NATIONAL MISSION ON INTERDISCIPLINARY CYBER-PHYSICAL SYSTEMS (NM-ICPS)

QUARTERLY **BULLETIN**

OCTOBER, 2023

Department of Science and Technology
Ministry of Science and Technology
www.dst.gov.in

National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS)

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Content

About NM-ICPS

The Union Cabinet has approved the National Mission on Interdisciplinary Cyber Physical System (NM-ICPS) in December, 2018 at a total outlay of Rs.3660 Crores for a period of five years to be implemented by Department of Science and Technology (DST).

Under the NM-ICPS, 25 Technology Innovation Hubs (TIHs) have been established in reputed institutes across the country. Each hub is a Section-8 Company, an independent entity within the Host Institute and has been assigned a Technology Vertical in the areas of advanced technologies such as Artificial Intelligence and Machine Learning; Technologies for Internet of Things & Internet of Everything; Data Banks & Data Services, Data Analysis; Robotics & Autonomous Systems; Cyber Security and Cyber Security for Physical Infrastructure; Quantum technologies etc.

The Mission aims at development of technology platforms to carry out R&D, translational research, product development, incubating & supporting start-ups as well as commercialization. The Mission is being implemented with all the TIHs undertaking activities under the four major categories i.e., 1. Technology Development 2. Entrepreneurship Development 3. Human Resource Development 4. International Collaborations.

Objectives of the Mission:

1. Technology Development, translational research and commercialization in Cyber Physical Systems (CPS) and associated technologies
2. Adoption of CPS technologies to address India specific National / Regional issues.
3. Produce Next Generation skilled manpower.
4. Catalyze Translational Research.
5. Accelerate entrepreneurship and start-up ecosystem development in CPS technologies.
6. Give impetus to advanced research in CPS technologies and higher education in Science, Technology and Engineering disciplines.
7. Bring India at par with other advanced countries and derive several direct and indirect benefits.

NM-ICPS is a comprehensive Mission that brings together academia, industry, government and international organizations. The mission has created an ecosystem that fosters entrepreneurship, develops next generation skilled manpower, catalyses translational research and promotes the commercialization of CPS technologies. NM-ICPS is an ambitious initiative that has the potential to transform key sectors of the Indian economy like healthcare, transportation, education, infrastructure etc. and make them more efficient, safe, and sustainable to place India at par with other advanced countries.

IIITB Comet Foundation, TIH at IIIT Bengaluru

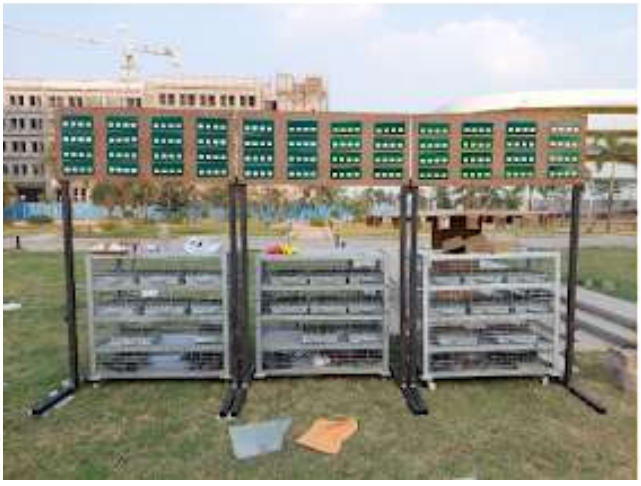
Technology Vertical: Advanced Communication Systems

IIITB COMET Foundation is set up to spearhead innovations in the next generation of communication systems; indigenously develop technologies to power 5G communication; address the critical demand of seamlessly connecting people, businesses and industries; and lay the foundations for 6G networks. IIITB COMET Foundation focusses on the verticals of 5G infrastructure as well as 5G applications such as Industrial IoT, eHealth, education, automotive V2X, AI/ML and AR/VR.

Highlights : Technology Development

5G-Advanced O-RAN Massive MIMO Base Station

5G-Advanced O-RAN Massive MIMO Base Station (TRL4) is being developed at the TIH. The goal is to facilitate the indigenous development of 5G technology which will lay the foundation for a secure telecom network in India. The end product will be a 5G-Advanced Massive MIMO Base Station compliant to O-RAN standards.

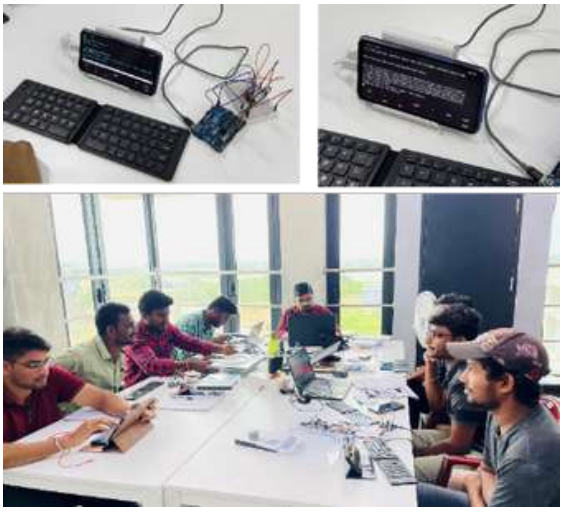


Massive MIMO: Open space testing

Highlights : Human Resource Development

Certificate course on - Future Wireless Communication

A Certificate course on "**Future Wireless Communication**" has been initiated where IIITB COMET Foundation is a joint program partner alongside IIT Hyderabad and WiSig Networks. It is a 12-month program consisting of 4 modules. Over 158 professionals have been trained. Participants gain hands-on experience with practical projects, contributing to their skill development and potentially benefiting the fields of communication and embedded systems.



Future Wireless Communication program

IHUB for Robotics and Autonomous Systems Innovation Foundation, TIH at IISc Bengaluru

Technology Vertical: Robotics and Autonomous Innovation Systems

I-Hub for Robotics and Autonomous Systems Innovation Foundation fosters innovations in AI & Robotics by bringing together the best of the start-up, industry, research, and government ecosystem in areas of Intelligent Healthcare, Automation for Logistics and Skilling for the AI age.

Highlights : Technology Development

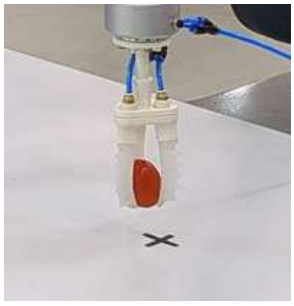
Robotic Actuator

Robotic Actuator (TRL 4), featuring novel strain wave gear and torque ranging from 2-40 Nm has been developed by the TIH. The actuator finds applications in manufacturing, electric vehicles, and surgical robots. Their development is poised to reduce costs and promote the adoption of indigenous robots in manufacturing, healthcare, and mobility sectors, fostering socio-economic benefits.

Robotic Actuator

Soft Gripper

Soft Gripper (TRL4) with pneumatic actuation and embedded sensors is being developed. The gripper finds applications in electronics manufacturing, surgical robots, food, agriculture. This would enable robotic automation to improve productivity and would reduce costs.



Soft Gripper

KISSANBOT

A-thon All Terrain, a start-up supported by the Hub has developed **KISSANBOT (TRL7)**. It is a compact, adjustable, and reconfigurable all-terrain BOT, that operates via assisted autonomous systems, ensures ease of use for farmers, to access advanced technology.

PRISM–H (Platform for Research, Integrated Surveillance and Management of Health)

TIH partnered with Department of Health and Family Welfare - Government of Karnataka, National Vector Borne Disease Control Program, and BBMP (Bengaluru Metro's Municipal Corporation) to develop **PRISM–H** (Platform for Research, Integrated Surveillance and Management of Health). The disease surveillance dashboard is providing a map of outbreaks across Karnataka at the district and sub-district levels along with case trends across years.

IIT Bhilai Innovation & Technology Foundation (IBITF), TIH at IIT Bhilai

Technology Vertical: Technologies for Financial Sector (Fintech)

IBITF at IIT Bhilai is focused on Translational Research, Entrepreneurship development, and commercialization of technologies in Fintech, including E-Payment systems, the Internet of Things, Artificial Intelligence, and Blockchain Technology

Highlights : Technology Development

Blockchain-based seed traceability

Blockchain-based seed traceability along with IoT-enabled Precision Agriculture and AI-Powered lending/renting of farm implements is being developed **(TRL6)**. It addresses key challenges in the agriculture sector by implementing seed/farm produce traceability solution, object detection, Convolutional Neural Networks (CNN) for the auto-identification to ease the lending/renting of farm implements within farmer communities, and IoT-enabled precision agriculture to improve productivity and income for farmers.


अब खेतों में लगेगा आधुनिक सेंसर बोर्ड मोबाइल के माध्यम से मिलेगी किसानों को समस्या की जानकारी

News about blockchain-based seed traceability

Blockchain and AL/ML-based application for healthcare

S**tar-Knowledge**, a start-up incubated under the TIH has developed a **blockchain and AL/ML-based application for healthcare** funding, seamless medical claim settlements, and reimbursement through data locker (TRL 6). The solution addresses the challenge of providing financial support for healthcare expenses in the unorganized sector, where irregular income and lack of formal credit history pose barriers.

Highlights : Human Resource Development

Workshop to empower innovation and entrepreneurship in Fintech for North-eastern India

Fintech Ignite- a **workshop to empower innovation and entrepreneurship in Fintech for North-eastern India** was organized. The workshop aimed at empowering faculty members and students (especially from the ST community) to identify regional problems, innovate and create solutions that can revolutionize the fintech landscape in the region. Around 200 professionals were trained under the said workshop.

TIH Foundation for IoT and IoE, TIH at IIT Bombay

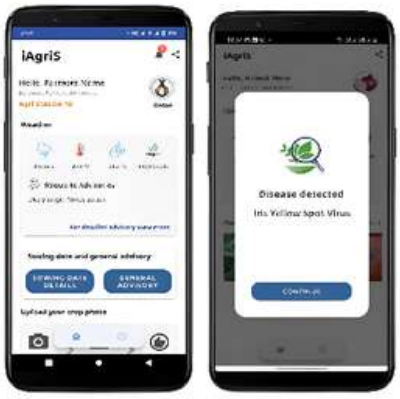
Technology Vertical: Technologies for IoT and IoE

The goal of the TIH is to create a self-sustaining IoT and IoE entrepreneurship ecosystem, increase Technology Readiness Levels (TRLs) in IoT R&D to build and commercialize reliable IoT products.

Highlights : Technology Development

iAgriS: An Intelligent Agriculture System

iAgriS: An Intelligent Agriculture System for end-to-end crop management (TRL-5) has been developed by the TIH. It offers image-based disease prediction, real-time monitoring, and decision support for precision agriculture. With ML-based disease diagnosis and advisories, it empowers farmers to optimize resources, manage crop health, and increase yields, making a significant socio-economic impact.



iAgriS Mobile App
.iAgriS: An Intelligent Agriculture System

SmartValve

Ekatva Innovations, a start-up incubated under the TIH has developed **SmartValve (TRL-7)**, an IoT-based device for precision irrigation. This technology enables farmers to micro-manage watering cycles, optimizing water and electricity usage while promoting environmental sustainability.

SmartValve

End-to-end solution for facilitating off-schedule inspection of underwater pipeline

The TIH has collaborated with **Indian Oil Corporation Limited (IOCL), Hindustan Petroleum Corporation Limited (HPCL) and Centre of Excellence in Oil, Gas and Energy IIT Bombay** to develop end-to-end solution for facilitating off-schedule inspection of underwater pipeline. The design and development of the product is completed and actual testing is planned to be done in the Underwater Vehicle Testing facility of IOCL.

Towfish for inspection of underwater pipeline

IHUB Anubhuti -IIITD Foundation, TIH at IIIT Delhi

Technology Vertical: Cognitive Computing and Social sensing

iHub Anubhuti-IIITD Foundation aims at building Cognitive Computing and Social Sensing solutions, mainly in the verticals - Healthcare, Education and Law Enforcement & Security.

Highlights : Technology Development

Precily suite

Precily suite, a pre-trained model-based approach to **characterization of functional heterogeneity in cancer (TRL5)** has been developed under the TIH. The suite builds learning capabilities for encoding mutations and gene expression while deciphering functional heterogeneity.

Precily webpage

Whatdish

Whatdish (TRL5), a deep learning strategy of automatic detection of food dishes in a platter is being developed. It involves application of digital diet coach mobile apps for food recommendation strategies and nutritional advisory. Using this digital diet coach, mobile apps can offer users tailored meal recommendations and nutritional guidance, facilitating improved dietary choices and enhancing their health and wellness.


The food business is using ingredients' data and algorithms to understand how to create unique recipes, how to ensure sustainable food

CONSUMING PASSION:
Data and delicious food

USING DATA TO PREDICT THE NEXT BIG FOOD ITEM
Whatdish

SURAKSHA.ai

Femacare Private Limited, a Startup incubated under the TIH has developed **SURAKSHA.ai** - a novel screening tampon based on biosensor technology that can detect cervical cancer within 30 seconds. The device is based on the computational algorithm of spectroscopy, and the diagnosis is based on morphological and functional changes.


Suraksha AI

Highlights : Human Resource Development

Build your own AI/Cognitive Computing Tool

Build your own AI/Cognitive Computing Tool- a hands on workshop was organized by the TIH in collaboration with Reskill and Microsoft Azure to skill train college students on the latest AI technologies and how they could build their own cognitive tools with available online free tools. Around 400+ participants were trained in the said workshop.

I-Hub Foundation for Cobotics (IHFC), TIH at IIT Delhi

Technology Vertical: Cobotics

The vision of the IHFC is to focus on the research and development of novel technology in the areas of robot analysis, design and control, communication, computer architectures, machine learning and artificial intelligence. The TIH aims at serving various sectors like Medical Robotics, Agriculture, Disaster Management, Defence, Industry.

Highlights : Technology Development

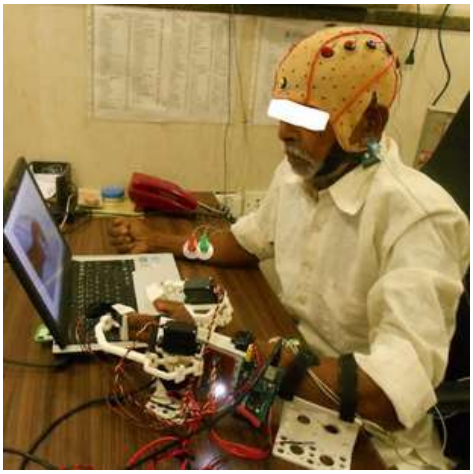
Drone-based Aerial Manipulation with Human-in-the-loop technology

TIH has developed **Drone-based Aerial Manipulation with Human-in-the-loop technology (TRL 5)**. The technology attributes to the drone pollination technology that showcases significant advantages over traditional manual pollination and presents a promising alternative to some existing solutions in terms of efficiency, cost-effectiveness, and environmental sustainability. The technology would be useful in enhancing pollination efficiency & accuracy, reducing labour costs & impacts on the environment, thereby increasing crop yields.

Drone-based Aerial Manipulation

Hand and arm exoskeletons for rehabilitation of stroke patients

TIH has developed **hand and arm exoskeletons for rehabilitation of stroke patients (TRL6)**, a technology which includes lightweight modular hand, arm and shoulder exoskeletons with embedded sensors, capable of replicating human finger and arm motion for physical practice. It also includes Novel Brain-Computer interface (BCI) for controlling the exoskeleton. The technology developed would be useful for rehabilitation of stroke patients.



Experimental BCI based Hand exoskeleton

Highlights : Human Resource Development

Delhi Robotics League Bootcamp

Delhi Robotics League Bootcamp for training Delhi Board school students in Robotics was organized by the TIH, wherein 1108 students were trained. This upskilling of underprivileged children in robotics curriculum would provide greater career opportunities to them in the future.

Delhi Robotics League Bootcamp

TExMIN Foundation, TIH at IIT (ISM) Dhanbad

Technology Vertical: Technologies for Mining

Technology Innovation in Exploration & Mining (TEXMiN) Foundation has been set up to address the issues and challenges of mining and exploration industry through intervention of CPS based technologies. The objective is to develop commercially feasible solutions using IoT, AI/ML, blockchain, drones, robotics, and satellite imagery for achieving 3S Mining (Safe, Smart, and Sustainable Mining) leading to Mining 4.0; and Mineral Exploration 4.0.

Highlights : Technology Development

Creating Iron Alloys from Red Mud for Aluminum-Iron Composite Production

The TIH has developed technology for **Creating Iron Alloys from Red Mud for Aluminum-Iron Composite Production (TRL-6)**. It offers environmentally sustainable Al-Fe alloy production through advanced stir-casting techniques. Its applications range from construction to household items, promising economic growth, job opportunities, and addressing environmental concerns associated with red mud disposal.

AI-Powered Integrated System to Identify Copper Deposit Exploration Target

AI-Powered Integrated System to Identify Copper Deposit Exploration Targets has been developed (TRL5). It is a software technology for intelligent exploration, predicting copper mineralization in uncharted areas through AI-driven predictive modeling. This innovation minimizes errors resulting from incomplete or inconsistent exploration data.

India's first DGMS-approved underground mines communication system

EASYM2M TECHNOLOGIES PVT LTD, a startup incubated under the TIH has developed India's first **DGMS-approved underground mines communication system**. It enhances worker safety and offers remote machine monitoring/control. With DGMS approval, Wi-Fi, and advanced features like video calls, it has a broad application in underground coal, metal, and non-metal mines, driving industrial automation and productivity while promoting computer literacy.

Underground Mines Wireless Communication System

Highlights : International collaboration

Carlson Software Inc

TEXMiN has partnered with **Carlson Software Inc**. to set up the TEXMiN – Carlson Lab which will facilitate world-class technology support to Industry and future workforce, specific to mapping, monitoring, and surveying in mines and allied industries.

IIT Guwahati Technology Innovation and Development Foundation, TIH at IIT Guwahati

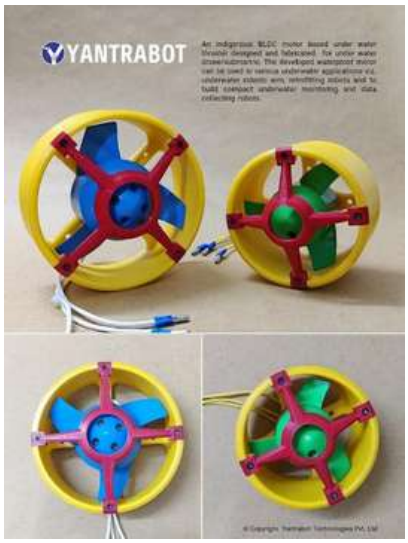
Technology Vertical: Technologies for Underwater Exploration

Technology Innovation & Development Foundation, IIT Guwahati focusses projects on the development of underwater robots, which may be used for underwater tracking, surveillance and monitoring purposes. Monitoring of cracks in ship hulls, industrial pipes and development of an apparatus for underwater operations like cleaning, cutting, etc. at lower cost are other areas of focus.

Highlights : Technology Development

An indigenous Brushless DC (BLDC) motor based under water thruster

An indigenous Brushless DC (BLDC) motor based under water thruster (TRL5) has been designed and fabricated by the TIH for under water drone/submarine. The developed waterproof motor can be used in various underwater applications viz. underwater robotic arm, retrofitting robots and to build compact underwater monitoring and data collecting robots.



BLDC motor based underwater thruster

Bamboo Composite Boats

Akvotransiro Technology Pvt. Ltd., a Start-up supported under the TIH has developed **Bamboo Composite Boats (TRL 8)**. Crafted using an innovative Bamboo-Epoxy-Fiberglass composite, they are 85% Bamboo, 10% Polymers, and 5% Fiberglass. Designed for shallow muddy waters, these are light in weight and are perfect for flood relief operations.

Bamboo Composite Shallow Water Boat

Highlights : Human Resource Development

Inter-engineering college water-based robot war

AquaWars, a ground-breaking **inter-engineering college water-based robot war** event was organized by the TIH in collaboration with IIT Guwahati and Dheya Career Mentors. This innovative program ignited engineering students' innovation and creativity while fostering the development of water-based/underwater robotics (ROV) and exploring solutions to challenges faced by India's vast coastline and oceanic environment through a competitive and fun environment.

IIIT-H Data I-Hub Foundation, TIH at IIIT Hyderabad

Technology Vertical: Data Banks & Data Services, Data Analytics

IIIT-H Data I-Hub Foundation (I-Hub Data) has been established to help coordinate and enhance national research and know-how in Data Banks, Data Services and Data Analytics. I-Hub Data is expected to play a central role in design, development, and diffusion of data-driven technologies by taking a proactive strategy in curating and creating data banks and data services and also to catalyse, nurture, and enable the growth of an ecosystem.

Highlights : Technology Development

Intelligent Solution for Road Safety

Intelligent Solution for Road Safety (TRL9) has been developed under the TIH. Leveraging the predictive power of AI/ML the solution helps to reduce fatalities and road accidents while making prediction of accident-prone locations using the data from Advance Driver Assistance System (ADAS) installed Vehicles.

Non-surgical brain modulation technology

Sputnik Brain, a Start-up incubated under the TIH has developed **non-surgical brain modulation technology (TRL8)**. The neuromodulation platform would facilitate ability to solve a real problem or fulfil a need in the market such as stress alleviation by pain and chemical-free methods.

Brain modulation

Highlights : Human Resource Development

Summer School on AI

Summer School on AI, a training course was organized by the TIH wherein recent advancements from the application domains of AI, pertaining to Computer Vision and Natural Language were covered supported by hands-on tutorials. Around 100+ participants were trained under this program. The course had a high impact on career advancements prospects of participants.

NMICPS Technology Innovation Hub on Autonomous Navigation (TiHAN), TIH at IIT Hyderabad

Technology Vertical: Autonomous Navigation & Data Acquisition Systems

Technology Innovation Hub on Autonomous Navigation (TiHAN) has the vision to become the global destination for next generation smart mobility technologies that utilize reliable and efficient autonomous navigation & data acquisition systems.

Highlights : Technology Development

HD LiDAR Map-Based Autonomous Vehicle

HD LiDAR Map-Based Autonomous Vehicle (AV) localization and navigation technology (TRL9) has been developed under the TIH. The developed technology is under deployment in Naval Dockyard, Visakhapatnam. The technology will facilitate Improved Transportation and Mobility, Reduced Traffic Congestion, Enhanced Logistics and Delivery, Urban Planning and Development, Disaster Response and Management.

Field Deployment of Autonomous Vehicle

Drug Delivery UAV for Beyond Visual Line of Sight

Drug Delivery UAV for Beyond Visual Line of Sight (BVLOS) in high altitude environments (TRL7) has been developed. A hexacopter UAV with a payload capacity of 5-10 Kg, for long-range flight of 30-40 Kms, at an altitude of 300-500m, with perception and navigation functionalities has been developed. It could find applications in defence, maritime sector – cargo shipping, healthcare.

Drug Delivery – BVLOS UAV

Autonomous Long Endurance Aerostatic Drone

Airbotix Technology Pvt. Ltd., a start-up incubated under the TIH has developed **Autonomous Long Endurance Aerostatic Drone (TRL5)**. Unlike traditional drones that rely solely on dynamic lift, this innovative drone harnesses the power of static lift, made possible by its helium envelope and would be useful across defence, surveillance, disaster response and monitoring, telecommunications.

Aerostatic drone

Highlights : Entrepreneurship Development

Training course on-Monitoring Drones:

TIH organized a **training course on-Monitoring Drones: How Tools are Evolving to Track Drone Activities in Real Time**. The course addressed issues related to the drone monitoring, dnti-drone and counter UAV systems, Laser weapons used to counter the drone, Wi-Fi Geofencing system for UAV detection. 54 professionals were trained under the program.

IITI Drishti CPS Foundation, TIH at IIT Indore

Technology Vertical: System simulation, Modelling & Visualization

IITI DRISHTI CPS Foundation, focusses on system simulation, modelling and visualisation. The hub has created an ecosystem which works as a focal point for the convergence of the efforts of academia, industry and government agencies for technology development and commercialization.

Highlights : Technology Development

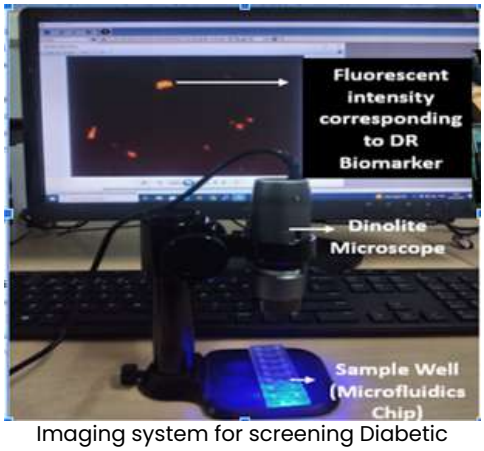
iGLU: Intelligent Glucometer

iGLU: Intelligent Glucometer (TRL5) has been developed as a non-invasive, affordable, and easy to use complete diabetes management with features like insulin adjustment, comprehensive glucose monitoring, and integration with mobile applications.

Continuous glucose monitoring and management system

DR-Biomarking

DR-Biomarking (TRL6), a technology to differentiate between mild, severe and no Diabetic Retinopathy (DR) has been developed. This technology intends to correlate each biomarker like Optical Coherence Tomography (OCT), Fundus Image analysis and serum biomarkers to the point of clinical validation in decision-making. It could be used in remote and rural settings.



Imaging system for screening Diabetic Retinopathy Patients

Battery-operated sensor module with onboard RF based cloud data transfer capabilities

Presage Insights Pvt. Ltd., a start-up incubated under the TIH has developed **battery-operated sensor module with onboard RF based cloud data transfer capabilities for continuous monitoring of critical assets (TRL6)**. The device can be mounted on rotating machinery such as pumps, motors, gearboxes among others. It is complemented by a portable data collector for monitoring semi-critical and other similar assets. The technology helps in reducing the cost of asset maintenance for MSMEs and other organizations.

PHOTOS/SCREENSHOTS/DEMO VIDEO LINK OF THE PRODUCT

Battery Operated Sensor For 24/7 Continuous Monitoring Of Critical Assets

Portable Data Collector With Mobile App For Semi Critical Assets And Customers With Low Investment Budgets

Highlights : Entrepreneurship Development

SETU (Stakeholder Engagement in Technology Upgradation)

The TIH organized **SETU (Stakeholder Engagement in Technology Upgradation)**, a technology exhibition in Indore showcasing CPS innovations. It fostered connections between technology developers, industry experts, and government officials.

IHUB Drishti Foundation, TIH at IIT Jodhpur

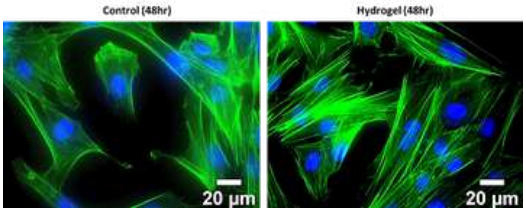
Technology Vertical: Computer Vision, Augmented and Virtual Reality

The TIH focuses on the core research areas of Seeing and Sensing, Dependable and Responsible CV/ARVR, Real-time Computer Vision Systems, and Data Collection, Curation and Annotation. It has identified the following application areas for developing technologies: Computer Vision for Autonomous Systems; Computer Vision for Better Living: Healthcare and Biosphere; Imaging for Document Analysis; CV and VR for Industry 4.0; Dependable AR-VR for X (including games).

Highlights : Technology Development

Capturing dynamics of cellular behaviour using bioinspired tunablesoft hydrogel

A technology for capturing dynamics of cellular behaviour using bioinspired tunablesoft hydrogel (TRL5) has been developed which would accelerate wound healing in diabetic patients. The technology involves a self-assembling acidic peptide-based cytocompatible, antibacterial, electronegative hydrogel platform for the delivery and engraftment of adipose tissue-derived mesenchymal stem cells to expedite diabetic wound healing process.



Comparative Analysis

Gamification of Concept of Physics

Gamification of Concept of Physics (TRL 5) has been developed which involves creation of a 2D side-scrolling single player platformer game for some of the concepts of physics in a fun way. For eg. puzzle game with an engaging story and gameplay elements in the form of 4 energies: kinetic energy, light energy, thermal energy and sound energy.


Gamification of Concept of physics

AI- guided customized and personalized bioinks for invitro disease models

Cellverse Pvt. Ltd., a Start-up incubated under the TIH is developing **AI- guided customized and personalized bioinks for invitro disease models (TRL4)** so as to translate cost effective scientific pre-clinical drug testing solutions as an alternative to animal testing and as a customized screening platform for personalized medicine.

Highlights : Human Resource Development

Advanced Computer Vision & Graphics training program

The TIH organized an **advanced Computer Vision & Graphics training program** in Computer Vision and Graphics. 30 professionals were trained under this program who gained a deep understanding of image processing, machine learning, 3D graphics, real-world project experience.

Cybersecurity and Cybersecurity for Cyber-Physical Systems Innovation Hub, TIH at IIT Kanpur

Technology Vertical: Cyber Security and Cyber Security for Cyber Physical Infrastructure

Cybersecurity and Cybersecurity for Cyber-Physical Systems Innovation Hub (C3iHub) aims to address cyber security issues of the cyber-physical systems and devise technologies for protecting these systems. C3iHub is focused on application verticals of critical infrastructure, automotives, Unmanned Aerial Vehicles (UAVs), cyber-crime prevention and tamper-proof data-storage and all horizontal layers of security associated with these verticals, including hardware security, network security, firmware security etc.

Highlights : Technology Development

Cybercrime Investigation Framework and Tool

Cybercrime Investigation Framework and Tool (TRL8) developed by the TIH is a framework-navigating interactive tool to apprehend attackers' tactics, techniques, and procedures (TTPs) in a crime execution lifecycle, intending to assist cybercrime investigators in cybercrime incident responses. The tool is ready to be launched with Cyberabad Police.

Tool Screenshot – Pre-Defined Crime Execution Path for Matrimonial Fraud

Cyber Asset Management Platform

Cyber Asset Management Platform (TRL9), is a crucial component of Security Operations Centre (SOC), continuously monitoring cyber threats. It offers real-time visibility into cyber assets, their vulnerabilities, and patch management status.

Vulnerability with Patch Status Display

ThreatSpy Application Security platform

Secure Blink, a Start-up incubated under the TIH has commercialized **ThreatSpy Application Security platform (TRL 9).** It aids developers and security engineers in detecting and remediating vulnerabilities efficiently. With automated playbooks and integration with popular workflow apps, it protects critical data and ensures secure web application functioning in sectors like healthcare, telecommunications, and government, contributing to a safer digital landscape.

Dashboard of ThreatSpy

Highlights : Human Resource Development

Cybersecurity Skilling Program (CSP)

Cybersecurity Skilling Program (CSP) implemented by the TIH aims to provide learners with the basic knowledge/skills in cybersecurity. The program is implemented in online mode with hands-on training through cyber-range and assignments with award of certificates and chances of internship at end. The program is completely free for SC/ST students. Over 10000+ students have been trained so far under this program.

AI4ICPS I-Hub Foundation, TIH at IIT Kharagpur

Technology Vertical: Artificial intelligence and Machine Learning

AI4ICPS@IITKGP aims to create a national ecosystem to foster innovations in AI and ML interventions to ICPS by solving societal challenges spanning across three core sectors namely Healthcare, Precision Agriculture, Manufacturing.

Highlights : Technology Development

AI in Safety

TIH has developed **AI in Safety (TRL5)**, a micro-hazard mapping and management system which has applications in Industrial Safety. The technology could be useful in reduction of accidents, injuries, and fatalities.

Micro-hazard mapping and management system

AI Nano-bots

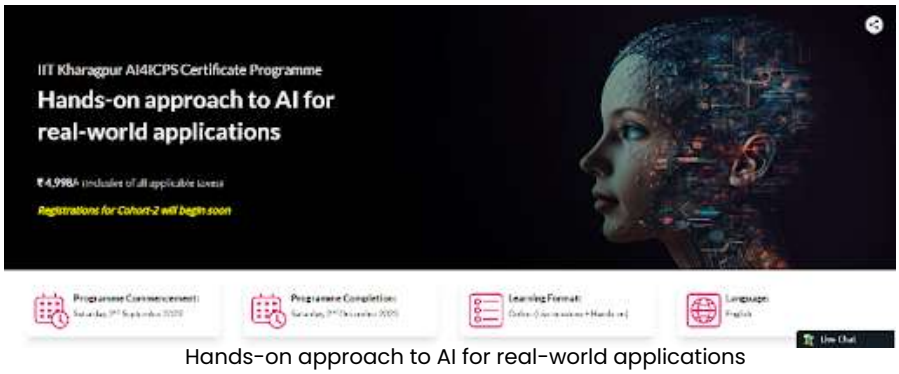
Nxtbot Technologies Pvt. Ltd., a Start-up incubated under the TIH is developing AI Nano-bots (TRL4), which encapsulate all advanced algorithms of AI/ML and mathematical operations such as anomaly detection, regression classification, causal inference. The product is useful to functional analyst, business analyst and Non-AI software developers.

Nxtbot Technologies

Highlights : Human Resource Development

3 month online certificate programme aligned with NEP 2020

Hands-on approach to AI for real-world applications- a **3-month online certificate programme aligned with NEP 2020** has been initiated by the TIH which provides a comprehensive education in AI and ML combining 80% practical hands-on learning with 20% theoretical instructions through live lectures. About 1000 professionals are being trained under this program.



Hands-on approach to AI for real-world applications

IDEAS-Institute of Data Engineering, Analytics and Science Foundation, TIH at ISI Kolkata

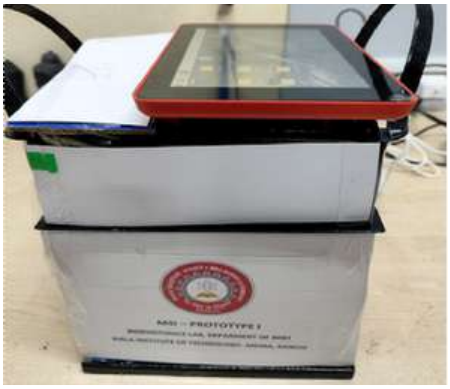
Technology Vertical: Data Science, Big Data Analytics & Data curation

The Technology Innovation Hub, IDEAS (Institute of Data Engineering, Analytics and Science Foundation), is working towards Data Science, Big Data Analytics, and Data Curation.

Highlights : Technology Development

A Portable AI based Multispectral Imaging System

A Portable AI based Multispectral Imaging System (TRL4) is being developed for detection of disease in plants. The prototype is ready for field examination. The technology would be helpful to farmers for making proper use of pesticides, enhancing crop yield.



Portable AI based Multispectral Imaging System

Multi-modal smart-Non-Lethal Deterrent (NLD) device for human-animal conflict mitigation

Multi-modal smart-Non-Lethal Deterrent (NLD) device for human-animal conflict mitigation (TRL3) is being developed for mitigating human-animal conflicts (e.g. leopard attacks, elephant attacks etc.). The technology would be implemented by the West Bengal forest department. Secondary data of human-animal conflict incidences collected for analytical model development.

Intelligizer System

Vashisth Automation Private Limited, a Startup supported by the TIH has developed the **Intelligizer System** (TRL4), a home automation system, which collects the data via sensors, IoT devices and user input, processes it using NLP, Predictive Analytics & ML and personalizes it for automation. The product provides benefits such as energy savings, convenience, security and data-driven insights.

Highlights : Human Resource Development

Training program on Earth Observation (EO) Data Analytics for Disaster Management

The TIH organized a Training program on Earth Observation (EO) Data Analytics for Disaster Management focusing on Flood and Drought. The program provided a valuable insight and experience in this domain, specifically in the application of data analytics in flood and drought prevention. It was attended by 40+ participants.

Training program on Earth Observation (EO) Data Analytics for Disaster Management

IITM Pravartak Technologies Foundation, TIH at IIT Madras

Technology Vertical: Sensors, Networking Actuators & ControlSystems (SNACS)

IITM Pravartak focuses on new knowledge in Sensors, Networking, Actuators, and Control Systems (SNACS) through extensive and application-oriented research and gladly prepares young India for the next generation of world-class technologies.

Highlights : Technology Development

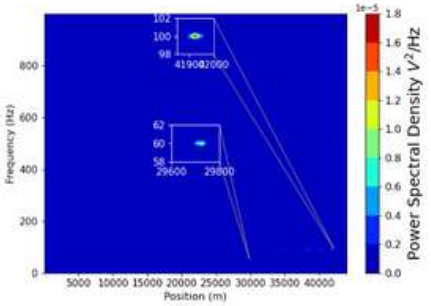
DEGA (Miniaturized EO Payload) and LWIR payload

Eon Space Labs Private Limited, a start-up incubated under the TIH has developed **DEGA (Miniaturized EO Payload) and LWIR payload (TRL4)**. It offers exceptional resolution and mechanical stability. The focus is mainly on making satellite data more affordable and accessible by miniaturizing Electro-Optical/Infra Red (EO/IR) satellites. These innovations find applications in agriculture, disaster response, defense, urban planning, and more, leading to improved resource management, reduced losses, and job creation.

DEGA (Miniaturized EO Payload)

Optical Fiber based Under Ground Vibration Detection System

TIH has collaborated with **Bharat Electronics Limited (BEL)** to develop **Optical Fiber based Under Ground Vibration Detection System** that can detect objects or any other entities on the surface. This would find major military application in detection of events and entities.



A spectrum of the acoustics detected on 44 km fiber

Highlights : Human Resource Development

Advanced Certification in Data Science and AI program

Advanced Certification in Data Science and AI program, offered by the TIH in association with IIT Madras, equips professionals with essential skills in Data Science, Machine Learning, Deep Learning, and Artificial Intelligence. 1145 professional have been trained under this program.

IIT Mandi IHUB and HCI Foundation, TIH at IIT Mandi

Technology Vertical: Human-Computer Interaction(HCI)

IIT Mandi iHub and Human-Computer Interaction (HCI) Foundation focuses on Human-Computer Interaction with a vision to nurture research in the area, enable technology translation for industry, and build scale in skill development.

Highlights : Technology Development

Innovo meter

Innovo meter (TRL8) developed by TIH offers a user-friendly interface for quick TRL assessments, making research and development more efficient. It also complements these assessments with Business Readiness Level (BRL) evaluations, facilitating startups and businesses in gauging product-market fit. The developed application has been successfully deployed with growing popularity on Google Play Store (iOS version in the pipeline).

Innovo meter App

AI Security Engine for monitoring users' gameplay and behaviour

256 Bits Studio, a Start-up incubated under the TIH has developed **AI Security Engine for monitoring users' gameplay and behaviour (TRL9)**. This cutting-edge engine facilitates game development across various genres and is embraced by AR/VR/XR/MR companies. Its broader applications span industries like robotics, drones, and pharma, providing secure and immersive digital experiences. The application software contains Authentication, Authorization, and Accounting (AAA) for game development and publishing.


Game engine for procedural generation using ML/DL

Highlights : Interational Collaboration

Exofense USA

TIH has forged an International Collaboration with **Exofense USA** to develop AI Agents. **Exofense** is a company that is building the new age AI-based Human-computer-based communication through AI agents. In the first phase, both partners will work to develop state-of-the-art AI agents that could have multi-industry applications.

IIT Palakkad Technology IHUB Foundation (IPTIF), TIH at IIT Palakkad

Technology Vertical: Intelligent Collaborative Systems

IIT Palakkad Technology IHUB Foundation (IPTIF) on Intelligent Collaborative System (TIH-ICS) aims to deliver commercial technology and products and build a vibrant innovation ecosystem by providing a reliable platform for technology-based start-ups and entrepreneurs in CPS

Highlights : Technology Development

Multipurpose Mobile Manipulator

Multipurpose Mobile Manipulator (TRL 4) is being developed by TIH is a four wheeled mobile manipulator with gantry type gripper fabricated and tested as an all-terrain stable manoeuvring, semi-autonomous robotic vehicle with remote operations. The product finds applications in defence and agricultural sectors.

Multipurpose Mobile Manipulator

Magic- a 30 sec Electric Vehicle (EV) charging station

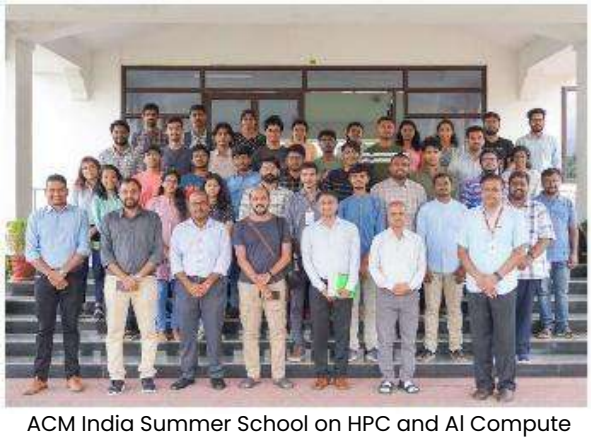
InfinityX Innovations Pvt. Ltd., a start-up incubated under the TIH is developing **Magic- a 30 sec Electric Vehicle (EV) charging station (TRL 5)**. It is a next-gen proprietary battery swapping through cable technology for two & three wheelers. The discharged cells from the vehicle's battery pack are replaced by fully charged cells from the charging station via the swapping cable.

EV cell Swapping robotic system

Highlights : Human Resource Development

ACM India Summer School on HPC and AI Compute Continuum

ACM India Summer School on HPC and AI Compute Continuum, an exclusive summer workshop for students and researchers was organised by the TIH with a focus on seamless integration of high-performance computing and artificial intelligence to accelerate scientific discovery, innovation, and problem-solving across various domains. Under this workshop 37 participants were trained.



ACM India Summer School on HPC and AI Compute Continuum

Vishleshan I-Hub Foundation, TIH at IIT Patna

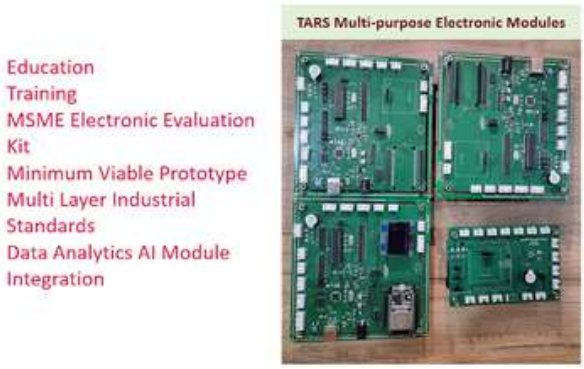
Technology Vertical: Speech, Video and Text Analytics

Vishlesan I-Hub foundation is established to build an ecosystem for the domain of "Speech, Text and Video analytics".

Highlights : Technology Development

Solderless codeless embedded electronic modules with AI enabled text and data analytics

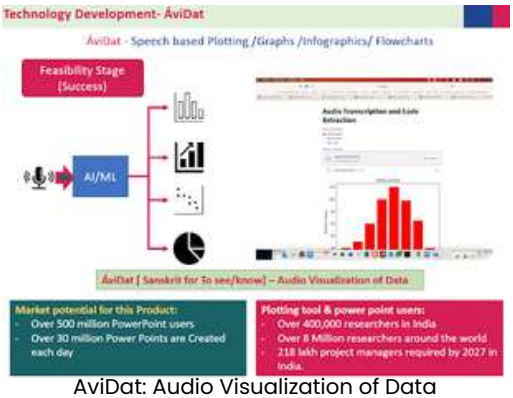
Solderless codeless embedded electronic modules with AI enabled text and data analytics (TRL6) have been developed by TIH. It is an innovative technology featuring AI-enabled text and data analytics, along with integration of more than 50 sensors. These modules offer versatile applications in various sectors including education, skill development, MSMEs.



Solderless Codeless Embedded Electronic Module

AviDat: Audio Visualization of Data

AviDat: Audio Visualization of Data (TRL4), a tool to convert Speech/Text to Images or Plots has been developed by the TIH. The current capability of the tool is to convert English language, while Hindi version is under development.



AviDat: Audio Visualization of Data

DIGICLINICS,

DIGICLINICS, a start-up supported under the TIH has developed AI enabled Video Analytics for Breast Cancer detection (TRL 7). The product offers a comprehensive suite of features, including Metastatic Breast Cancer Diagnostics, Nottingham grading platform for digitized pathology, and patented diagnostics for Sentinel Lymph Node Metastasis.

AI enabled Microscope to Computer module for cancer detection

Highlights : International Collaboration

National Research Council, Italy

TIH has collaborated with National Research Council, Italy to promote research and exchange of researchers in the area of: AI/ML in agriculture and AI driven research in material sciences and nanotechnology. This will help to promote collaboration and knowledge sharing in these areas.

BITS BioCYTiH Foundation, TIH at BITS Pilani

Technology Vertical: Bio-CPS

The mission of BITS BioCyTiH Foundation is to foster research, innovation, skill development and training in the interdisciplinary area of Bio-CPS through mentoring and nurturing start-ups & entrepreneurs, and industryacademia collaborations. The foundation envisions to undertake cutting edge research to provide affordable solutions in the areas of healthcare, agriculture, water and environment

Highlights : Technology Development

Wastewater Treatment Monitoring System

The **BacTreat Environmental Solutions LLP** at TIH has developed **wastewater treatment monitoring system (TRL7)**, which offers decentralized and online monitoring wastewater treatment for single household, an institution or for a community. This online monitoring system is a better alternative to increase reactor volumes as well as to guarantee effluent quality as per standards. The device developed has already been deployed for a community in Goa.

Wastewater Treatment Plant

X100

Flic Farm Pvt. Ltd., an incubated Start-up under the TIH has developed **X100 (TRL 7)**, a compact autonomous electric robot that can perform seeding, weeding, spraying & monitoring operations with precision in agriculture. The product reduces dependency on labour, operational costs, inputs costs while improving soil health and allowing timely and precise farm operations.

Spraying chemical on crop plants

Highlights : Human Resource Development

Deriving value from Intellectual Property: Lessons and Insights for Indian Academia

The TIH organized a webinar- **Deriving value from Intellectual Property: Lessons and Insights for Indian Academia** to provide a comprehensive overview of how intellectual property can be strategically managed and leveraged within academic institutions. The event equipped participants with valuable insights into leveraging IP assets for innovation, economic growth, and societal impact.

IHUB Quantum Technology Foundation, TIH at IISER Pune

Technology Vertical: Quantum Technologies

I-HUB Quantum Technology Foundation is focussing on translating research in Quantum Information and Computing, Quantum Communications, Quantum Sensing and Metrology, and Quantum Materials and Devices and is currently working on developing ion-trap based quantum computer, gravity sensor, quantum clock, advance materials and devices that can be commercialised in future.

Highlights : Technology Development

Nano-Burst/Delay Generator

GDQ Labs, a Start-up incubated under the IHUB QTF has developed **Nano-Burst/Delay Generator (TRL8)** which is an important sub-system of a Quantum Computing control and measurement system to generate pulses with variable duration to drive the qubits for applications in quantum computation, quantum information, and many more. The product will help in Indigenization of Quantum enabling technologies for India and reduction of imports.

Nano-Burst/Delay Generator

Highlights : Human Resource Development

A workshop on Quantum Technologies: Introduction, Materials and Devices

A workshop on **Quantum Technologies: Introduction, Materials and Devices** was organised by the Hub where the leading quantum material experts across India and USA gave lectures to Doctoral and Post- Doctoral researchers. The workshop trained 70 researchers creating a future pool of Quantum ready talent for India, in this emerging field.


Workshop on Quantum Technologies

Highlights : International Collaboration

Tabor Electronics, Israel

IHUB QTF has collaborated with **Tabor Electronics, Israel** for the development & miniaturization of highly specialized electronics for Quantum Technologies.

Divyasampark IHUB Roorkee for Devices Materials and Technology Foundation, TIH at IIT Roorkee

Technology Vertical: Devices Materials and Technology

Divyasampark iHUB Roorkee for Devices, Materials, and Technology Foundation aims to enable an innovative ecosystem in CPS and become the source for the next generation digital technologies, products, and services by promoting translational research, enhancing core competencies, capacity building, and training.

Highlights : Technology Development

Smart fully instrumented anti rotational helmet

Smart fully instrumented anti rotational helmet (TRL 5) has been developed by the TIH. This innovative helmet utilizes advanced materials to mitigate the effects of rotational acceleration and features a smart system for monitoring impacts during accidents. This smart helmet can alert medical professionals and first-aid responders and would also be able to provide a full impact-related report to the medical team in a short period of time.

Smart anti rotational helmet

IDR Doot Mk-1

IDR Research & Development Pvt. Ltd., a Start-up incubated under the TIH has developed the IDR Doot Mk-1 (TRL7), a cutting-edge Nano UAV tailored for close-range Intelligence, Surveillance & Recon (ISR) operations. This personal UAV system offers GPS-assisted flight modes, GPS denied assistance, Multiple video display making it suitable for defence, law enforcement, surveillance, and various applications.

IDR Doot Mk-1

Highlights : Human Resource Development

Skill Development Program

TIH has started a dedicated Skill development program for the students and faculty of colleges of north-eastern states with an aim to improve skills by using digital platforms & techniques like artificial intelligence (AI). So far 1400 students/faculty have been trained under this program. The program enhances employability and career growth.

Highlights : International Collaboration

Microelectronics and Information Research Centre, NYCU, Hsinchu, Taiwan

The TIH has collaborated with Microelectronics and Information Research Centre, NYCU, Hsinchu, Taiwan, wherein events for academia-industry innovation in semiconductors are organized; information on research, training, and education is shared; and collaborative research & training, seminars, conferences, and workshops are organized.

IHUB - AWaDH (Agriculture & Water Technology Development Hub), TIH at IIT Ropar

Technology Vertical: Technologies for Agriculture and water

iHub - AWaDH is involved in the development of technologies to support environmentally sustainable and profitable agriculture, quality food for all, and the preservation of biodiversity. It aims to provide technological solutions to the Agricultural & Water related issues through deployment CPS in Food Processing, Rural Development, Fisheries, Textiles, Electronics, Fertilizer, Atomic Energy etc.

Highlights : Technology Development

Bee Watcher

Bee Watcher (TRL9), a technology for monitoring bee populations and their activities in various ecosystems has been developed. This is done using specialized equipment such as bee traps, observation hives, or even citizen scientists who actively observe and record bee behaviour.

Bee watcher

Manja eStore

Manjha Pvt. Ltd., a start-up incubated under the TIH has developed **Manja eStore (TRL 9)**. It is an online platform that provides full stack solution for aquaculture sector on both input and output side. This platform offers a marketplace for fish/shrimp seed suppliers, centralized access to agricultural inputs, and utilizes IoT for water parameter tracking.

Manjha App

RAHI

R2E Technologies Pvt. Ltd., a women-founded tech-driven start-up has developed a patented technology **RAHI - Resilient Authorization Device for Human Identification & Tracking (TRL7)**, a real time hybrid tracking device having IoT and NAVIC enabled.

RAHI

Highlights : Human Resource Development

The SAMRIDHI Conclave

The SAMRIDHI Conclave was organised by the TIH with more than 110 partners from government, academia, venture community and international collaborators. The event featured start-up showcases, pitches, MoU signings, technology exhibitions, panel discussions, and attracted over 550 stakeholders.

SAMRIDHI Conclave Team

IIT Tirupati Navavishkar I-Hub Foundation, TIH at IIT Tirupati

Technology Vertical: Positioning and Precision Technologies

The Navavishkar I-Hub Foundation primarily focuses on Public Private Partnership (PPP) model to generate revenue. For technology development, the Hub is focusing on Developing atomic clocks for GPS and navigation systems and their applications; Developing solar-blind UV photodetectors for LIDAR; Indoor positioning systems; Data analysis and image processing techniques and visualization tools; Decision making systems. The activities of the hub are primarily aligned to the National Geospatial Policy.

Highlights : Technology Development

All-optical Trapped Ion Portable Atomic Clock for PNT Applications

Development of an **all-optical Trapped Ion Portable Atomic Clock for PNT Applications (TRL3)** is underway. This technology addresses the critical need for precise timekeeping in various applications, including GPS, telecommunications, and military uses. Unlike conventional clocks, this portable trapped ion clock relies upon atomic frequency standards, providing exceptional accuracy and hold over time, making it ideal for remote or GPS-denied areas. Its applications range from ensuring accurate deep space navigation to supporting PNT (Positioning, Navigation, and Timing) requirements.

Highlights : Human Resource Development

Atomic Clock/Quantum Navigation Stakeholders meeting

Atomic Clock/Quantum Navigation Stakeholders meeting was organized by the TIH to form a consortium of industry, academia and government agencies interested in partnering for joint activities on atomic clocks, inertial navigation sensors, quantum positioning and quantum navigational sensors. The meeting aimed to create a Center of Excellence (CoE) in Quantum Navigation under the aegis of the TIH IIT Tirupati.

Atomic Clock/Quantum Navigation Stakeholders Meeting

A workshop on Remote Sensing Image Analysis

A workshop on Remote Sensing Image Analysis was organized by the TIH with an aim to provide hands-on training to the scientists / researchers / academicians in utilizing the potential of hyperspectral data as a tool to aid detailed mapping for different mineral deposits. Around 34 participants were trained during the workshop

Remote Sensing Image Analysis - Workshop

I-DAPT-HUB Foundation, TIH at IIT (BHU) Varanasi

Technology Vertical: Data Analytics and Predictive technologies

I-DAPT Hub Foundation aims to use the interdisciplinary nature of data analytics and predictive technology to fulfil the modernization of socio-technical systems and services with disruptive innovations in Telecommunications, Power, Road Transport and Highways, Defence Research and Development, and Health and Family Welfare.

Highlights : Technology Development

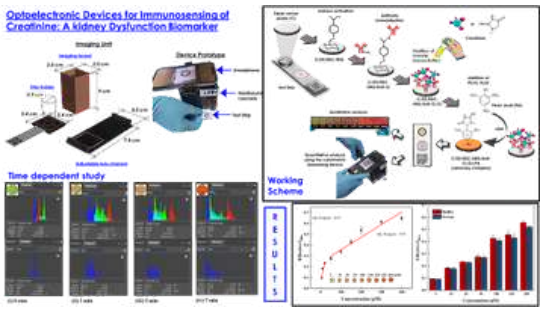
Prescribed-Time adaptive backstepping control

Prescribed-Time adaptive backstepping control of an uncertain nonlinear **2-DOF helicopter (TRL5)** has been developed under the TIH. The technology facilitates precise attitude tracking in a 2-DOF helicopter, even with uncertain parameters. Its prescribed-time adaptive backstepping control allows for predetermined settling times, ensuring stability and control

2-DOF Helicopter System

A paper-based optical sensing device

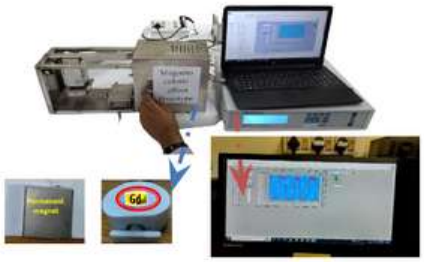
A **paper-based optical sensing device (TRL6)** for quantitative monitoring of creatinine in serum samples has been developed. The device has excellent selectivity toward creatinine in the presence of other proteins and ions. The sensor has a calculated selectivity of 94.8% and a recovery of 89.71-97.30% in spiked serum samples, proving its potential in medical diagnostics.



Paper-based optical sensing device

Magnetic Cooling

Magnetic Cooling (TRL4), a technology to measure the magnetic cooling capacity of a magnetic caloric materials for magnetic refrigeration is being developed under the TIH. The prototype measures the direct adiabatic temperature change in the magneto caloric materials under the 0.5 Tesla magnetic field. This technology would be helpful in reducing the carbon foot print of the conventional (gas based) air-conditioning systems.



Magnetic cooling system

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IISc Bangalore

IIT Bhilai

IIT Bombay

IIIT Delhi

TIH @ IIT Delhi

IIT ISM Dhanbad

TIH IIT Guhwati

IIIT Hyderabad

IIT Hyderabad

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