Framework on

Climate & Green Technologies at IIT(BHU)

Preamble:

India is a developing country facing the major challenges of sustainable development without compromising its growth targets. Climate change and environmental degradation are some of the problems that arise due to rapid development. All over the world and even in India many initiatives were taken towards sustainable development. India required the indigenous technologies and unique initiative to solve its own problems. Technology and solutions developed outside may not work very well in India.

IIT(BHU) being a premium technical institute and having experts in many domain areas is playing a leading role towards these green and sustainable initiatives. IIT(BHU) is taking lead role in initiative research towards achieving the goals of green mobility, green energy, smart city and green campus, clean Ganga and Sustainable industries. Pilot projects in collaboration with urban local bodies and industry is already in progress or in active stage of initiating to demonstrate few of the technologies. The research and expertise available in the various fields of engineering and technology may lead to a promising interdisciplinary research which will lead to achieve the desired objectives. Institute with industrial collaborations is working towards developing and indigenizing the technologies and implementing them in the field.

IIT (BHU) main focus is in the following Five Major Verticals:

- Green Mobility

- Green Energy
- Smart City and Green Campus
- Clean Ganga
- Sustainable Industries

Already research and industrial projects are going on in these areas and the Institute has the capability to grow in these five areas in the next 5 years by collaborating with various departments and facilities. Further there is strong collaboration with other institutions in India and abroad to carry out path breaking research in this field.

Developments in the field of Remote Sensing, IoT, data science, smart materials, waste management, health management, hydrogen and other sustainable energy technologies, and many other related fields have made the pathway for green and sustainable technologies. These technologies not only ease human life but also save our climate and natural resources. Judicial use of all such technologies will lead to solve many basic problems like energy, mobility, pollution, waste etc. face by the society. Green and sustainable technology studies have tremendous impetus now, and a large number of countries are involved in undertaking a variety of such projects, which include creating a sound knowledge base by funding basic science studies related to technological developments in mentioned areas. Promotion and progress of research, and related technological developments in the area bring opportunities for both national and international collaboration, for commercial benefits in a variety of domains, and also ensuring the security and sovereignty of a nation in a substantially enhanced manner.

Research Work under various verticals

i. Green Mobility:

Dr. Agnievsh P of Transportation Engineering Section of Department of Civil Engineering is working in the area of improving public transport ridership which is critical for arresting the persisting issued faced by Indian cities such as traffic congestion, environmental decay, job-housing imbalance, and poor health conditions. Most of the Indian cities are characterized by high population density, intensely mixed land use patterns, short trip distances, and more than 50% share of motorized two-wheelers, intermediate public transport (IPT) covering both non-motorized "cycle-rickshaws" and motorized "three-wheeled auto-rickshaws", walking, and cycling. The fixed-route bus transitis currently serving about 15% of travel demand in the city and is in dire need of expanding and improve its shortcomings because of this majority of the people are relying on IPT alternatives provided by the private sector. These shortcomings include the lack of first/last-mile connectivity, low level of service and comfort, absence of dedicated lanes, inefficient transit network, schedule, and stop locations, escalating cost of operations, high labour costs, poorly maintained or ageing fleet and overcrowding. The city structure of Varanasi deviates from the classical "employment-dense

centre and housing-dense periphery" model since commercial activities are spatially dispersed and central core consists of not only commercial but also housing concentration. These complex land-use and transport patterns make it difficult to plan for transit system redesign or emerging transit modes such as Aerial Ropeway Transit (ART) using the same accessibility indices used for cities in highly motorized countries in North America.

With a funded project through I-DAPT hub foundation (as a part of the NSF-DST funding for US-India collaborative research), research is already underway to to develop data-driven transit solutions for underserved communities. This ongoing research is examining the potential of the Aerial Ropeway Transit (ART) to improve the overall patronage of transit system in Varanasi and enable multimodal mobility for its citizens. The specific milestones of the project will be: (1) developing transit demand forecasting algorithms, (2) identifying optimal stop locations for fixed-line ART service, (3) redesigning transit network and operational schedule with fairness and equity considerations, (4) creating story-maps animation videos on public transportation usage for informing policymakers and transport authorities. The analysis carried out in the project will explore how the existing transit services. e.g., buses and IPT shuttles, can be altered to create multi-modal plans that can further improve coverage and accessibility for underserved origin-destination pairs.

ii. Clean Ganga:

IIT(BHU) has successfully developed integrated sensor systems for direct detection of various carcinogenic metals as well as xenobiotics in the tap water matrix as well as in the Ganga river matrix. All the sensing chips have been indigenously developed and the voltammetric responses were analyzed in using a miniaturized device. Such systems for direct detection of these targets are able to sense the molecules in merely 2-3 seconds without any mediator and / or redox molecules. Such an analytical system will provide the basis to develop the green initiatives to clean Ganga as well as the water bodies at IIT(BHU). Not only this, these sensor systems will be applied to monitor the cleaning strategies of Ganga river. We intend to place this system at even various water bodies across Varanasi ghats and municipal water treatment plants. On additional following are few more areas where IIT(BHU) is working

In the Department of Civil Engineering research is going on in cleaning of River Ganga through rejuvenating its tributaries. Department of Civil Engineering is actively working with many state and level agencies to keep the Ganga clean through various technological interventions. Mainly work is going on To restore the river channel, to restore its linkages with feeder streams, tributaries and surface water bodies and to revive the hydrological cycle of the watershed for a sustainable flow of water.

iii. Smart City:

Department of Architecture, Planning and Design is working on Retrofitting Existing Buildings using green and sustainable strategies which can help address National

issues - Energy & Water Efficiency, Conserving Natural Resources, Handling of all kinds of Wastes etc. Application of both Technical & Non-technical Strategies can be applied to existing buildings through the process of retrofitting using Bioclimatic & Eco- design Principles.

Studio 2 in Block B of the Department of Architecture, Planning and Design, IIT (BHU) has a large influx of direct solar radiation in the months of April, May and June leading to discomfort for both students and teachers. A study is being undertaken to create thermal comfort conditions in the studio. Initial strategy targets reducing solar radiation insolation by using various shading devices. Preliminary results suggest that by incorporating inclined shading systems a reduction in the indoor temperature can be achieved. Further studies are required to understand the impact of the shading systems on the daylight levels.

In addition, work is going on to formulate specialized urban sustainability assessment framework/tool for environmentally sensitive hilly areas known as Sustainable Urban Development of Environmentally Sensitive Hill Areas Sustainability IndeX (SUDESHA-SIX). The framework comprised of major parameters relevant to measure sustainability levels in hilly areas such as Site Suitability, Climate and Energy, Environment and Ecology, Transportation and Connectivity, Built Environment and Visual Resources.

Currently, the formulation of sustainability action plan for the IIT (BHU) (at campus and building level) is under progress. Working on the ECBC Compliance report for primary healthcare buildings using Design Builder for running various simulations such as lighting, heating design, cooling design.

Few goals to achieve in near future:

- Planning to take up more hill towns for the evaluation of developed urban sustainability assessment tool so as to evolve more generic criteria and indicators for all hill context or similar context.

- Development of a software based decision-making tool that take into account of context specific sustainability factors which can be used throughout a project, from initial design, planning to operation; display results of the assessment visually (via dashboards) and track sustainability through its life cycle and assessing alternatives where a decision is to be supported (using AR, VR).
- Development of sustainability assessment tool for hill areas useful at building level.

Dr. Hari Prabhat Gupta is working on the designing and implementing comprehensive IoT sensing systems that effectively meet a wide range of requirements. Group possess extensive expertise across various domains, including sensor data analytics, computer networks, artificial intelligence, Fog computing, and ubiquitous computing. With a strong emphasis on research and development, we have specialized in harnessing the immense potential of LoRaWAN communication technology. This allows to seamlessly transmit and manage sensory data, enabling the creation of intelligent IoT sensing systems adaptable to diverse applications. Simultaneously, they are dedicated to pushing the boundaries of technological innovation. The team actively develops cutting-edge edge devices that function as powerful processing units at the network's edge. These devices optimize performance, enhance computational capabilities, and facilitate real-time data analysis and decision-making. By combining our expertise in LoRaWAN communication technology with advanced edge device development, group pioneer the next generation of IoT systems. Through our ongoing research, research group continuously seek to unlock new possibilities, improve efficiency, and empower businesses and industries with the transformative capabilities of IoT technologies. The ultimate goal is to drive innovation, shape the future, and create a significant impact in the realm of IoT.

iv. **Green Energy**:

Prof Rajesh Kumar Uphadayay research group in Department of Chemical Engineering is working on development of on-site ultra-pure hydrogen generation devices. We have already demonstrated a 1kW device for on site production of hydrogen and integrated it with a Fuel cell to generate 1 kW power. The same is now under the commercialization. We are also working on a self-sustaining hydrogen production device which will require no external energy.

With GAIL India Limited we are working on generation of ultra-pure hydrogen from natural gas. This device is of 5 kW capacity. Apart from this we are working on underground coal gasification, biomass gasification to produce green hydrogen

Dr. Abir Ghosh in the Deparmtnt of Chemical Energy is working on *Design and Development of Novel Electrolytes for Next-Generation Na-ion Batteries* **They** have identified the specific degradation mechanisms undergoing within the positive electrode (PE) and electrolytes of a Li-ion battery. Continuum-scale models of these degradation mechanisms are developed.

In future they are planning to experimentally validate the developed models, couple all the developed degradation models with the other already available models of negative electrodes to develop a whole-cell degradation model.

In addition the team is working on the Linear Stability Analysis (LSA) of Electrode/Electrolyte Interface (E/EI). A LSA model has been developed. The developed LSA model is able to distinguish stable and unstable domains of the interface. In **Future they** will include different interfacial chemical reactions into the model to obtain the effect of the undesirable chemical reaction kinetics.

Work is also going on in the Molecular-scale Na-ion Positive Electrode (PE) Development. Prussian blue (PB) and its analogues are an attractive material for positive electrodes in Na-ion batteries. We have performed classical molecular dynamics (MD) simulation on Prussian white structure to optimize the same to be used in the Na-ion batteries to obtain high energy and power densities.In Future group will finalise the optimum PB structure and focus on PB/electrolyte interface.

Dr. Mahobia The iron and steel industry contributes about 7 % of the total carbon dioxide emission in the world and about 35% of all CO_2 produced in the manufacturing sector. About 1.9 tons of CO_2 is produced per ton of crude steel. Carbon from coke or coal is the primary source of heat energy in blast furnaces, and rotary hearth furnaces used worldwide. Carbon in the form of graphite electrodes is also used in electric arc furnaces. Thus, it is easy to comprehend that carbon is used extensively along the entire steelmaking route, making it a high contributor to global CO_2 production. Using hydrogen gas as a reductant in place of carbonaceous material offers significant advantages like zero greenhouse gas (GHG) emissions, faster reduction at lower temperatures, absence of a complicated boudouard (C-O) reaction system. Using green hydrogen can reduce the emissions of 2.3 gigatons of CO_2 annually and decrease global warming. The most important benefit would be the production of water as a byproduct gas which could reduce the carbon footprint of the iron and steel industry. As the hydrogen molecule size is smaller than CO, the diffusion rates into the pellet will be much higher than CO, which could lead to a faster reduction rate and enhanced Metallization. Many studies have been conducted worldwide on the direct reduction (DR) of iron ores and have established that the reduction rate of iron oxides with hydrogen was higher than that observed for CO-based processes.

In literature, most hydrogen reduction studies have been carried out on commercial-grade iron ores containing more than 65% Fe and limited studies on the hydrogen reduction of low-grade ores containing less than 50% Fe are available. Any pellet's crushing strength after reduction (CSR) is a critical factor for its use in any shaft furnace. Limited studies are available on the CSR of hydrogen-reduced low-grade iron ore pellets. According to the world steel association, the worldwide crude steel production as of December 2022 was 1878.5 Mt, of which 124.7 Mt was produced in India. India has ambitions of producing 300Mt of crude steel by 2030. To achieve such a humongous target, low-grade ores, which India has vast reserves, need to be utilized. The reduction of low-grade ores with hydrogen could be advantageous as the time consumed could be less than that observed with high-grade ores. Some low-grade ores also contain other precious metals like Nickel, Cobalt, Vanadium, Chromium, etc. Moreover, low-grade ores are also found in mines as stockpiles.

Though the amount of gangue elements would be high, shorter reduction times and lower reduction temperatures could make hydrogen reduction a better alternative to carbon-based reduction. Laboratory scale studies on hydrogen reduction of low-grade ores are few, hydrogen reduction of pellets made from low-grade multimetallic ore (Total Fe: 45%) has been investigated by the Department of Metallurgical Engineering, Indian Institute of Technology (BHU), Varanasi.

As freshwater resources become increasingly scarce, seawater electrolysis is anticipated to become the preferred method for hydrogen production in the future. Saline water electrolysis encounters competition between the anodic oxygen evolution reaction (OER) and chloride oxidation. Further, the electrodes suffer from corrosion from the produced Cl_2, and blockage of the active sites. Dr. Arindam Indra, developed different layered double hydroxide (LDH)-based catalysts, which can produce high activity for seawater oxidation under industrial conditions. In 6.0 M KOH seawater electrolyte, the catalyst requires only 250 mV overpotential to achieve an industrial-scale current density of 500 mA cm -2 . In an alkaline seawater electrolyte, this multi-metallic electrocatalyst stands out as one of the most efficient transition-metal-based OER electrocatalysts reported to date, thus advancing the progress of seawater electrolysistechnology. Interestingly, our catalyst achieved a current density of 2.5 A cm -2 , a remarkable high-value in this field.

v. Sustainable Technologies:

Dr. Prodyut Dhar is working on Biodegradable polymers and renewable materials for replacement of single-use plastics & green technologies for microplastics mitigation**.** The utilization of single plastic has progressed rapidly worldwide in recent decades due to its lightweight, mechanical properties, and low cost. High plastic consumption with increased micro-plastic contamination causes severe detrimental impacts on human health, soil and aquatic ecosystems. With the Government of India (GoI) decision to ban single-use plastic from the year 2021, it is important to develop commercially-viable and scalable biodegradable and renewable polymer based processing technologies to meet the huge demands of the country. This brings in an opportunity for the indigenous synthesis, fabrication, and processing of biomass-derived bio-plastics and biodegradable polymers such as cellulose derivatives, poly(lactic acid) (PLA), poly(hydroxybutyrate) (PHB), and polyvinyl alcohol (PVA) due to their renewability, sustainability, low energy consumption during production, non-toxicity to living entities, and low-cost. Moreover, development of composite formulations using renewable derivatives such as bamboo or agro-waste residues such as rice, sugarcane and wheat will induce bio-plastics with high thermal, barrier and mechanical stability, which can aid in the production of a variety of daily-use plastic products. Scalable extrusion based processing technologies for biomass-based plastics production finds potential application in plethora of sectors involving electronics, food packaging, and biomedical applications.

He is also working in the Life-cycle assessment (LCA) of green and sustainable technologies. LCA provides a platform for evaluation of sustainability in developing novel innovations that can be scaled to pilot and further at the industrial level to

substitute or replace the conventional technologies. It aids the stakeholders in deciding the industrial scale production feasibility, ecological hotspots in production processes, and potentially harmful effects of the proposed technologies on the ecosystem. Recently, several eco-friendly novel technologies such as electric vehicles, fuel cells, batteries, biofuels, and green hydrogen energy are being proposed for replacement of non-sustainable petroleum-based materials and fuel sources like hard coal, petrol, and plastics. The development of life cycle-based studies for these emerging novel technologies will allow to evaluate and screen different processes based on sustainability and environmental impact parameters. The environmental impacts in a quantified manner for carbon footprints or global warming potential and its comparison with the sustainable systems will aid the consumer, government, and manufacturers in selecting the appropriate sustainable systems. The life cycle analysis covers the ecological impacts generated during production, utilization as well as after shelf life of a product. The end-of-life LCA can suggest and compare the ecological impacts of conventional and sustainable technologies for assessing the potential harmful effects of a disposed product on the environment.

Dr. Bhuvaneshwari research is mainly focused on designing electrode and catalyst materials from sustainable resources as well as biomimicking them through advanced process methods like electrospinning technology. Her lab is currently developing fiber based free standing electrodes for supercapacitor and battery in a sustainable manner via choosing the biopolymer based matrix material for carbon matrix formation. Further, as part of waste utilization, her lab targeting agricultural waste materials towards carbon catalysts synthesis for fuel cell and other energy and biomedical related applications. Recently, her lab is into the field of designing natural product based nanofiber mats for sustainable packaging, membrane in water filtration and fuel cell applications and antimicrobial wound healing bandages. Her lab also formulating the sustainable bio-ink from agricultural based materials for tissue engineering applications.

Sustainable Healthcare:

Dr. Cherial Samual project aimed to assess the impact of Ayushman Bharat on institutional deliveries, maternal mortality, and infant mortality rates in the UP-East region. The working paper employed a comprehensive approach to investigate the transformative potential of Ayushman Bharat in rural India. The final project will encompass both quantitative and qualitative research methods, including surveys, interviews, and data analysis, to gather comprehensive insights into the effectiveness of Ayushman Bharat. By focusing on the UP-East region, the research aims to provide a region-specific analysis, highlighting the unique challenges and opportunities in the area. This will enable tailored interventions and policy recommendations for effective healthcare transformation and inclusive development. The research questions address the impact of Ayushman Bharat on maternal and infant mortality rates, factors influencing the attainment of sustainable development goals, and the increase in institutional deliveries. The working study integrates the initiative with the sustainable development goals (SDG 3.1 and SDG 3.2), emphasizing its alignment with the

global health agenda and fostering international collaborations. This research project will hold significant relevance for evidence-based policymaking, fostering inclusive healthcare growth, and achieving sustainable development goals related to good health and well-being. The study aims to contribute to the transformation of healthcare in the UP-East region, improving health outcomes, reducing mortality rates, and promoting inclusive and sustainable development in rural India. The findings aims to provide valuable insights and recommendations for policymakers, enabling informed decision-making, resource allocation, and policy adjustments.

Green Committee

Green Committee has been constituted in the Institute which works on the following:

1. Develop a green policy and framework for the Institute to address and promote sustainable practices and sustainable living.

2. Green audit of infrastructure planning, execution maintenance for the Institute.

3. Facilitate quantification of green initiatives for the Institute.

4. Develop a plan for implementation in a phased manner at the Institute.

5. Making the green agenda a participatory and transparent process to generate greater awareness in the campus community.

6. Suggest ways by which green initiatives can connect with neighbours-hood communities,

Green Committee at IIT(BHU)

Biosafety Committee at IIT(BHU)

List of Ongoing and completed Projects

- Amitesh Kumar (PI), "Development of connected vehicle technology for an urban concept autonomous vehicle", I-DAPT HUB FOUNDATION, 30 Lakhs, 2023 - 2025,
- Shishir Gaur (PI), Dr. Anurag Ohri (Co-PI), Hydrological experiment and water fluxes modeling for SWOT and Sentinel-3A/3B missions: Ganga River , 10.34 Lakh , 2023-24 , ISRO , Ongoing
- Shishir Gaur (PI), Dr. Anurag Ohri (Co-PI), Bringing Global Sustainable Solutions for Clean Rivers in India through the Concept of Living Lab , 59.05 Lakh , 2023 , The Danish Embassy, N Delhi , Ongoing
- Shishir Gaur (PI), Dr. Anurag Ohri (Co-PI), Development of Algorithms for water quality monitoring using ground instrumentation and optical sensors

onboard Unmanned Airborne Vehicle and Satellite Data , 25.18 Lakh , 2022-25 , ISRO , Ongoing

- Dr. P.K. Singh (PI), Shishir Gaur Co-PI), Dr. Anurag Ohri (Co-PI), Strategic Planning for Water Resources and Implementation of Novel Biotechnical Treatment solutions and Good Practices (SPRING) , 71.28 Lakh , 2020-23 , Indo- EU Collaborative research project, DBT, GOI , Ongoing
- Dr. R.K. Upadhyay (PI), Preparation of Dense Pd/Pd-Alloy Membrane and Optimization of Multi-Pass Membrane Separator to Separate Ultra-Pure Hydrogen for Onsite Application in Year 2021 to 2024, Agency: SERB, Amount: 42.576 Lakhs
- Dr. R.K. Upadhyay (PI), Development of Natural Gas Based Membrane Reformer for Fuel Cell Grade Hydrogen Production in Year 2021 to 2023, Agency: GAIL (India) Limited, Amount: 121.54 Lakhs
- Dr. R.K. Upadhyay (PI), Design and Development of a Membrane Reformer Prototype for Production of Ultra-Pure Hydrogen from Methanol for Fuel Cell Based Vehicle and Power Generators in Year 2016 to 2020, Agency: Department of Science and Technology, India, Amount: INR 115 Lakhs
- Dr. R.K. Singh (PI), Data Anomaly Detection and Mitigation for Distributed Control and Optimization with Inverter Based resources (IBR) in cyber physical Network Infrastructures, I-DAPT Hub foundation IIT (BHU), Ongoing
- Design and Development of the Next Generation Cost Effective Reconfigurable On-Board Battery Charger with Health and Fault Monitoring. MeitY, Ongoing
- Electrolytic Capacitor-less Six Pulse DC-Link Photovoltaic System Connected to Grid". CPRI, Ongoing
- Design, Development and Demonstration of solar PV integrated On board and Off-board Electric-Rickshaw charging Infrastructure, DST SERD, Ongoing
- Dr. Abir Ghosh (PI), Design and Development of Kinetically Stable Electrolytes for Next-gen Li-ion Batteries (ElectroLiion), SREB, 29.4 Lakhs, October 2022 – October 2024.
- Dr. Amitesh Kumar (C0-PI), Development of catalytic integrated air-steam gasifier for the gasification of agriculture waste and valorization of gasified fly ash on concrete work", DST, 39.5 lakhs (accepted)
- Dr. Prodyut Dhar (PI), Bioengineering of Living Materials to fabricate Functionalized Bacterial Nanocellulose for High-Performance Applications, DBT, Govt. of India,, 2021-26, Ongoing
- Dr. Prodyut Dhar (PI), Novel Bioprocessing routes for development of value-added products, IIT (BHU), 2020-21, Ongoing

List of Publications:

- Pani, A., Mishra, S., and Sahu, P. (2022) "Developing multi-vehicle freight trip generation models quantifying the relationship between logistics outsourcing and insourcing decisions", Transportation Research Part E, Vol. 159, DOI: https://doi.org/10.1016/j.tre.2022.102632 (Q1 Journal in Transportation - Impact Factor: 10.047)
- Sukhija, M., Saboo, N., and Pani, A. (2022) "Economic and environmental aspects of warm mix asphalt mixtures: A comparative analysis", Transportation Research Part D: Transport and Environment, Vol. 109, DOI: https://doi.org/10.1016/j.trd.2022.103355 (Q1 Journal in Transportation - Impact Factor: 7.041)
- Pani, A. and Sahu, P. (2022) "Modelling Non-Response in Establishment-based Freight Surveys: A Sampling Tool for Statewide Freight Data Collection in Middle-Income Countries" Transport Policy, Vol. 124, DOI: https://doi.org/10.1016/j.tranpol.2019.10.011 (Q1 Journal in Transportation - IF: 6.173)
- Sahu, P., Qureshi, D., and Pani, A. (2022) "Examining commercial vehicle fleet ownership decisions and the mediating role of freight generation: A structural equation modeling assessment" Transport Policy, Vol. 126, DOI: https://doi.org/10.1016/j.tranpol.2022.07.007 (Q1 Journal in Transportation - IF: 6.173)
- Koramati, S., Majumdar, B.B., Pani, A., and Sahu, P. (2022) "A registry-based investigation of road traffic fatality risk factors using police data: A case study of Hyderabad, India", Safety Science, Vol. 153, DOI: https://doi.org/10.1016/j.ssci.2022.105805 (Q1 Journal in Safety Research - Impact Factor: 6.392)
- Chandra, A., Pani, A., Sahu, P., Majumdar, B., and Sharma, S. (2022) "Identifying Large Freight Traffic Generators and Investigating the Impacts on Travel Pattern: A Decision Tree Approach for Last-Mile Delivery Management", Research in Transportation Business and Management, Vol. 43 DOI: https://doi.org/10.1007/s11067-021-09530-z (Q1 Journal in Decision Sciences - Impact Factor: 4.286)
- Hirose, R., Mehran, B., and Pani, A. (2022) "Investigating Combined Impact of Adverse Road-Weather Conditions and Heavy Vehicles on Saturation Headway", Transportation Research Record, DOI: https://doi.org/10.1177/03611981221089303 (Q2 Journal in Transportation - IF: 2.019)
- Sahu, P., Pani, A., and Santos, G. (2022) "Freight Traffic Impacts and Logistics Inefficiencies in India: Policy Interventions and Solution Concepts for Sustainable City Logistics", Transportation in Developing Economies, Vol. 8. Issue (2) Pages 1-20, DOI: https://doi.org/10.1007/s40890-022-00161-8

- Das, N., Bhattacharjee, R., Gupta, A., N Das, Agnihotri, A., **Ohri, A.**, Gaur, S., (2022), Analysis of algal bloom intensification in mid-Ganga river, India using satellite data and neural network techniques, Environmental Monitoring and Assessment, 194 (8), 1-20, I.F. =2.513.
- Das, N., Sagar, A., Bhattacharjee, R., Choubey, A., Agnihotri, A., **Ohri, A.**, Gaur, S., (2022), Time series forecasting of temperature and turbidity due to global warming in river Ganga at and around Varanasi, India, Environmental Monitoring and Assessment, 194 (9), 1-27, I.F. =3.307.
- Das, N., Bhattacharjee, R., Choubey, A., N Das, Agnihotri, A., **Ohri, A.**, Gaur, S., (2022), Analysis of the spatio-temporal variation of the thermal pattern of River Ganges in proximity to Varanasi, India, Journal of the Indian Society of Remote Sensing, I.F.=1.563.
- Das, N., Bhattacharjee, R., Choubey, A., Agnihotri, A.K., **Ohri, A.**, Gaur, S., (2021), Analyzing the change in water quality parameters along river Ganga at Varanasi, Mirzapur, and Ghazipur using Sentinel-2 and Landsat-8 satellite data during pre-lockdown, lockdown, and post-lockdown associated with COVID-19, Journal of Earth System Science. (Accepted), I.F.=1.371.
- Kaur, H. and Garg, P. (2023). Urban Sustainability Assessment Tool for Hillside Planning, Design and Development. Journal of Urban Planning and Development. https://doi.org/10.1061/JUPDDM/UPENG-3590. (SCI Indexed – Q1, IF: 2.526)
- Kaur, H. and Garg, P. (2021). Case-based assessment of planned hill town using existing urban sustainability assessment tools. Environment, Development and Sustainability. https://doi.org/10.1007/s10668-021-01585-9. (SCI Indexed – Q1, IF: 4.080)
- Kaur, H., Singh P., Bivina GR and Nawani A. (2021). Qualitative Evaluation of Pedestrian Facilities using the PLOS Model. IOP Conf. Series: Earth and Environmental Science 775, 012006. (Scopus Indexed: IS: 0.45)
- Nawani, A. and Kaur, H. (2021). A Microclimatic Study of Urban Neighbourhood Parks. IOP Conf. Series: Earth and Environmental Science 775, 012006. (Scopus Indexed: IS: 0.45)
- shish Gupta and **Hari Prabhat Gupta**, “YogaHelp: Leveraging Motion Sensors for Learning Correct Execution of Yoga with Feedback”, IEEE Transactions on Artificial Intelligence, 2021.
- Swati Chopade, **Hari Prabhat Gupta**, Rahul Mishra, Aman Oswal, Preti Kumari, and Tanima Dutta, "A Sensors based River Water Quality Assessment System using Deep Neural Network", IEEE IoT Journal, 2021 (Accepted).
- Rahul Mishra, **Hari Prabhat Gupta**, and Tanima Dutta, *“*Analysis, Modeling, and Representation of COVID-19 Spread: A Case Study on India", IEEE Transactions on Computational Social Systems, 2021 (Accepted).
- Swati Chopade, **Hari Prabhat Gupta**, Rahul Mishra, Preti Kumari, and Tanima Dutta, "An Energy-efficient River Water Pollution Monitoring System in Internet of Things", IEEE Transactions on Green Communications and Networking, 2021 (Accepted).

- Ramakant Kumar, Rahul Mishra, **Hari Prabhat Gupta**, and Tanima Dutta, "Smart Sensing for Agriculture: Applications, Advancements, and Challenges", IEEE Consumer Electronics Magazine, 2020 (Accepted).
- Preti Kumari, Rahul Mishra, **Hari Prabhat Gupta**, Tanima Dutta, and Sajal K. Das, "An Energy Efficient Smart Metering System using Edge Computing in LoRa Network", IEEE Transactions on Sustainable Computing, 2020 (Accepted).
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- S. R. Meher and R. K. Singh, "A Multimode Power Processor with Wired and Wireless Battery Charging for Electric Vehicle," in IEEE Transactions on Industrial Electronics, doi: 10.1109/TIE.2023.3277094.
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- Simanta Kumar Samal, Rajeev Kumar Singh and R. Mahanty, "Multi Output Hybrid Solar Inverter with no Right Half Plane Zero and Reduced Common Mode Leakage Current", IEEE Transactions on Industry Applications, Vol. 58, Issue 6, Nov-Dec 2022.
- Shri Prakash Sonkar, Vivek Nandan Lal, Rajeev Kumar Singh "Performance Analysis of Diode Assisted Switched LC qZSI Network Based Multi Output Series-Parallel Topologies in Microgrid Application," International Transactions on Electrical Energy Systems, 2022
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