उपन्यास की मूल अंतर्वस्तु यही है.

वी. एस. नायपॉल की कृति हाफ़ ए लाइफ़ का अनुवाद करते समय विभिन्न अनुभवों से गुजरा. इससे मेरी भाषिक-सांस्कृतिक समृद्धि तो बढ़ी ही, इंग्लैण्ड और अफ्रीका के इतिहास, भूगोल एवं सामाजिक जीवन-शैली की समझ भी विकसित हुई.

'हाफ़ ए लाइफ़' नायक के आधे जीवन की अधूरी जीवनी है. पुस्तक के अंग्रेज़ी शीर्षक में ये दोनों अर्थ ध्वनित होते हैं. इस उपन्यास का मूल शीर्षक अनूदित करते हुए मुझे कई विकल्प सूझ रहे थे. जैसे- आधी ज़िदंगी, अधूरा जीवन, अधूरी जिंदगी, एक जीवन अधूरा-सा – लेकिन वस्तुत: कोई भी अनुवास अंग्रेज़ी शीर्षक के समकक्ष नहीं लग रहा था, आखिरकार मैंने इसे 'हाफ़ ए लाइफ़' ही रखने का निर्णय लिया.

उपन्यास का नायक विली ब्राह्मण पिता और बैकवर्ड (भारतीय संदर्भ में कहें तो दलित) माता की संकर संतान है, जो अपनी अलग पहचान की तलाश में चिन्तित रहता है. उसकी जटिल मानसिक ग्रंथियों एवं संवेदनाओं

को पकड़कर समझने और अनूदित करते हुए निश्चय ही कई-कई बार पंक्तियों को छोड़ना, जोड़ना और संयोजित करना पड़ा है. मूल रचना के प्रति निष्ठा रखते हुए लक्ष्य भाषा की प्रकृति के अनुसार थोड़ी-बहुत रचनात्मक छूटें भी ली गई हैं, जिसका उद्देश्य अनुवाद में प्रवाहमयता और पठनीयता बनाए रखना था.

इस उपन्यास में नायपॉल ने अपनी शैली के अनुरूप लम्बे-लम्बे वाक्यों का प्रयोग किया गया है. जिनमें विशेषण, वाक्यांश भी खूब आए हैं. यद्यपि 'डेली टेलीग्राफ़' ने इस कृति की विशेषता 'वण्डरफुल रीडेबिलिटी' कहकर रेखांकित की है. लेकिन उनकी वाक्य-शैली की यही विशेषताएँ लक्ष्य-भाषा हिन्दी में लाने में काफी मेहनत करनी पड़ी है. मूल पाठ में प्रयुक्त कुछ शब्दों के समतुल्य हिन्दी में सटीक अनुवाद न मिलने के कारण उनका या तो वैसे ही लिप्यन्तरण कर दिया गया है अथवा उचित शब्द के अभाव में प्रचलित शब्द का सहारा लेकर काम चलाया गया है. उदाहरण के लिए, 'जीनियाज', 'जैक्वारी' जैसे शब्द लिप्यांतरित किए गए हैं. कुछ महत्त्वपूर्ण संदर्भों की पाद.टिप्पणियाँ यथास्थान दे दी गई हैं.

यह अनुवाद मेरे अकादमिक कार्य का हिस्सा रहा है, जो अब पुस्तक रूप में आपके सम्मुख प्रस्तुत है. उम्मीद करता हूँ, इसे पढ़कर आप जहाँ विश्वविख्यात उपन्यासकार नायपॉल को थोड़ा और समझ सकेंगे, वहीं एक विश्वस्तरीय उपन्यास को हिन्दी में पढ़ने का सुख भी प्राप्त कर सकेंगे।

सादर...

- जय कौशल