IIT KANPUR
Indian Institute of Technology Kanpur

SHAPING A SUSTAINABLE FUTURE THROUGH CSR PARTNERSHIPS

CSR INNOVATION
AT IIT KANPUR

IIT Kanpur was established in 1960 as an Institute of National Importance, through an act of the Parliament (Institutes of Technology Act, 1961).

Since its inception, IIT Kanpur has been striving for excellence in education, scientific exploration, and industrial research.

OVERVIEW OF IIT KANPUR

IIT Kanpur is a hub of innovation and technology where academia, industry, and entrepreneurship converge. With a strong and well-established ecosystem of R&D, the verticals of the institute are distinct and yet interconnected that provide a very robust foundation for fostering academia-industry collaborations under many domains, such as health care, community welfare, sustainable energy, education, cyber security etc.

The symbiotic relationship between academia and industry produces ground-breaking innovations that help solve real-world problems. The ecosystem of IITK provides a strong platform to ideate, innovate, and inspire. IIT Kanpur's commitment to nurture talent and foster a culture of innovation has only resulted in producing outstanding professionals, entrepreneurs, and researchers who have made significant contributions in their fields globally.

WHY COLLABORATE

nirf

5 OVERALL

4 ENGINEERING

5 INNOVATION

1055 ACRES	558+	9500+	40,000+
LUSH GREEN CAMPUS	FACULTY STRENGTH	TOTAL STUDENTS	ALUMNI BASE

- **Successful incubated tech driven projects**
- **Rs. 3000 Crores portfolio value creation**
- **World renowned faculty awarded with Goedel/TWAS/Bhatnagar Prize/ Infosys Prize etc**
- **Legacy of 64 years**
- **19 departments and 25+ Centre of Excellences (CoE's)**
- **Opportunity to support and partnership with Central Govt. of India**

IIT Kanpur stands as a beacon of innovation and social responsibility. Recognizing the pivotal role of technology in shaping society, the institute has embarked on various Corporate Social Responsibility (CSR) projects aimed at healthcare, fostering community development, environmental sustainability, Education, Environment & Sustainability, Water and waste recycle management and our initiatives towards differently-abled people.

Through collaboration with local stakeholders, IIT Kanpur delivers innovative solutions that transform lives, ensuring that even the remotest areas benefit from advancements in science and engineering. By employing cutting-edge research methods, students and faculty develop sustainable interventions, underscoring the institute's commitment to environmental stewardship.

Our CSR projects exemplify IIT Kanpur’s dedication to creating a meaningful impact beyond academia. By weaving social responsibility into its core mission, the institute not only nurtures future leaders in technology but also champions a sustainable and inclusive future for all, effectively bridging the gap between knowledge and societal advancement.

HEALTHCARE

GANGWAL SCHOOL OF MEDICAL SCIENCES AND TECHNOLOGY

AIM

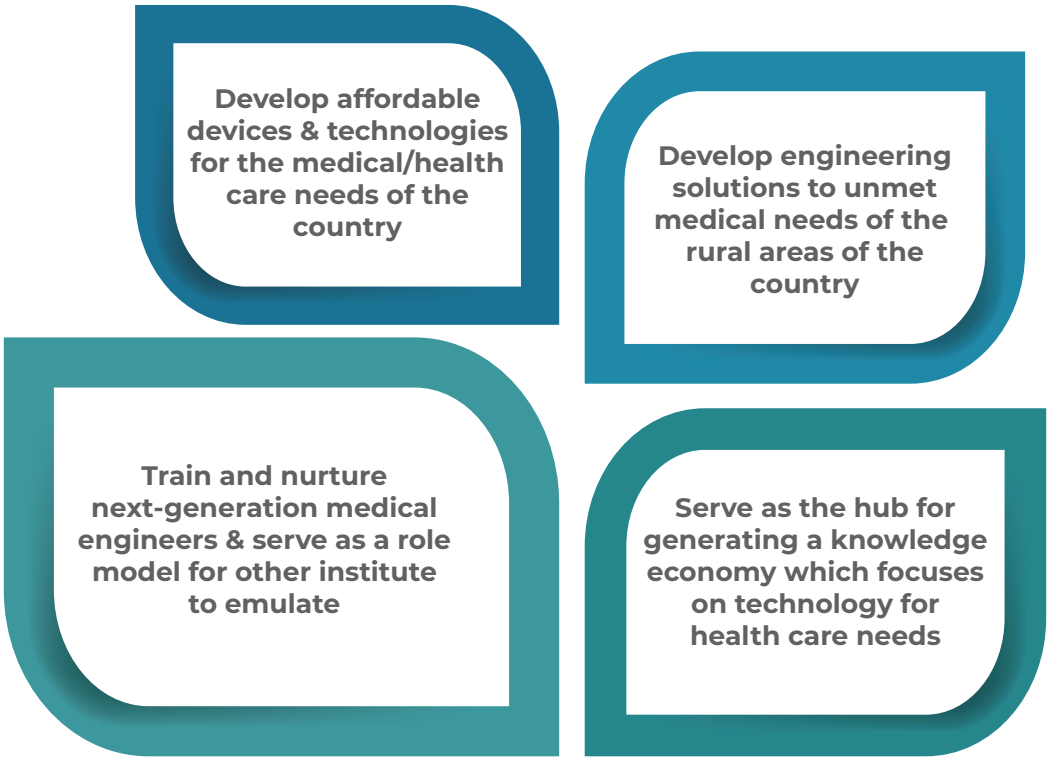
IIT Kanpur is currently in the process of establishing the groundbreaking Gangwal School of Medical Sciences and Technology, with the primary aim of transforming the landscape of medical research and innovation in the country.

The hospital complex is set to include the expensive Yadupati Singhania Super¬ speciality hospital with over 500 beds, alongside a 50+ bedded Cancer Care and Research Center.

The Centers of Excellence (CoEs) will serve as a convergence point for faculty expertise spanning diverse disciplines encompassing science, engineering, humanities, and medicine. These CoEs are poised to become pivotal hubs driving MedTech innovation in advanced and futuristic medical practices

OBJECTIVES

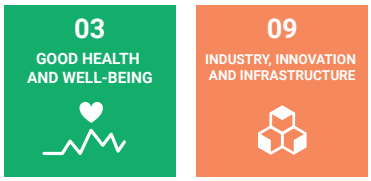
IIT Kanpur is establishing a one-of-its-kind Gangwal School of Medical Sciences and Technology to bring in a paradigm shift in approach towards medical research and innovation in the country. Gangwal School structure will be equipped with a super specialty hospital, bio-medical expertise of IITK faculties from various departments and a center of excellence to drive research in the field of medical technology.



IMPACT

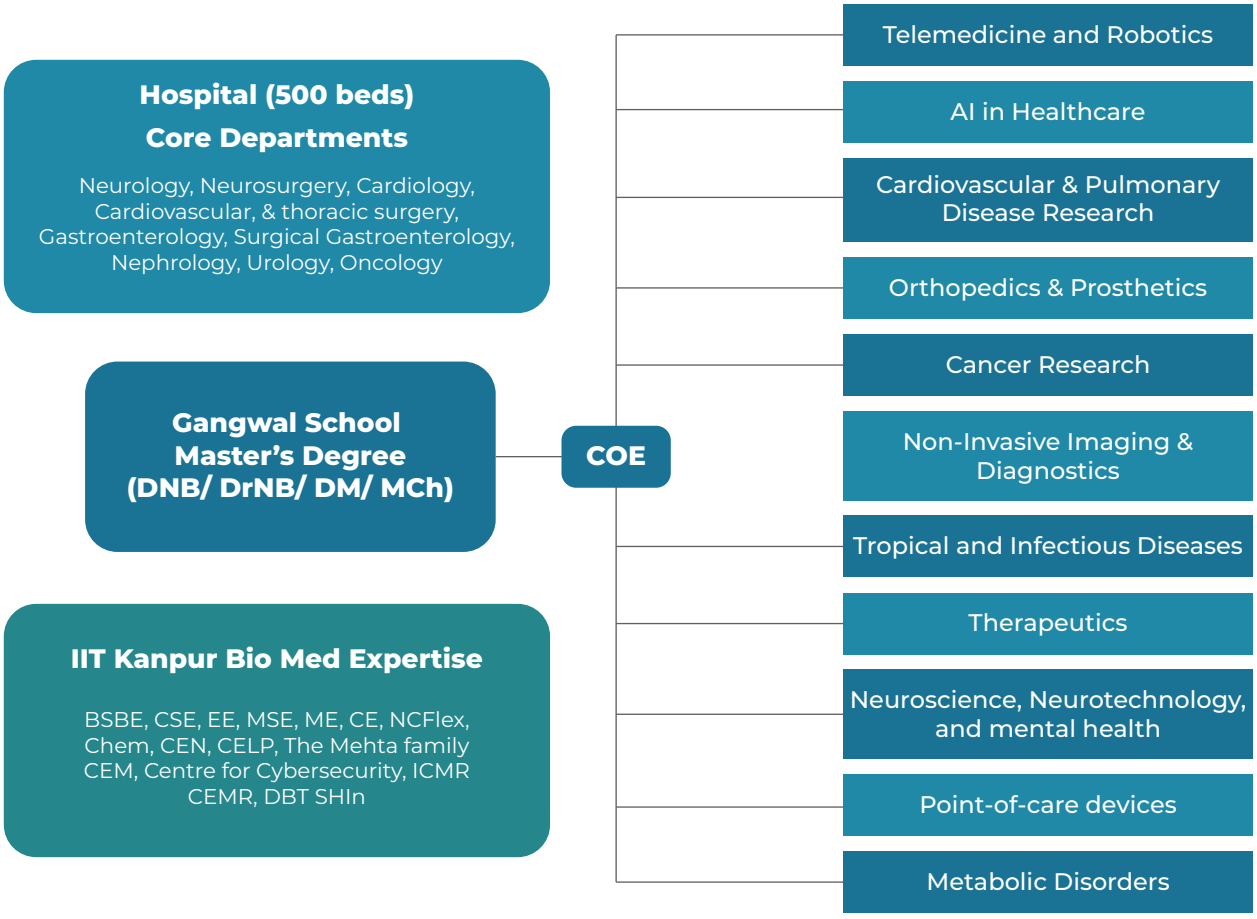
The Gangwal School will be the first-of-its-kind institution in the country with the potential to create an impact on society and the economy on a local, national, and global scale. With the technological expertise of IIT Kanpur and one of the best Innovations and Incubation ecosystems, the setting up of the school will complete the MedTech system at IIT Kanpur. It will not only help meet the needs of the underserved population in and around Kanpur but also will have PAN India benefits. Most certainly, it will be an addition to making India self- reliant or AtmaNirbhar.

SDG ALIGNED



MAIN COMPONENT

The School will be the confluence of IIT Kanpur's faculty, cutting across the disciplines built on the backbone of a super-specialty hospital, BSBE research prowess, and various CoE. These CoEs will be specialized centers in targeted biomedical research areas and are expected to work in confluence with the core clinical departments of hospital components and biomedical expertise of various engineering departments of IIT Kanpur.



YADUPATI SINGHANIA SUPER SPECIALITY HOSPITAL

YSSSH will be a 500-bed facility with eight core clinical departments (4 medical and 4 surgical), two clinical centers, ICUs, and several non-clinical facilities.

YSSSH with state-of-the-art medical technology will have 50% of beds designed and modelled to cater to government-financed health coverage scheme patients (like Ayushman Bharat-PMJAY, etc.) and the The departments will be equipped with state-of-the-art equipment and supported by best-in-class facilities including:

- **Outpatient Services**
- **Diagnostics labs**
- **Operation Theatre facilities**
- **Pharmacy**
- **Cath labs**
- **Training Auditorium**
- **Administrative Unit**

BUDGET AND FUNDING OPPORTUNITY

Clinical Departments	Amount (in Cr.)	Centers of Excellence	Medical Facilities	Amount (in Cr.)
Oncology	75	Therapeutics AI in Healthcare Telemedicine & Robotics Orthopedic & Prosthetic Cardiovascular & Pulmonary Non Invasive Imaging	OT	30
Cardiology+Cardiovascular & Thoracic Surgery	55		Support Nursing Block	20
Neurology + Neurosurgery	50		Cath lab	11
Nephrology + Urology	50		Critical Care bed	10
Gastroenterology + Surgical Gastroenterology	50		Endoscopy	5
Pediatrics	20		Dialysis Facility	2
		Rs 20 Cr. each		

SPECIFIC HEALTH FACILITIES

Facility options available	Description	Amount (INR Crores)
Ophthalmology OPD services	This speciality offers routine ophthalmic evaluations which screen and treat a wide range of ophthalmic conditions including cataracts, ocular surface disorders, glaucoma, diabetic retinopathy and macular degeneration.	2
Cardiology OPD services	This speciality encompasses an array of diagnostic tests and non-invasive treatment options for heart-related conditions. Through tests like ECG, echocardiography, stress tests, and Holter monitoring, healthcare providers can identify underlying cardiac issues.	2
Diagnostic laboratory services	The laboratory services for diagnosis include: • Biochemistry • Hematology • Serology • Microbiology • Clinical pathology • Histopathology Diagnostic Services facilitate the provision of timely, cost-effective, and high-quality diagnostic care in safe and secure environments.	2
Blood bank	Blood bank facility will be set-up to collect, separate, test and stores blood until a patient needs it. It ensures that donated blood, or blood products, are safe before they are used in blood transfusions and other medical procedures.	2
Ultrasound Facility	This facility will have an ultrasound imaging test that uses sound waves to create real-time pictures or videos of soft tissues inside your body. Doctors commonly use this facility to study a developing fetus (unborn baby), a person's abdominal and pelvic organs, muscles and tendons, or their heart and blood vessels.	1.5
X-rays Facility	X-ray or radiography facility will be set-up to detect bone fractures, certain tumors and other abnormal masses, pneumonia, some types of injuries, calcifications, foreign objects, or dental problems. This is an important diagnostic facility for the hospital.	1

CENTRE OF NON-INVASIVE IMAGING

AIM

The IIT Kanpur's Center of Excellence in Non-invasive Imaging and Diagnostics aims to establish a collaborative environment where faculty and students from various disciplines work together with the medical community. Their goal is to enhance imaging technologies, create innovative measurement setups, develop advanced data interpretation algorithms, and design specialized instrumentation to enhance patient care. The center is dedicated to establishing an interdisciplinary engineering-medical environment, aiming to deliver cutting-edge MedTech solutions to tackle the extensive healthcare challenges facing the nation.

OBJECTIVES

Non-invasive imaging techniques are powerful tools for diagnostics and therapeutics. In the line of treatment, non-invasive imaging is usually the first step, and it dictates the course of action for the treatment.This centre aims to tackle these problems by providing engineering solutions to overcome the limitations of the existing tools in the near term and innovating novel tools with better performance metrics in the long term.

MAIN COMPONENT

To develop the following two techniques that we believe will redefine how we diagnose a broad range of diseases

TECHNIQUE 1-
THIN, FLEXIBLE, AND VERSATILE ENDOSCOPE FOR 3D IMAGING USING MULTI-MODE FIBER

TECHNIQUE 2-
WIDE-FIELD VECTORIAL LIGHT-BASED MICROSCOPY

-

IMPACT

ENHANCED DIAGNOSTICS
The center's goal of seamlessly conceiving, optimizing, and deploying light-based solutions will streamline the implementation of cutting- edge technologies in medical practice.

LIGHT BASED THERAPIES
The center's work on light-based therapies is expected to pave the way for effective and precise therapeutic interventions, contributing to improved patient outcomes.

INNOVATIVE DISEASE MANAGEMENT
Novel optical solutions will offer fresh approaches to managing various medical conditions, potentially revolutionizing treatment strategies.

COMPREHENSIVE OPTICAL EXPERTISE
The establishment of a well-equipped optical facility will foster expertise in multiple optical techniques, benefitting both research and clinical applications.

DURATION
3 YEARS

BUDGET
5 Cr

SDG ALIGNED

RAPIDLY DEPLOYABLE CARDIAC DIGITAL TWIN

IMPACT

Successful culmination of this project would translate into a cardiac digital twin, a new therapy planning tool that would replicate the electrophysiological and structural characteristics of an individual's heart

DURATION
24 MONTHS

BUDGET
INR 0.96 CR

SDG ALIGNED

AIM

The proposed cardiac twin model would aid in this goal through helping clinicians gain insights into a patient's cardiac health and facilitating improved and personalised diagnosis, risk assessment, and treatment of heart diseases.

OBJECTIVES

Develop a cardiac electrophysiological digital twin using public patient datasets.

Validate the digital twin models through clinical studies and trials

Deploy the tool for use in hospitals as a therapy planning tool

Expected Deliverables:
A computer model workflow that allows the quick creation of a cardiac digital twin and various proof of concept developments demonstrating its use in clinical settings.

MAIN COMPONENT

Cardiac digital twins, enabled by high-performance computing, replicate the heart mechanical and electrical functions, predicting blood flow, valve performance, muscle contractions, and electrical signals to emulate a real heart.

They have shown promise in forecasting sudden cardiac death risk, ablation targets in ventricular tachycardia and atrial fibrillation patients, and optimal pacing sites for cardiac resynchronization therapy. These digital twins, created from 3D heart MRI and 12-lead ECG data, serve as personalized insilico cardiology tools, answering critical questions about individual cardiac health. This initiative seeks to build an electrophysiological digital twin, using medical imaging, physiological data, and computer simulations, for enhanced diagnosis, risk assessment, and treatment of heart diseases.

IMPACT

An affordable, easy-to-use device that can be carried anywhere by patients can prove to be a lifeline for those who suffer from periodic migraine attacks. Migraines can be debilitating and affect a person's work, focus, and health, and long-term medications further risk damage to liver and kidneys. A non-pharmacological and non-invasive treatment for migraine that can be used at the time of a migraine attack with instant benefits will improve the quality of lives of patients as well as reduce the economic burden of migraine on society.

DURATION
12 MONTHS

BUDGET
INR 15 Lakhs

SDG ALIGNED

STIMULATE AWAY MIGRAINE - A LOW COST, CLINICAL GRADE TRANSCUTANEOUS AURICULAR

AIM

Transcutaneous auricular Vagus Nerve Stimulator (taVNS) has been clinically proven to treat a myriad of neurological problems like epilepsy, depression, migraine, etc. We propose to develop a small, portable, earbud like device that is capable of stimulating the auricular branch of the vagus nerve. Periodic stimulation has been found to be effective for reducing the length and frequency of episodes of migraine.

OBJECTIVES

- Development of a functional prototype.
- Testing the prototype in laboratory environment.
- Refining the prototype.
- Development of a minimum viable product. (Up to TRL-6)
- Clinical Validation to prove the efficacy of the device

MAIN COMPONENT

- Conduct extensive clinical research to study feasibility and define requirements.
- Conduct engineering and biodesign research to finalise the technical specifications and product design.
- Develop a proof of concept with basic functionality.
- Test the proof of concept and refine the prototype.
- Develop a minimum viable product (MVP) with the finalised specifications. (TRL 6)
- Test the MVP in laboratory environment. Place orders for pilot batch.
- Conduct a clinical validation study to find out the efficacy of the device.

AN AI ENABLED ROBOTIC DEVICE FOR DIAGNOSTIC AND THERAPEUTIC INTERVENTION IN TREATMENT OF BEHAVIORAL DISORDERS IN CHILDREN

IMPACT

Quantitative includes Scientific parameters (Journals, Papers, Patents etc.)

Research Papers on the subject behaviors of typically disabled children

Patents on the device (hardware) with multi-modal sensor-based diagnostics (software)

Qualitative includes Social/Economic impact.

Improving the quality of life for typically disabled children by enabling early diagnosis and intervention.

Data generated through the device in operation can enable better research outcome for research community on ASD (subject to data privacy policy and ethical clearances)

DURATION
12 MONTHS

BUDGET
INR 50 LAKHS

SDG ALIGNED

AIM

To design, develop and test an anthropomorphic robot capable of engaging children through visual, voice and motion stimulation with the aim of acting as a diagnostic tool for detection of behavioural disorders, ASDs and ADHD and provide a medium of intervention for conducting therapy on the diagnosed subjects. The proposed robot will incorporate state-of-art AI such as LLMs (for conversational AI) and programmable interfaces for therapy design for clinical psychologists. Continuous monitoring of subject and behaviour data analytics will enable the doctors/clinical expert for a comprehensive management of the subject thereby improving the quality of life.

OBJECTIVES

- Design and hardware Development of anthropomorphic Robot
- Built-in ROS and incorporating cognitive features in the device
- Incorporating diagnostic and therapeutic treatment procedures
- Training the device and building knowledge models for behaviour disorder/ASD diagnosis and treatment

MAIN COMPONENT

The proposed project would involve the development of an anthropomorphic robot with the objective of engaging children through visual, voice and motion stimulation with the aim of acting as a diagnostic tool for detection of ASDs and ADHD and provide a medium of intervention for conducting therapy on the diagnosed subjects. This may assist the clinical psychologists as an intervention tool for planning therapy session, through interaction design voice, visual and mobility between the subject and robot.

The approach would involve the design and development of a robot targeted at treating children with ASDs. After the hardware and ROS Robot Operating System has been built numerous field testing will be carried out in close association with the clinical psychologist to train the device using Machine Learning/AI/Cognitive Models/LLMs etc., to detect anomalies in child behaviour through interaction design.

The design and development are essential as opposed to reprogramming a commercially available robot as the aesthetics level of anthropomorphism will be an essential part of the desired functionality. The outcome being two-fold in nature first it delivers a reprogrammable platform for therapy and second a data acquisition system to train available cognitive models which is essential for diagnosis and treatment of such disorders.

DEVELOPMENT OF A PORTABLE AND SAFE LOW FREQUENCY ULTRASONIC BASED MEDICAL IMAGING TOOL

AIM

We propose to develop a tool that will create 3D images by stacking 2D slices using low-frequency (3kHz-1.5 MHz) ultrasonic pulses and algorithm for its processing using the Full waveform Inversion (FWI) which is adopted from the geophysics.

OBJECTIVES

The primary goal of this project is to engineer a medical imaging tool that delivers exceptionally high-resolution images for accurate medical diagnoses. This tool will prioritize safety, portability, and cost-effectiveness, while maintaining a standard of quality that meets global benchmarks. This tool has potential to revolutionize medical imaging, providing healthcare professionals with a reliable and accessible tool that significantly enhances diagnostic capabilities. By emphasizing portability and affordability, we intend to ensure accessibility to even the remote and rural areas.

MAIN COMPONENT

Data Acquisition Setup: The process will commence with the acquisition of ultrasound data corresponding to the object under examination. This will be achieved through a specialized setup comprising multiple transducers that will be made up of piezoelectric crystals

The details on the experimental set up and processing of the datasets is described as follows:

Rotatory Table Integration: The data acquisition rim will be fixed to a rotatory table. This configuration will allow for a spiral motion, enabling the capture of a three-dimensional image of the body. To optimize data quality, a coupling gel will be employed to fill the space between the object and the sensors, ensuring optimal coupling.

Ultrasonic Pulse Propagation: The generated ultrasonic pulse will propagate through the body parts under examination, acquiring essential information about its physical properties.

Algorithm: The imaging workflow will be initiated with the creation of synthetic data through forward modelling. This will involve data generation based on a starting model.

Misfit Computation: The misfit between synthetic and true data will be quantified and the background velocity model will undergo an iterative refinement. This will involve adjustment of the model based on the computed misfit, a process carried out over multiple iterations.

IMPACT

Social Accessibility: Our cost-effective machine will ensure availability for all, making this technology inclusive and widespread and would a priceless alternative to MRI.

Technological Advancement: Our synthetic studies will yield results comparable to prevailing machines, without causing any harm to human tissues in contrasts to the techniques based on harmful radiations.
This technology will not only be safe but also highly portable, allowing for easy transportation in lightweight vehicles.

Economic Empowerment: Importing imaging machines contributes to a trade deficit and inflates overall treatment costs. By developing this technology locally, we will be capable to reduce expenses and create job opportunities for the educated workforce, contributing to economic growth.

Global Influence: This homegrown technologywill not only fulfil our domestic needs but also position India as a global leader in the field. It will enable us to extend humanitarian support to countries in need, demonstrateing India's potential to lead in critical medical technologies worldwide.)

DURATION: 12 MONTHS

BUDGET: INR 42 LAKHS

SDG ALIGNED

DESIGN AND DEVELOPMENT OF AUTONOMOUS STAIRS ESCALATOR CLIMBING & SEMI-AUTONOMOUS SMART WHEELCHAIR

AIM

A simplified slider-crank mechanism-based Stairs/Escalator Climbing & Self-navigating Smart Wheelchair is proposed along with development and integration of algorithms to achieve Semi-autonomous navigation for the wheelchair.

PROJECT SUMMARY

In this proposal, a simplified slider-crank mechanism-based Stairs/Escalator Climbing & Self-navigating Smart Wheelchair is proposed. While a wheelchair climbs up or down a Stairs/Escalator, its inclination angle varies drastically which causes a potential safety threat to the rider. Hence, a slider crank based mechanism is proposed to compensate for any variation in the inclination angle of the wheelchair. In the proposed system, the inclination angle of the chair is altered by varying the length of the linear actuator. Based on Newton-Euler formulations, the mathematical models of the proposed system will be developed. A prototype will be designed to perform real-world experiments. In the proposed system, the user is faced towards the direction of motion (while climbing up or down an obstacle), which not only improves the safety but also increases the confidence of the rider. Moreover, using state-of-the-art sensors and semi-autonomous navigation algorithm the wheelchair will be capable of autonomously navigate through a desired territory by avoiding dynamic obstacles.

The proposed wheelchair will navigate in the workspace with the aid of the sensors (LIDAR +Camera) embedded within it. The technique that will be implemented for navigation is SLAM (Simultaneous Localization and Mapping). It will enable the wheelchair to intelligently navigate within the hospital by avoiding obstacles dynamically. Besides semi-autonomous navigation, a manual override option will be integrated so that the subject can take control remotely in case of an emergency. The wheelchair will remain in a connected network that will enable the tracking of the subject remotely.

IMPACT

Quantitative includes Scientific parameters (Journals, Papers, Patents etc.)

- Patent related to a novel mechanism for escalator/stair climbing.
- Research papers focused on the dynamics and control of the proposed system.

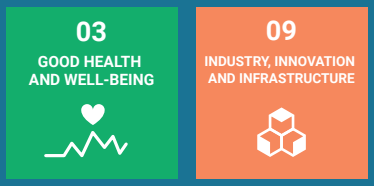
Qualitative includes Social/Economic impact

Currently, commercially available state-of-the-art electric wheelchairs are capable of commuting with the assistance of electric motors, however, the instability of climbing stairs/escalators limits the rider to travel on a planner surface only. With the proposed system, wheelchair users will be able to travel seamlessly without any additional human assistance. This will significantly improve the confidence and mental health of patients with disabilities.

DURATION
36 MONTHS

BUDGET
INR 50 LAKHS

SDG ALIGNED



HRIDYANTRA

IMPACT

At IIT Kanpur, we believe that India is a minefield of talent which if provided with appropriate resources and opportunity can successfully achieve ambitious dreams. Project Hridyantra will not only impact millions of Indian lives but will act as a game changer in establishing India as a potential destination for developing high quality medical devices and ecosystem. We aim to deliver at least 1000 LVADs in the first 2 years of the product launch thereby directly impacting as many patient lives and indirectly impacting at least 0.5 million lives. As an institution of national importance, it is our goal and responsibility to find new and innovative technologies that aim to provide potential solutions to patients from around the world. The Hridyantra program will also result in development of a product of high complexity, covering the entire gamut of ideation, design, fabrication, experimentation, all the way to animal and clinical trials.

DURATION
12 MONTHS

BUDGET
INR 11 CR

SDG ALIGNED

AIM

The present proposal aims to address cardiac health challenges by developing a new generation of indigenous left ventricular assist devices (LVADs) that offer superior performance at a lower cost, thereby making LVAD implantation affordable for a significantly larger portion of the population suffering from end-stage heart failure. Additionally, this project seeks to create a device with improved hemocompatibility compared to existing options, ultimately enhancing treatment outcomes on a broader scale. The possibility of spin-off technologies is immense. In addition, it is a precursor to the development of a total artificial heart (TAH)

OBJECTIVES

The ultimate outcome of the project will be a Left Ventricular Assist Device (LVAD), designed to enhance the pumping efficiency of a weakened heart. The development of the device is divided into following objectives

Pump design and manufacturing:
The pump design of the device is optimized to have compact size and efficient operation providing necessary pressure head and flow rate. Moreover, the pump should result in minimum hemolysis and thrombus formation. The flow patterns and damage of the blood cells is studied using Ansys simulations to evaluate the design. The finalized design is initially implemented in the form of a 3D-printed polymeric laboratory prototype. It is driven by an off-the-shelf motor for experimental verification. The final design is made of titanium alloy and driven by a magnetically-levitated BLDC motor. Several parts of the pump will have to be specially coated to promote hemocompatibility.

Motor drive and Maglev:
Based on the pump rating and size constraints a brushless DC motor is selected as the drive motor. The motor has been designed and verification using simulations performed for the required range of functionality. Motor design requires several cycles o optimization before the desirable performance is achieved.

Electronics and speed control:
The speed of the motor is monitored and controlled to maintain constant speed operation using a feedback circuit. The blood pump design requires a contactless bearing to avoid blood cell damage. Therefore, a Maglev configuration has been developed to integrate with the drive to achieve biocompatibility of the device. The device health monitoring, alarm systems and battery management systems are to be designed along with a suitable user interface for ease of use by the clinicians.

Surface modification and biocompatibility:
The internal surface of the device is modified to provide a blood-friendly environment. Two methods of surface modifications were considered and preliminary tests have been performed. One of these methods will be finalized for the device, generating suitable surface prototypes. Several in-vitro tests have been performed and the surface parameters have shown promising results. The modified surfaces will be further investigated for biocompatibility during animal trials. Designer surfaces that fulfill the required criteria will be taken up for device prototyping. The device will then undergo several animal and clinical trials.

MAIN COMPONENT

The project has now advanced to a stage where attention is entirely dedicated to accomplishing a fully-functioning device complete in all respects. These include:

1. Manufacturing impeller with the cover plate as a single unit
2. Full maglev technology and associated electronics and control
3. Designing an advanced hemolysis loop with the intended flow-pressure rise performance to conduct comprehensive testing of blood pumps.
4. Endurance tests of the device prototype with fresh human blood
5. Planning and conducting large animal trials with the device in explanted and in vivo implanted conditions
6. Planning clinical trials in a major center of cardiovascular surgery

The device thus fabricated will have competitive specifications in terms of hemodynamic performance, power consumed, weight, volume, noise level, vibrations, surface finish, adaptability to patients, and longevity.

A LOW-COST PORTABLE EEG DEVICE FOR DIAGNOSTICS IN NEUROLOGICAL CONDITIONS AT COMMUNITY HEALTH CENTRES

AIM

Indigenously developing a low-cost, Ambulatory EEG device, suitable for point of care, and remote applications like primary and secondary healthcare centers in rural India.

OBJECTIVES

- To develop a low-cost compact EEG system for triaging and diagnostics of mental health disorders in rural areas
- To meet safety and regulatory compliance, health technology assessment:
- To deploy a telemedicine framework for establishing effective communication across levels for healthcare services in rural populations
- Clinical testing and validation at hospitals and community health centres

MAIN COMPONENT

We are indigenously developing a low-cost, Ambulatory EEG device, suitable for point of care, and remote applications like primary and secondary healthcare centres in rural India. We have already developed and tested for the proof of concept as well as an 8-channel prototype device in our lab. At the initial stage, we are focused on addressing epilepsy diagnosis, for which ICMR is supporting us by assisting for the process of regulatory approvals and facilitating clinical trials. Further, we intend to utilize our EEG device, along with behavioural assessments (underpinned by neural mechanisms); and deploying neural circuits-based AI algorithms to extract relevant insights mental health conditions like dementia, sleep disorders, anxiety, depression etc in rural populations.

IMPACT

1. Reducing the number of undiagnosed/unattended patients due to limited capacity of infrastructure: Ambulatory EEG can be easily utilized at home, in cases when it's not possible to admit the patient for continuously monitoring neural activity (in sleep disorder, epilepsy etc., where EEG is administered for multiple days)
2. Eabling diagnostic aid to rural areas: An affordable device for diagnostic aid with ease of use without essential need of expertise will enable its reach to the parts of India that serves the maximum cases but unfortunately lacks infrastructure for mental health services.

DURATION
24 MONTHS

BUDGET
INR 50 LAKHS

SDG ALIGNED

SUSTAINABLE DEVELOPMENT

IMPACT

In total, around half of the world's population lives within 3 km of a freshwater body, whilst 90% live within 10 km. The research and outcomes of this project will help to improve the health and living conditions of the population living close to such water bodies.

DURATION
24 MONTHS

BUDGET
INR 1.2 CR

SDG ALIGNED

AUTONOMOUS WATER QUALITY MONITORING AND ACTIVE RIVER CLEANING SYSTEM

AIM

To design and develop a Cyber-Physical River cleaning system that continuously monitors the water quality and removes foreign bodies (solid wastes) from the river.

OBJECTIVES

Develop a Cyber-Physical River Cleaning System comprising a multi-link hyper-redundant reconfigurable manipulator (Smart Arm) and an interactive floating platform.

Floating Sensor platform with sensory network which scans and identifies the incoming foreign bodies and alerts the Manipulator located at the banks at 70-100 m.

In-house development of Water Quality Sensors system at fixed locations surrounding the areas.

Development of a Wireless Communication System between Smart Arms for River Cleaning (SARC) and a floating platform for relaying information about trash.

MAIN COMPONENT

Multi-link hyper-redundant reconfigurable manipulator (smart arm). Floating sensor platform which scans and identifies the incoming foreign bodies by using an array of sensors and alerts the manipulators at the banks at 70-100 m.
In-house development of water quality sensors system at fixed locations surrounding the area.
Development of a wireless communication system between smart arms for river cleaning (sarc) and a floating platform for relaying information about trash.

IMPACT

The project has both significant social and scientific impacts, aiming to improve public health, empower communities, increase awareness, and contribute to scientific knowledge and innovation in the field of rural drinking water safety.

Social Impact: By providing safe drinking water, the risk of chronic exposure to pollutants and waterborne diseases will be reduced, leading to improved overall health and well-being. Further, the proposal emphasizes the transfer of technology and knowledge to the villagers, enabling them to take ownership of the water treatment system's maintenance and operation. This empowerment will not only ensure the sustainability of the system but also foster a sense of community engagement and responsibility.

Scientific Impact: The study on the extent and nature of groundwater pollution, will contribute to a better understanding of the specific pollutants and their sources in these areas. Further, the development of a low-cost integrated water treatment system tailored to remove prevalent groundwater pollutants will be a significant scientific contribution which will likely yield in a patent, and a few scientific publications and reports.

DURATION
24 MONTHS

BUDGET
INR 75 LAKHS

DEVELOPMENT AND PILOTING OF ENGINEERING INTERVENTIONS FOR DRINKING WATER SAFETY IN RURAL COMMUNITIES

AIM

The proposal aims to address the issue of unsafe drinking water in rural communities in the regions of Kanpur / Unnao / Lucknow districts of Uttar Pradesh, India. Groundwater, the primary source of drinking water in these areas, has been found to contain elevated levels of pollutants such as fluoride, chromium, nitrate, uranium, and even pathogens. This poses a significant health risk to the population residing there. The program's goal is to develop and demonstrate safe water provisions for drinking and cooking purposes in 2-3 selected villages from this region.

OBJECTIVES

- Assessment of localized groundwater quality in the selected villages, and identification of source quality protection measures
- Development of a low-cost integrated water treatment system for the removal of prevalent groundwater pollutants (especial focus on fluoride, chromium, nitrate, arsenic and uranium) and coliforms from groundwater and making it fit for drinking purpose
- Installation and performance evaluation of the developed system for a period of more than 6 months
- Transfer of technology for this low-tech water treatment system to the villagers for its long-term maintenance and operational sustainability
- Increasing knowledge and awareness on water quality and its related health impact issues in the areas (as a part of CSR objectives).

MAIN COMPONENT

Selection of 2-3 villages

- Collection of baseline data (Sampling and quality characterization of groundwater; identifying pollution sources, if any; estimation of sectoral water demand with future projections)
- Development and lab-scale testing of a low-cost water filtration unit to remove the pollutants present in the groundwater in the selected villages
- Installation and performance evaluation (water quality monitoring) of pilot-scale treatment unit in the selected villages
- Scale-up and design of the final treatment unit based on results from the pilot units
- Training of villagers for treatment unit operation and maintenance
- Monitoring of the cases of water borne diseases in the villages
- Organizing stakeholders' workshop to disseminate the knowledge to various stakeholders for replication
- Report preparation and submission

SDG ALIGNED

RESIDUE-FREE DECENTRALIZED GREYWATER TREATMENT BASED ON COLD PLASMA FOR RECLAIMED WATER PRODUCTION AND REUSE

AIM

To develop engineering solutions to make the Cold Plasma (CP) technology viable for greywater reuse in rural settings in India.

OBJECTIVES

To design, develop, and optimise a hybrid cold plasma reactor (HCPR) for greywater treatment.

To quantitatively evaluate emerging contaminants (ECs) degradation and microbial pathogens (MPs) inactivation in HCPR.

To develop process-based models for simulating the ECs degradation and MPs inactivation efficiency of the HCPR.

To design, develop, and implement a one-household level and a ten-household level pilot-scale HCPRs for greywater treatment and reclaimed water reuse in the Nankari village, Kanpur, UP.

To perform a sustainability-focused life cycle assessment of HCPR technology for greywater treatment and reclaimed water reuse.

MAIN COMPONENT

Optimisation of Hybrid Cold Plasma Reactor (HCPR) parameters

Quantitative evaluation of HCPR performance

Process-based modelling of the HCPR

Real-world implementation of HCPRs in an Indian village

Life cycle assessment of HCPR technology

IMPACT

The scope of the proposed research and expected results listed above directly align with Sustainable Development Goal 6, i.e., "to ensure safe drinking water and sanitation for all, focusing on the sustainable management of water resources, wastewater and ecosystems, and acknowledging the importance of an enabling environment". We will focus on applying the proposed technologies in a village near IIT Kanpur, Nankari village. The technologies developed and tested in this project are transferrable to every rural community constrained by water scarcity for multifaceted reasons.

DURATION
36 MONTHS

BUDGET
INR 1 CR

SDG ALIGNED

TRASH TO TREASURE: UTILISATION OF FLY ASH, LEATHER AND PLASTIC WASTE IN AFFORDABLE COMMUNITY HOUSING

IMPACT

Technology development for producing composite bricks using fly ash and leather waste and their potential application in affordable community housing projects.
Technology development for producing paver blocks using waste plastics and their potential application in affordable community housing projects.

DURATION
24 MONTHS

BUDGET
INR 55 LAKHS

SDG ALIGNED

AIM

Considering the local availability of leather waste and fly ash in Kanpur, the proposed project aims at investigating the feasibility of using composite fly ash – leather waste bricks for affordable community housing.

OBJECTIVES

The two major motivations underpinning the project are (a) production of low-cost bricks using fly ash and leather waste, and waste plastic-based paver blocks, thereby promoting a circular economy model, and (b) taking advantage of the thermal insulation behaviour of leather in these bricks that provide year wide thermal comfort to the occupants habiting in the houses made using these bricks.

The followings are the objectives of the proposed study:

- To develop fly ash and leather waste based composite thermally insulating bricks for their potential application in the affordable housing projects.
- To develop waste plastic-based paver blocks in the footpath and/or residential roads in the affordable housing projects.

MAIN COMPONENT

Workplan 1: Sourcing of waste streams, Laboratory scale investigations, Cost analysis

Workplan 2 (future scope)
Life cycle analysis for production of bricks and paver blocks

Numerical modelling of thermal comfort level in the buildings using composite bricks

1. Pilot study on a model instrumented house and footpath built using the composite bricks and paver blocks for their performance under climatic conditions
2. Patenting of the technology
3. Commercialization

SOLID WASTE MANAGEMENT AT IIT KANPUR

AIM

Setting up a material recovery center on campus and operationalizing comprehensive municipal solid waste segregation and handling. This will not only be environmentally sustainable, aesthetically pleasing, but also save the institute significant resources in the long run. It will also foster a culture of segregation at all levels, leading towards a non-zero waste generating campus which can serve as a role model to other campuses.

OBJECTIVES

- To set-up a material recovery center on IIT Kanpur campus
- To do a comprehensive recycling of the municipal solid waste, after bio-degradable and non-biodegradable wastes are duly segregated.

MAIN COMPONENT

Material recovery centre infrastructure and plan:

- Provisioning of color-coded dustbins at different waste generation and collection points.
- Transport of waste from the collection points to the MRC.
- Bio-degradable waste goes to composting facility.
- Non-biodegradable waste is further segregated into different types, e.g. types of plastic, metals, packing materials.
- Cleaning and drying of food contaminated recyclable waste
- Packaging of different types of waste as er vendor requirements into easily sellable units.
- Transportation to vendor, if required.
- 10-15% of non-recyclable waste to be isolated and periodically disposed off to Nagar Nigam appointed authority.
- Revenue from the waste generated will party offset the cost of operations.
- Spreading awareness and enabling participation of various stakeholders (residents and visitors.

IMPACT

This will help in developing a net-zero waste producing campus. Program will lead to social awareness and responsible citizens. It will provide employment to workers and generate revenue for the institute. It will ensure carbon savings associated with recycling and composting. The project can serve as a pilot for implementation at other educational institutions, and more importantly will be an example of IIT Kanpur's responsible leadership in environmental education through practice.

DURATION
36 MONTHS

BUDGET
INR 1.88 CR

SDG ALIGNED

12
RESPONSIBLE CONSUMPTION AND PRODUCTION

WASTE TO HYDROGEN

AIM

To convert biogas, primarily consisting of methane, to hydrogen and solid carbon. This approach is novel and promising because clean hydrogen is produced in this process and carbon is permanently removed as a solid by-product

OBJECTIVES

Develop a Cyber-Physical River Cleaning System comprising a Lab-scale demonstration of hydrogen production from biogas.

Identification of novel molten catalysts for hydrogen production from biogas.

MAIN COMPONENT

Biogas would be collected and treated via absorption/adsorption to separate CO2 and other impurities. The clean biomethane would be passed to the molten catalyst reactor. Biomethane cracking experiments will be conducted in the reactor using molten catalysts. The molten catalyst reactor set up consists of a quartz tube placed in a high temperature furnace, gas feed inlet, product outlet lines, and an online mass spectrometer for analysing produced gas samples in real time. Molten catalyst will be placed in the quartz tube and heated to the desired temperature. Biomethane, with argon, will be bubbled through the molten catalyst which would increase the gas temperature and catalyse biomethane conversion to carbon and hydrogen. A gas sparger may be used to increase the gas-liquid surface area. The ratio of biomethane to argon will be maintained using mass flow controllers. The formed carbon will float over the molten catalyst and the product gases will be analysed using an online mass spectrometer. The carbon obtained would be analysed using various analytical techniques to identify potential applications.

IMPACT

A lab-scale working demonstration of biogas conversion to hydrogen and solid carbon. Effect of various parameters, including catalysts, on hydrogen production. This solid carbon can be easily separated, permanently stored, and may find potential applications in other areas including electrodes for batteries, etc

DURATION
24 MONTHS

BUDGET
INR 1 CR

SDG ALIGNED

13
CLIMATE ACTION

AMBIENT AIR QUALITY MONITORING OVER RURAL AREAS USING INDIGENOUS TECHNOLOGY (AMRIT)

AIM

To set up a scientifically validated real-time air quality monitoring network in states, covering all the blocks in the first three years followed by more sensors in tele towers of the blocks in phase 2. Such a first of its kind network in these regions would provide unprecedented insights into the air quality conditions of rural sectors

- To deploy low-cost air quality sensors in consultation with the State Pollution Control Board at different sites of the states.
- To improve the reliability of the LCS-based Air Quality devices for ambient PM2.5 and Big Data platform for real-time air quality, reducing dependence on imported Air Quality equipment – thereby aligning with the Atmanirbhar Bharat program of India.
- To analyze the data generated from the deployed low-cost sensor network in Mumbai for research, understanding the city-level air quality conditions, and identifying city-level air pollution hotspots.

MAIN COMPONENT

Air-shed

The data-driven air-shed delineation using machine learning algorithms is one of the important techniques adopted within the AMRIT project to address rural air quality issues. The identification of air-shed is one of the essential concepts in the study of air quality and pollution management, as it helps understand the patterns of air movement and the dispersion of pollutants within a specific region. It will also help to identify the air quality at the local level, and it can be effectively managed by understanding the contribution from the different sources within the micro air-shed (i.e., industries, vehicles, etc.) and the larger macro air-shed. Notably, the identified air shed will be irrespective of any defined administrative boundaries, so it requires different stakeholders from different states, cities, or districts for effective policy intervention.

Exposure analysis

Prolonged exposure to ambient PM2.5 has been associated with numerous adverse impacts on human health and premature deaths, including increased mortality from cardiovascular and cerebrovascular diseases, acute lower respiratory tract infections, diabetes, lung cancer, and adverse effects on birth outcomes and neonatal health. Developing a high-spatiotemporal resolution exposure and health risk model using machine learning is another essential aspect of the AMRIT project to facilitate policy-level interventions to mitigate the health hazards associated with poor air quality. This model helps to identify populations at high risk across different socio-economic strata of society at the local level over the IGP regions. The outcomes offer a promising avenue for policymakers to effectively target interventions and safeguard public health against the detrimental effects of poor air quality.

Air quality contrast in Rural and Urban areas

Further, AMRIT project aims to address the urban and rural disparities in the ambient concentration. For instance, urban and rural areas account for different socio-economic and environmental contexts. Both regions account for different levels of infrastructure and associated sources, which lead to differences in ambient PM2.5 concentration. In the present scenario, air pollution studies are predominantly centered on urban areas, particularly in metropolitan cities and major urban agglomerates. Monitoring stations are primarily within such cities and district headquarters, providing a skewed perspective on ambient air pollution levels. This urban-centric approach resulted in a significant knowledge gap regarding air quality in smaller cities (tier II and lower) and rural areas, where various local sources contribute to pollution. Additionally, in India, variations in the implementation chronology of sectoral air pollution regulations are evident in sectors like vehicular, thermal power plants, etc. These variations lead to differences in overall emissions. The SAAQM network will provide the ground truth air quality contrast in different settlements and have an opportunity to discuss the impact of existing policies

SDG ALIGNED

DURATION
36 MONTHS

BUDGET
INR 11.8 CR

03 GOOD HEALTH AND WELL-BEING

11 SUSTAINABLE CITIES AND COMMUNITIES

13 CLIMATE ACTION

IMPACT

Quantitative includes Scientific parameters (Journals, Papers, Patents etc.): The outcome of the project will be a compact solar-wind hybrid energy system for powering the rural communities. We possible to file one patent based on the proposed idea and submit one journal article based on the research work done.
Qualitative includes Social/Economic impact:
Improved Energy Security: A small solar and wind hybrid power system can improve energy security for India, especially in rural areas where access to electricity is limited. By harnessing the power of the sun and wind, these systems can provide a reliable source of energy that is not subject to disruptions in fuel supply.
Reduced Environmental Impact: Small solar and wind hybrid power systems have a much smaller environmental impact than traditional ones. By using clean and renewable energy sources, these systems can help reduce the adverse effects of climate change.

DURATION: 36 MONTHS
BUDGET: INR 1 CR

SDG ALIGNED

SOLAR-WIND HYBRID ENERGY SYSTEM FOR RURAL COMMUNITIES

AIM

The main objective of the project is to develop compact and efficient solar-wind hybrid energy system for the rural communities. It involves development of efficient and low speed capable vertical axis wind turbine. The project also requires design and development of power converters for the different sources such as solar PV and wind turbine, battery energy storage system, and the loads. Finally, robust control strategies will be required to extract the power from the sources and transfer it efficiently to the loads.

OBJECTIVES

To design and develop a compact solar-wind hybrid power system for powering the rural communities.

To develop new vertical axis wind turbine with higher efficiency and capability to operate at low wind speeds up to 2 m/s

Design and develop power converters for interfacing the solar PV panel, vertical axis wind turbine, battery energy storage system, and the loads.

Design and develop efficient control and energy management algorithms for extracting energy from the solar PV panels and wind turbine and supply it to the loads.

MAIN COMPONENT

The entire project is divided into three different tasks.

Task1: Development of VAWT rotor

The task consists of development and fabrication of VAWT rotor followed by testing at different wind speeds and optimizing the flapper's spring force. The development and fabrication of guide vanes consists of evaluation and modification of shape, size, and number of vanes.

Task2: Development of power electronic converters

The solar-wind hybrid energy system requires four different power electronic converters for transferring the energy from the various sources to the loads. The main components to be designed for each converter include input and output capacitors, inductors, switches, and gate drivers. between dc-bus and ac-bus.

Task3: Solar-wind hybrid energy system

In this task, the integration of all the power converters will be done and their performance will be tested with actual solar PV panel and VAWT for different operating conditions

IMPACT

Creating a resource pool that external partners can access to solve their business problems using principled AI and Machine Learning technologies.

Channeling the ongoing efforts of IITK; offer the drive to create impactful solutions that increase the productivity of local businesses & better millions of lives.

Attracting strong students and engineers to become a part of the center's activities to gain training, expertise, certification, & contribute to the research and development, and "graduate" as highly productive and sought-after professionals.

DURATION: 5 YEARS
BUDGET: INR 3.5 CR

SDG ALIGNED

DEVELOPING BHARATAI FOR SUSTAINABLE CITIES

AIM

To develop AI/ML products for use cases impacting Indian city problems.

RATIONALE

Adoption of AI technologies has been rapid in India, even outpacing several developed economies. Currently, Indian users, primarily located in the public sector, consume AI technologies on a SaaS (Software as a Service) model from primarily foreign vendors, e.g. AWS, Google Cloud Services, Microsoft Azure, IBM Cognitive Stack etc. This constitutes a severe strategic weakness of the Indian IT ecosystem by increasing the likelihood of data leakage and poisoning, and considerably reduces the potential for indigenous development of such technologies.

OBJECTIVES

i. Developing an indigenous, API-based, India-stack for AI services. CDIS has taken upon itself the ambitious goal of developing a SaaS (Software as a Service) platform for common AI/ML use cases and serving AI/ML models specialized for the needs of India. E.g. applications are in the areas of Digital Health Stack, Routing/ Scheduling, Income Estimation, Property Valuation, Document/ Image/ Audio analysis, Forensic tools for the police.

ii. Developing a digital twin that integrates the multiple aspects of Sustainable Cities – e.g. mobility, energy, and middleware. The basic idea is to create a platform that provides the traffic data, energy distribution data, and grievance analysis in a geo-tagged visual format. In addition, the advanced modeling would help in forecasting demand and making decisions for a sustainable city.

iii. Developing taxi, and shopping, services that are administratively decentralized and support a Nostr-like open messaging protocol. This framework will give more power to local businesses and reduce overhead costs compared to the existing centralized aggregators. Also, by co-locating physical delivery service administration with open messaging relay servers, this framework will solve the principal agent problem that reduces the sustainability of current peer-to-peer messaging services.

We would like to test-launch a service for local businesses (in a small city) which is decentralized and have additional features like: service discovery and recommendation systems. This can be later ported to the government portals like ONDC (Open Network for Digital Commerce) and GEM (Government e Marketplace).

IMPACT

Quantitative includes Scientific parameters (Journals, Papers, Patents etc.): The outcome of the project will be a new multiport converter which offers compact and efficient solution compared to conventional system. It is possible to file one patent based on the proposed idea and submit one journal article based on the research work done.

Qualitative includes Social/Economic impact: Solar PV assisted EV charging can further help in reduction of carbon footprint in Indian scenario, wherein most of the power generation is based on coal-based power plants. The proposed multiport converter facilitates the reduction in capital cost as well as energy savings due to higher efficient operation

DURATION: 24 MONTHS
BUDGET: INR 40 LAKHS

SDG ALIGNED

NOVEL MULTIPORT CONVERTER FOR SOLAR PV INTEGRATED EV CHARGING

AIM

To develop multiport converters which can reduce the total number of components and thus, reduce the overall cost as well losses.

OBJECTIVES

- To develop compact and efficient multiport converter for integrating solar PV panels with grid for EV charging.
- To develop efficient control and energy management algorithms for the solar PV assisted EV charging.
- Cost benefit analysis compared to conventional EV charging setups.

MAIN COMPONENT

Currently, solar EV charging stations use the 50Hz alternating current (AC) grid to exchange power from PV to EV. However, this is not efficient and cost-effective for two reasons. First, EV and PV are fundamentally direct current (DC) in nature, so conversion to AC leads to unnecessary conversion steps and losses. Secondly, two separate DC–AC inverters are required, one for EV and PV, increasing the cost and size of the power electronics.

A solution is to use a single integrated converter that charges the EV from PV on DC and requires only a single, common inverter for both EV and PV. Multi-port power converter topologies are best suited for integration and used in many applications, e.g., hybrid electric vehicles (HEV), microgrids, battery chargers, uninterruptible power supplies, etc. The use of multi-port stages reduces the number of individual converter stages to be used. Multi-port converter with an internal DC-link is developed that can charge the EV from both the PV and the AC grid. The charger is bidirectional and can implement vehicle to grid (V2G) where the EV can feed power back to the AC grid. The converter can realize four power flows: PV to EV, EV to Grid, Grid to EV and PV to Grid. The advantages of using multi-port converters are its high-power density, bi-directional power flow, simple phase-shift-based control, providing isolation along with the elimination of low-frequency transformers, and high-efficiency conversion.

EDUCATION


EDUCATION
WISDOM
LEARNING
TRAINING
TEACHING
COACHING
C
D
A
B

IMPACT

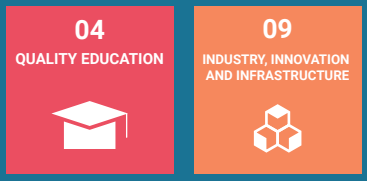
Bridging the Digital Divide: PadhAI-LikhAI lab aims to bridge the digital divide between urban and rural populations,particularly underprivileged students, by providing them access to state-of-the-art technology and resources.

Enhancing Educational Opportunities: The lab aspires to enhance educational opportunities for underprivileged students, empowering them to overcome socio-economic barriers and achieve academic excellence.

Encouraging Innovation and Creativity: PadhAI-LikhAI lab aims to foster a culture of innovation and creativity among students, enabling them to develop problem-solving skills and think critically.

DURATION: 36 MONTHS
BUDGET: INR 50 LAKHS

SDG ALIGNED



ESTABLISHMENT OF PADHAI-LIKHAI : ADVANCED INNOVATIVE (AI) LAB

AIM

In the era of rapid technological advancements, it is crucial to provide equal opportunities for all students, particularly those from underprivileged backgrounds, to access cutting-edge educational resources. Padhai-likhai lab aims to create such an environment for underprivileged students between 6th to 12th standard (secondary education) in proposed geographies of maharashtra/delhi ncr/ tamil nadu /karnataka, enabling them to explore and learn about different innovative technologies.

OBJECTIVES

Objective 1: Providing Access to AI and Emerging Technologies.

The primary objective of PadhAI-LikhAI lab is to provide students with hands-on experience in AI and other emerging technologies, equipping them with essential skills for the future job market.

- Developing Technical and Soft Skills
- Encouraging Collaboration and Networking
- Promoting Research and Development
- Supporting Sustainable Development

Objective 2: Capacity building program for Teachers and Students

Training of teachers and students is of utmost importance under this program and requires expert people to be involved in the whole process. Training will be conducted by Academicians from IITs and other HEIs shared below is a tentative activity schedule:

1. Artificial Intelligence
2. Drone Technology
3. Internet of Things
4. Robotics

MAIN COMPONENT

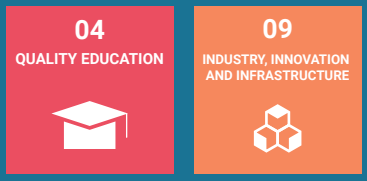
- Engaging children in lively and joyful activities with practical hands-on training thus allowing them to learn through interactive projects and exercises.
- Enabling children to be motivated and engaged in innovative learning through observation, experiment, critical thinking, reasoning, and problem solving.
- Bringing excellence and innovations in teaching and learning through AI, IOT and Drone technology.
- Preparing students for their future careers in fields such as data science, machine learning and robotics which are increasingly in demand in the near future.

IMPACT

1. Enhanced Teaching Quality
2. Improved Learning Experiences
3. Innovation in Education Technology
4. Educator Empowerment
5. Broadening Access to Quality Education

DURATION: 36 MONTHS
BUDGET: INR 8.71 CR

SDG ALIGNED



USING MULTI-MODAL LLM'S TO IMPROVE INFRASTRUCTURE FOR TEACHERS

AIM

The project aims to furnish online course instructors with comprehensive feedback on their teaching practices for class IX-class XII. To achieve this goal, we aim to develop multilingual multimodal Language Models (LLMs) capable of comprehending students' behavior during online courses.

OBJECTIVES

Develop Multilingual Multimodal LLMs: Create advanced multilingual multimodal Language Models (LLMs) capable of comprehending and analyzing diverse inputs, including lecture content (videos, slides), subject materials in various languages, and detailed student engagement profiles.
Assess Lecture Video Quality: Implement algorithms to rank lecture videos based on multiple criteria, such as content relevance, engagement levels, length, and overall quality, providing instructors with a comprehensive evaluation of their teaching materials.
Predict Student Engagement Levels: Develop predictive models to estimate the level of engagement students are likely to exhibit during online lectures. This includes analyzing metrics such as clicks, time spent engaging, and interactions with the content.
Evaluate Teaching Effectiveness: Establish a model to assess the effectiveness of teaching methods employed in online courses, providing instructors with insights into the overall impact of their teaching on student learning outcomes.
Generate Comprehensive Feedback: Design a feedback system that delivers detailed insights to instructors, offering actionable suggestions on how they can improve their teaching material, instructional techniques, and overall course delivery.
Enable Instant Feedback for Recorded Lectures: Develop a mechanism allowing instructors to receive instantaneous feedback on the quality of their recorded lectures, facilitating continuous improvement in real-time.

MAIN COMPONENT

Ranking of Lecture Videos: Evaluate and rank lecture videos based on criteria such as content richness, engagement levels, relevance, and duration.

Engagement Level Prediction: Predict the anticipated level of student engagement during the lectures

Feedback Generation for Instructors: Provide instructors with comprehensive feedback, including actionable suggestions on how they can enhance the quality of their teaching material.

Instant Feedback for Recorded Lectures

Focus on Regional Language

LEARNING BY DOING: IMPARTING HANDS-ON EDUCATION THROUGH DIGITAL TOOLS AND CONCEPT

AIM

Prepare science and social science modules for class IV to VIII and test them out at Swami Vivekananda Vidyalaya. Then take these modules to the government and public schools for demonstration and experimentation.

Prepare computer modules for basic word processing and Python programming. Also, identify apps for science and social science subjects for classes IV to VIII. Take them to schools.

Conduct Teachers Training Workshops twice a year

OBJECTIVES

Impart hands-on science education to the students belonging to schools in economically and socially marginalized regions around Kanpur.

Provide hands-on computer education to the students.

Employ apps for fun education.

Train teachers for the above.

MAIN COMPONENT

Prepare modules for science/social science/computer courses (classes IV to VIII).

Teachers of SVV and NSS and student volunteers will visit schools and introduce these modules to the students and teachers. At least once a month.

Conduct teachers training workshops (twice a years)

IMPACT

Quantitative includes Scientific - parameters (Journals, Papers, Patents etc.): 50 modules for science/social science/computer courses (classes IV to VIII).

Qualitative education includes Social/Economic impact : Working with 6000 students and 200 teachers belonging to economically weaker sections. These interactions will have multiplying effects.

DURATION: 36 MONTHS
BUDGET: INR 72 LAKHS

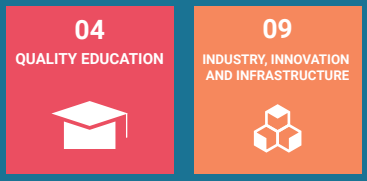
SDG ALIGNED

IMPACT

This proposal is a step towards a longer-term effort in improving CS and CT education in schools, including engagement with schools, teachers and education boards to effect ground-level impact via changes to curricula, textbooks, teacher training, etc.

DURATION: 36 MONTHS
BUDGET: INR 29 LAKHS

SDG ALIGNED



FOSTERING COMPUTIONAL THINKING IN SCHOOLS

AIM

We aim to introduce Computational thinking in schools, train teachers around it, and create CT kits to teachers to teach and understand CT in classrooms.

OBJECTIVES

Find fun, age-appropriate, culturally relatable, and affordable activities and exercises to teach the CT concepts in the syllabus to students in an engaging manner.

Train teachers on CT concepts, as well as provide pedagogical inputs on how to teach CT to students at various levels, or how to incorporate CT into various subjects,

Develop instruments (tests, survey) to scientifically measure the CT skills at various levels in India, to evaluate the effectiveness of the kits

MAIN COMPONENT

1. CT kit development
2. Teacher training (F2F workshops + online sessions)
3. Use CT kits to teach CT in classrooms (Classes 6-8)
4. Evaluation of students (pre and post-tests for CT skills)
5. Gathering qualitative feedback from teachers & students
6. Revision of kits, continuation

ENTREPRENEURSHIP, INNOVATION & RESEARCH

OFFICE OF RESEARCH & DEVELOPMENT

In the ever-evolving landscape of Research and Development, IIT Kanpur has continuously strived to push the boundaries of knowledge, foster innovation, and contribute to the betterment of society. It is dedicated to developing cutting-edge technology for creating social impact by fostering successful industry-academia collaborations on technology advancements, computational research, life sciences, environmental studies, and interdisciplinary collaborations.

IITK is equally devoted to global engagement, actively pursuing international collaborations through academic-industrial partnerships, international conferences, workshops, and research Memorandums of Understanding (MoUs). Notably, the joint degree programs with international universities further enrich the institute's academic tapestry.

STARTUP INCUBATION & INNOVATION CENTRE

SIIC is a startup for startups that supports every budding startup in its growth journey. Our network of experienced academicians, founders, mentors, and team members aim to mold, shape, and provide the right opportunities to young talent with technological goals, investors, and mentor pool.

SIIC, IIT Kanpur came into existence when in 2000 SIDBI approached IIT Kanpur to form an Incubation center. The idea was to deepen the entrepreneurship and incubation culture of the institute.

SIIC, IIT Kanpur aims to develop cutting-edge technologies grounded in science and engineering Innovations to solve pressing problems of the country, focusing on the underprivileged strata. It provides the right space and opportunities for converting your startup ideas into products and business.

The multi-disciplinary incubation ecosystem at Startup Incubation and Innovation Centre, IIT Kanpur, hones entrepreneurial talent and converts their vision into disruptive technology solutions. Over the last two decades, the incubation facility has linearly progressed from incubating to graduating over 150+ successful startup ventures in healthcare, agritech, cleantech, artificial intelligence, machine learning, and cybersecurity domains with promising impact. The robust network of cutting-edge, state-of-the-art infrastructure facilitates the journey of ideas into products that put quality at the helm of innovation.

DOMAINS

AgriTech	CleanTech	EdTech	FinTech
Healthcare	Cybersecurity	Hardware	Defense

CYBERSECURITY AND CYBERSECURITY FOR CYBER

PHYSICAL SYSTEMS INNOVATION HUB (C3 I HUB)

C3iHub is a Technology Innovation Hub at IIT Kanpur funded by the Department of Science and Technology, Government of India, under the National Mission of Interdisciplinary Cyber-Physical Systems (NM-ICPS). From analysing security vulnerabilities and developing tools to address them at various levels of critical cyber-physical system architectures, to nucleating start-ups developing such tools at scale, to partnering with industries for co-development and transfer of technologies, to training the next generation of cybersecurity researchers, C3iHub works on every level that facilitates country's adoption and advancement of cyber-physical systems.

HIGHLIGHTS

Security Operation Centers at NHAI IPA, BIT - Mesra	Security Audit NHAI, IPA, SAIL	Blockchain Technology Based TDR with Kanpur Development Authority	RnD Projects on critical Sectors
Partnership: 5+ International Collaborations	Financial and Technical Support: 55+ Startups and 55+ R&D Projects	Cybersecurity skilling program - 10,000 Students Enrolled	Cyber Investigation Tool for Cyberabad Police

ACHIEVEMENTS

5 International Collaborations

30+ Technologies Developed

50+ R&D Projects Supported

50+ Startups Supported

100+ Technology Products

140+ Publications / IPS

200+ Fellowship

10,000+ Trained Individuals

1080+ Jobs Created

IIT KANPUR RESEARCH & TECHNOLOGY PARK FOUNDATION

Technopark@iitk is not-for-profit Section 8 company registered on 7th February 2019, working towards accelerating & strengthening industry-academia for development of indigenous cutting-edge technologies.

Technopark aims to foster Industry-IIT Kanpur collaboration by promoting co-development of cutting-edge technologies in line with the national priorities by leveraging the core competence of IIT Kanpur. It focuses on strengthening industry-student engagement, and identify potential technologies developed at IITK for lab-to-market transition.

450+
Industry Connects

250+
Industry Interactions

18
Current Members

31
Total Members

CELL FOR DIFFERENTLY ABLED PEOPLE

DESIGN AND DEVELOPMENT OF A HYBRID ASSISTIVE DEVICE FOR TRANSFER MOBILITY AND REHABILITATION

IMPACT

Allows person with disability to have more mobility and more independent.
Assistive chair makes are easier for those providing care, like family members.

The chair makes it possible for individuals to have meaningful and healthy interactions which has indicated towards better mental health.

DURATION: 24 MONTHS
BUDGET: INR 53 LAKHS

SDG ALIGNED

AIM

The main purpose of this research project is to design and develop a hybrid assistive health care device that is easy to use, affordable, low maintenance, can meet the needs of most users and addresses problems like motion disability, patients, old people, caregivers and physiotherapists.

OBJECTIVES

- Transfer and Mobility function that will allow for easy lifting and transporting.
- Rehabilitation function: use as walk support and Sit to Stand exercise.
- Designed with Universal design to ensure One product fit for all
- Ergonomic and Modular to ensure comfort and usability for both users and carers.
- Low maintenance and manufacturing cost
- Safe and secure experience for all users and carers

MAIN COMPONENT

To comprehensively resolve the challenges presented in the study, a set of primary functions and constraints have been incorporated into the design of the transfer mobility hybrid chair. These features are required for the device to effectively assist individuals with varying degrees of mobility impairment. The following principal functions for the assistive chair have been proposed:

a. Ergonomics design
b. Functional analysis
c. Design and QFD Correlation
d. CAD designing using Top-down method

IMPACT

1. The technology developed during this project will provide the means for the deaf community to communicate seamlessly with the rest of the population.
2. Given that India has a shortage of trained sign language professionals, this will significantly impact society.
3. It is expected that the project will help to facilitate the linguistic rights of the deaf community and consequently empower the deaf community.

DURATION: 12 MONTHS
BUDGET: INR 53 LAKHS

SDG ALIGNED

03
GOOD HEALTH AND WELL-BEING

09
INDUSTRY, INNOVATION AND INFRASTRUCTURE

AI FOR DEVELOPING SIGN LANGUAGE TECHNOLOGIES: TOWARDS EMPOWERING & HELPING HARD OF HEARING PEOPLE

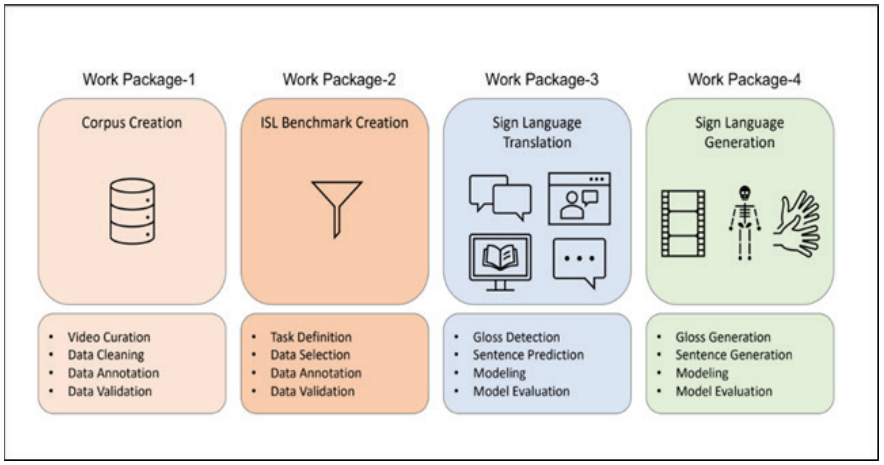
AIM

In this project, we would like to develop AI (ML and NLP) based technologies for automatically processing and generating Indian Sign Language so that the deaf community can communicate seamlessly with people who can speak and hear.

OBJECTIVES

- Addressing the gap between sign language and spoken language community
- Linguistic Understanding of ISL
- Facilitating Sign Language Research community with available datasets and benchmarks
- Modern NLP pipelines for Signed Languages
- Developing Educational Content in Sign Language

MAIN COMPONENT



IMPACT

1. Enhanced learning experience
2. Increased Inclusivity
3. Improved Navigation
4. Enhances safety
5. Accessibility
6. Comfort and Ergonomics

DURATION: 24 MONTHS
BUDGET: INR 1.2 CR

SDG ALIGNED

INFRASTRUCTURE SUPPORT TO STUDENTS INSIDE CAMPUS

AIM

The Project aims to have a multiple fold approach where we seek support for students with low visibility, students with physical limitations, and for ensuring overall commute within the campus is hassle free students and to provide the necessary support focusing on much needed facilities enabling stress-free and smooth functioning.

OBJECTIVES

- Ensures equal access to education for all, regardless of their physical limitations.
- Low cost, minimal effort and easy implementation. No new equipment or infrastructure is required. The faculty would be fine with the connection and any other technical settings.
- Test runs and surveys with beneficiaries affirm the productivity of the proposal.
- To facilitate the independent navigation of visually impaired students within the campus.
- Reduce the risk of accidents by providing a clear and tactile path.
- Promote an inclusive campus environment where all students have equal access to facilities.
- The objective is to improve accessibility and ensure adequate, clearly marked parking spaces are available for people with mobility challenges.

MAIN COMPONENT

Lecture hall visibility: High-definition cameras to be installed in the lecture halls and tutorial blocks.

These cameras will be synced and connected with the computers.

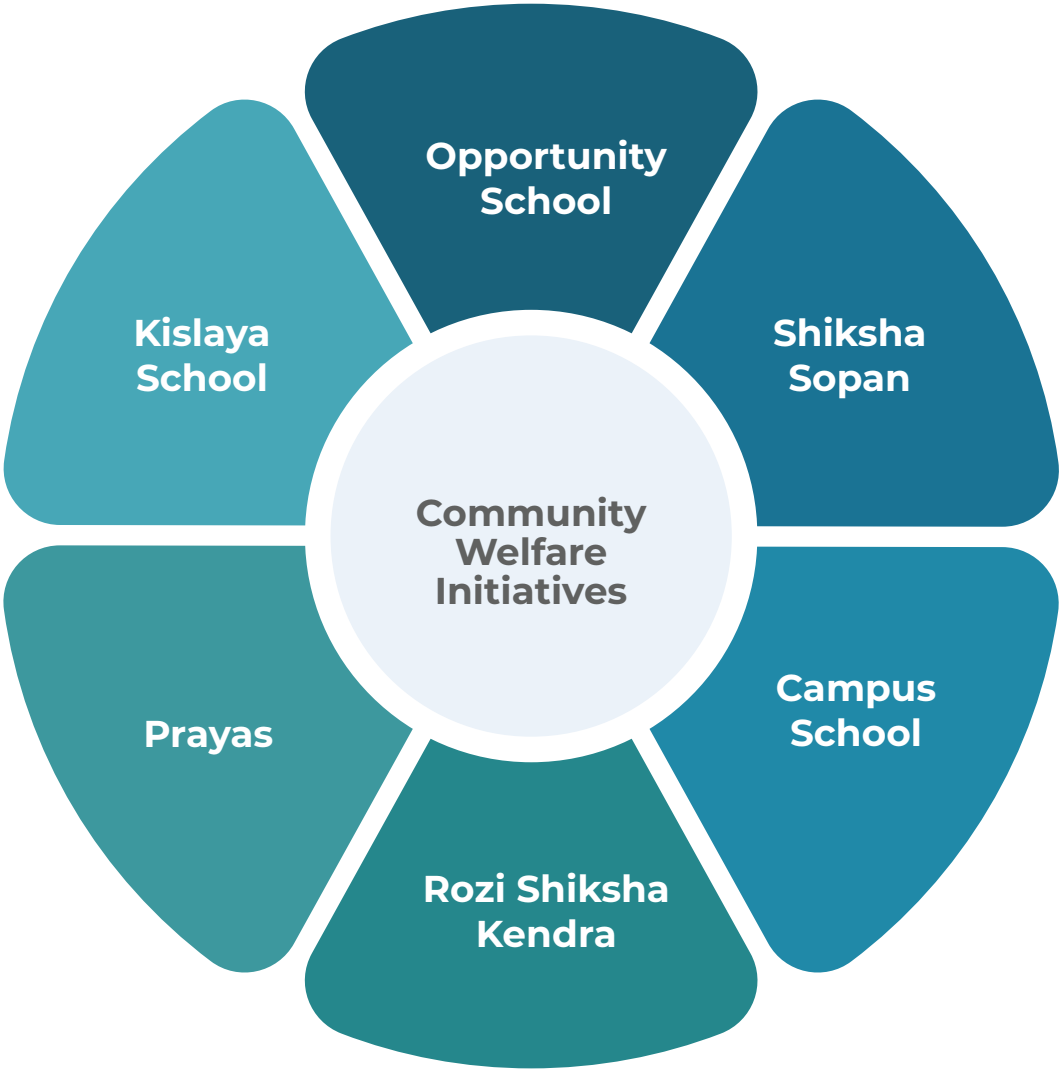
A duplicate screen will display a zoomed in clear video of the board regardless of the distance between the student and the board and the presenter

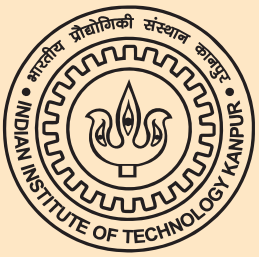
Tactile Pathway and Signage board: To install tactile pathways in all major corridors, including those leading to classrooms, restrooms, labs, hostel corridors, etc. and to install dedicated parking signage for tricycle and wheelchair users within the academic area and hall of residences.

Mobility and Infrastructure:

- To have a dedicated accessible mini bus
- E-Rickshaw
- Ergonomic height adjustable foe wheelchair users

COMMUNITY WELFARE INITIATIVES





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