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

DEPARTMENT OF SCIENCE & TECHNOLOGY
Ministry of Science and Technology
Government of India

आज़ादी का अमृत महोत्सव

Mission:

Various CPS and its associated technology verticals have been considered under NM-ICPS which includes: Artificial Intelligence and Machine Learning, Technologies for Internet of Things & Internet of Everything, Data Banks & Data Services, Data Analysis, Robotics & Autonomous Systems, etc. The Mission aims at development of technology platforms to carry out R&D, Translation Research, Product Development, Start-ups and as well as Commercialization. NM-ICPS is a comprehensive Mission aimed at complete convergence with all stakeholders by establishing strong linkages between academia, industry, Government and International Organizations. The Mission working with all the concerned Ministries/ Departments to identify their technology needs, develop solutions and technical support. The Mission is implemented through 25 number of Technology Innovation Hubs (TIHs) already established as part of the Mission in the top academic and National R&D Institutes. Hubs will be the platform for executing all Mission activities.

Hubs architecture: Each is created as a Section-8 Company with industry as Members in co-development, partnerships and for commercialization. The Industry - Academic-Govt collaborations are the main focus of the Hubs.

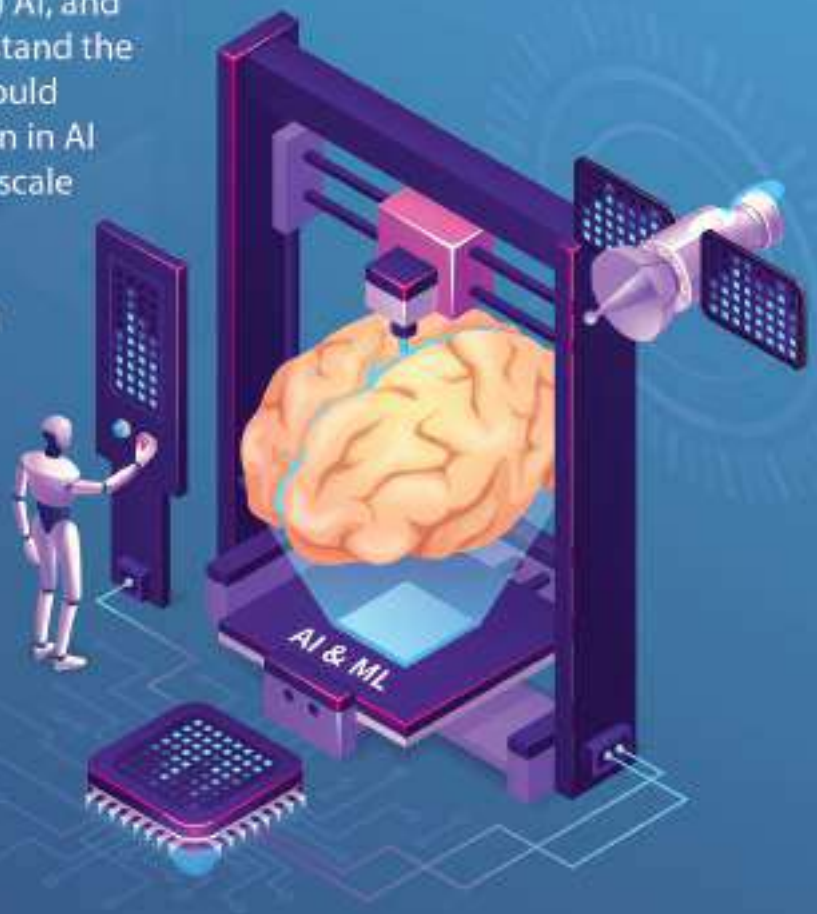
The list of 25 TIHs

S.NO	INNOVATION HUB	TECHNOLOGY VERTICAL
1	AI4ICPS I-Hub Foundation (TIH) at IIT Kharagpur	Artificial Intelligence and Machine Learning
2	TIH Foundation For IoT And IoE at IIT Bombay	Technologies for IoT & IoE
3	IIIT-H Data I-Hub Foundation at IIIT Hyderabad	Data Banks & Data Services, Data Analysis
4	I-HUB for Robotics & Autonomous Systems Innovation Foundation at IISc Bengaluru	Robotics and Autonomous Systems
5	IHUB NTIHAC Foundation at IIT Kanpur	Cyber Security and Cyber Security for Physical Infrastructure
6	IHUB Drishti Foundation at IIT Jodhpur	Computer Vision, AR & VR
7	Divyasampark IHUB Roorkee for Devices Materials and Technology Foundation at IIT Roorkee	Device Technology and Materials
8	IIT Patna Vishlesan I-hub Foundation at IIT Patna	Speech, Video & Text Analytics
9	IITM Pravartak Technologies Foundation at IIT Madras	Sensors, Networking, Actuator & controls
10	NMICPS Technology Innovation Hub on Autonomous Navigation Foundation (TiHAN) at IIT Hyderabad	Autonomous Navigation & Data Acquisition systems
11	I-DAPT-HUB Foundation at IIT (BHU) Varanasi	Data Analytics & Predictive Technologies
12	IIT Guwahati Technology Innovation and Development Foundation at IIT Guwahati	Technologies for Under water exploration

S.NO	INNOVATION HUB	TECHNOLOGY VERTICAL
13	IIT Mandi IHub and HCI Foundation at IIT Mandi	Human Computer Interaction
14	I-Hub Foundation for Cobotics (IHFC) at IIT Delhi	Cobotics
15	IIT Ropar Technology & Innovation Foundation at IIT Ropar	Technologies for Agriculture & Water
16	Technology Innovation in Exploration & Mining Foundation at IIT(ISM) Dhanbad	Technologies for Mining
17	IIT Palakkad Technology Ihub Foundation at IIT Palakkad	Intelligent Collaborative Systems
18	IIITB Comet Foundation at IIIT Bangalore	Advanced Communication System
19	BITS BioCYTiH Foundation at Birla Institute of Technology & Science, Pilani	Bio-CPS
20	IDEAS- Institute of Data Engineering, Analytics and Science Foundation at Indian Statistical Institute, Kolkata	Data Science, Big Data Analytics & Data curation etc.
21	IITI Drishti CPS Foundation at IIT Indore	System Simulation, Modeling & Visualization
22	IHUB Anubhuti-IIITD Foundation at IIIT Delhi	Cognitive Computing and Social Sensing
23	I-Hub Quantum Technology Foundation at IISER Pune	Quantum Technologies
24	IIT Tirupati Navavishkar I-Hub Foundation at IIT Tirupati	Positioning & Precision Technologies
25	IIT Bhilai Innovation & Technology Foundation at IIT Bhilai	Technologies for financial sector (Fintech)

AI4ICPS I-Hub Foundation, IIT Kharagpur is set up in the technology vertical of Artificial Intelligence (AI) and Machine Learning (ML).

AI4ICPS aims to create a multidimensional ecosystem to foster innovations of AI and ML interventions to Interdisciplinary Cyber-Physical Systems (ICPS) spanning across several industry sectors. The ambition is to become the world's center for innovation in fairness, accountable, transparent and explainable (FATE) AI, and its application to interact & understand the complex world of CPS. The Hub would facilitate and accelerate innovation in AI technology and services, for large scale solution development and deployment, to solve India's societal challenges, by developing cloud and edge compute optimized software & hardware architectures, live testbeds and digital twins of CPS, standards for AI, safety and robustness assessment mechanisms, and open source library of tools and techniques.



The major application areas include industry sectors of

- healthcare,
- energy infrastructure, where cloud accessible AI can enable implementation of public health observatory, real-time transactional energy management system, amongst others. The AI interventions would also be extended to industry sectors on
- precision agriculture and nutritional security,
- manufacturing,
- transportation,
- environment and pollution,
- education,
- judiciary and legal,
- communication.

TIH Foundation For IoT And IoE, IIT Bombay is set up in the technology Vertical-Technologies for Internet of Things (IoT) & Internet of Everything (IoE).

The aim is to develop an eco-system for channelizing commercialization and to develop novel technologies for stationary and self-driven IoT and IoE spanning the cyber and physical systems. It will develop technologies for devices ranging from ultra-low power to high power, various communication ranges and target various climatic conditions. The TIH-IoT would act as a premier hub for disruptive yet practical ideas on IoT for system-level implementation, prototype development, tested and handed over to capable partners for commercialization and deployment in various industries. A typical portfolio of these industries would include agriculture, aquatic, automobiles, defence, healthcare, nuclear, process, smart cities, smart energy, space, structures and telecommunication applications. The intellectual focus of the TIH-IoT is System of Interconnected Systems (SIS) with the aim of providing end-to-end solutions using networked devices for a defined objective. The SIS is a step towards Industry 4.0 revolution where existing and new devices are interconnected to support digitization of industries by incorporating IoT standards and making them smart industries. The focus of TIH-IoT would be on development of highly knowledgeable human resource, building a vibrant start-up ecosystem, establishing a symbiotic network of academia, financial institutes, industries and other institutions, including international organizations. This will help the country to become a pioneer in technology led economic growth and prepare India to be the world leader in the technology arena. TIH-IoT would strive to emerge as a polestar in IoT and IoE technology area through creation of self-sustaining innovation continuum by fostering translational research for technology development.

I-Hub Foundation, IIIT Hyderabad is set up in the technology vertical- Data Banks & Data Services, Data Analysis.

The Hub is working to coordinate, integrate, and amplify basic and applied research in broad Data-Driven Technologies as well as its dissemination and translation across the country. Collecting, collating, and distributing useful data from multiple domains for use by the national and global community will be a significant effort at our Hub. One of our primary aims is to prepare a critical resource for the future use by researchers, startups, and industry. Two major domains, smart mobility and healthcare along with smart buildings, systems and India specific research initiatives have been as our major focus. Initiatives have begun in areas where development and implementation of data-driven technologies are perceived to bring about a marked transformation. The TIH aims to be a global leader in research outcomes that also impacts our society with the technologies that are translated to local industries and governmental agencies. It would play a central role in development and penetration of data-driven technologies by taking a proactive strategy in curating and creating data banks and data services. We aspire to catalyze, nurture, and enable the growth of an ecosystem with researchers, technologists, practitioners and entrepreneurs in the area of data-driven solutions to the local problems and is in the process of setting up the necessary infrastructure/ equipment to manage the data storing, annotation and access processes.

I-Hub For Robotics & Autonomous Systems Innovation Foundation, IISc Bangalore is set up in technology vertical- Robotics and Autonomous Systems.

The primary goal of this TIH will be to provide a platform to translate innovative technology research into Proof of Concept, Productization and finally Commercial Application. The hub will also build an ecosystem of venture studios, Venture Funds and other capital providers so that these technologies can be spun off as companies after achieving TRL 5-6 stage.

The ARTPARK also aims to develop a pool of skilled global level manpower who have not only theoretical knowledge but also practical skills in the area of AI, Robotics and Autonomous Systems. National and International collaborations with reputed Academic Institutes and Private Companies will be an important goal for ARTPARK as the objective is to produce technology which meets the objectives of social good and/ or commercial applicability on a global scale. The overarching remit of the ARTPARK is to work in the area of AI, Robotics and Autonomous Systems. This has wide applicability in many different fields including Mobility, Drones, Urban Transportation, Agricultural, Healthcare, Education, Water Sufficiency, Energy Footprint, Supply Chain Optimization, Smart Cities, Manufacturing, Governance etc.

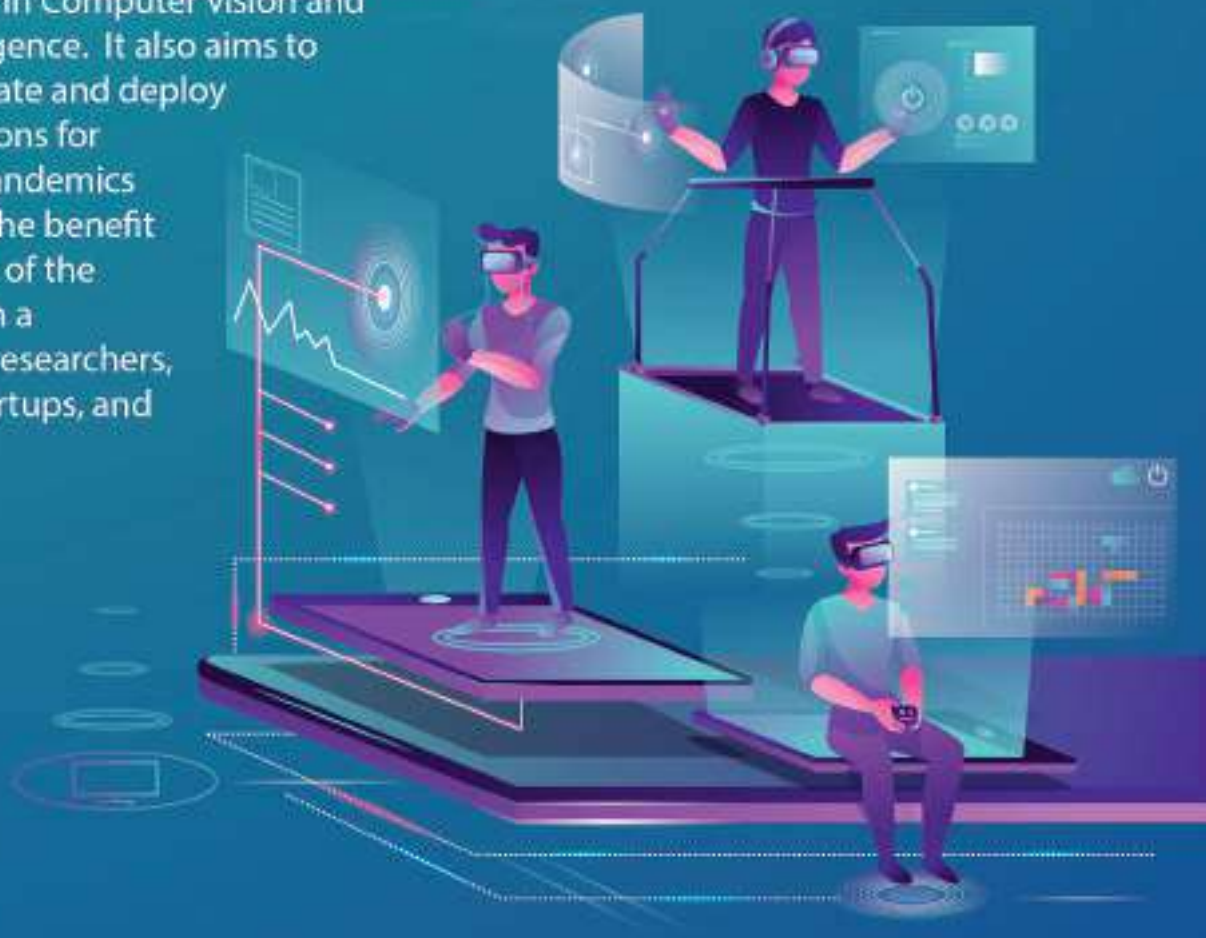
I-Hub NTIHAC Foundation, IIT Kanpur is set up in technology vertical- Cyber Security & Cyber Security for Physical Infrastructure.

The Hub aims to address the issue of cyber security of cyber physical systems in its entirety. From analyzing security vulnerabilities and developing tools to address them at various levels of system architecture, to translating these tools to deployment-ready software, to nucleating start-ups developing these tools at scale, to partnering with industries in this domain and co-development and transfer of these technologies, to training the next generation of cyber security researchers and professionals. In the short term, the work being done in the center on security vulnerabilities of critical infrastructure will be expanded to include automotive and UAV sectors. Also, a masters program in cyber security, eMasters in Cyber Security as well as multiple professional certification courses in cyber security will be launched at IIT Kanpur. In the long term, hardware testing lab will be created to test presence of Trojans and side channels in imported hardware, courses on various aspects of cyber security will be developed on online platform and wide range of awareness and executive training programs will be launched along with faculty and student training programs.

DRISTI Foundation, IIT Jodhpur is set up in technology vertical- Computer Vision (CV), Augmented and virtual reality (AR&VR).

The TIH will: (i) focus on advancing the research outcomes in core problems related to CV and, ARVR, (ii) augment imaging with additional (multimodal) sources of input such as haptics, language, and IoT to advance state-of-the-art in the domain areas, (iii) create technology solutions for socially relevant and industry-facing problems, (iv) support and nurture start-up ecosystems, (v) stimulate skilling and reskilling educational programs, and (vi) to advise governments for appropriate policy-related matters in the domain of CV and AR-VR.

The proposed TIH will also focus on the core research areas of (i) Seeing and Sensing, (ii) Dependability, (iii) Real-time Computer Vision Systems, and (iv) Data Collection, Curation and Annotation for developing technologies in the applications areas: 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. TIH aims at providing elements of technology that give autonomy, for example, better sensors, improved processing, cost efficient inertial measurement units, and miniaturization driven by a revolution in Computer vision and Artificial Intelligence. It also aims to Develop, translate and deploy AI-based solutions for dealing with pandemics like COVID for the benefit of all segments of the society through a consortium of researchers, developers, startups, and industry.



Divyasampark I-Hub Device Material and Technology, IIT Roorkee is set up in technology Vertical- Device Technology and Materials.

The hub will foster research and innovation towards product development and commercialization of technologies with the special focus on three verticals namely Smart City, Industry 4.0 and digital health. The hub focuses on growth and development of Technology by merging the cyber physical Systems with Devices and Materials to come up with smart devices and systems needed for making our Smart cities more sustainable, MSMEs globally competitive and healthcare accessible and affordable for every Indian. To realize these goals, Hub is also working on an ambitious project of bringing all the stakeholders like researchers, students, startup, venture capital funds, industries and policy makers on a single social media like platform for the easy exchange of ideas and support. Few representative projects that hub is taking in the initial phase are smart helmets for army and civilian use, AI/ML powered Smart traffic light systems, Touchless patient registration system for hospitals for the pandemic like situation, Low-cost robots for MSMEs and digital twins for the large-scale training of the technical manpower.

Vishlesan I-Hub Foundation, IIT Patna is set up in technology vertical- Speech, Video & Text Analytics.

It has wide-spread activities ranging from the fundamental basic research, to translational research and development of cutting-edge technologies for creating solutions to serve the technological requirements in the areas of "Speech, Video and Text Analytics" for societal applications such as health, judiciary, education, national security, environment etc.; creating products for commercial use, nurture startups and increase the job market. Some of the important applications to be developed include multilingual translation, chatbot, summarization system, misinformation detection system, edge computing-based health care platform, embedded with heterogeneous swarm systems for real time video analytics etc. Some of the important problems identified include the technology and product development for smart health care, swarm robotics for security, multilingual machine translation, summarization, misinformation detection, chatbot development, sentiment analysis, human activity recognition etc.

IITM Pravartak Technologies Foundation, IIT Madras is set up in technology Vertical - Sensors, Networking, Actuators & Control System. SNACS powered IOT & IOE, are significant components of a Cyber Physical Systems (CPS).

The TIH aims at solving both fundamental problems in SNACS for IOT/IOE and develop enabling technologies for systems and applications. This involves multidisciplinary interventions starting from sensor manufacturing, sensor testing and characterization, sensor interfacing with control systems, establishing command and control through actuators, networking the sensor to aggregators and secure data transmission to the cloud and decision support systems at the cloud level. It aims to build a plug-and-play system development stack that could seamlessly integrate sensors, communication modes and cloud based interfaces to quickly realize a large scale sensor driven system. The two major application areas wherein we would deploy the above stack into building large scale end-to-end systems include Precision Agriculture and Digital Health. As a grand challenge the Hub is planning to develop the Bharat RASA (Regenerative Agriculture Stack Architecture) with an objective to double farmers income through Technology enabled Natural Farming methods.

I-Hub on Autonomous Navigation Foundation (TiHAN), IIT Hyderabad is set up in technology Vertical- Autonomous Navigation & Data Acquisition systems(UAV, RoV etc...)

This hub primarily focuses on technology development for next generation navigation, addressing the challenges hindering the real-time adoption of CPS technology for autonomous navigation, that include multi-sensory perception, quality data acquisition, payload, stability, AI/ML framework, Edge-computing architecture, communication and networking framework, security, swarms, standard operating procedures (SOPs), regulations and policy recommendations. TIH aims at development of standardized architectures for autonomous Unmanned Ground Vehicles, autonomous Unmanned Aerial Vehicles, autonomous Unmanned Surface Vehicles for various applications like Mobility, Agriculture, Surveillance, Infrastructure, Environmental monitoring. A living lab/Testbed on Autonomous Navigation (Ground/Aerial) is being established as part of this Technology Innovation Hub at IITH campus, which is envisaged as a platform for collaborative research between academia, R&D Labs and industry, for safe, sustainable and next generation mobility solutions, both national and international

I-DAPT-Hub Foundation, IIT BHU is set up in technology vertical- Data Analytics & Predictive Technologies.

The DAPT aims to address issues related to power management in the Smart Cities Mission, Transportation, Healthcare, Intelligent Communication System, and Defence infrastructure of the Government of India. It aims to Develop Industry 4.0 compliant software and hardware protocol, develop nationally scalable critical technology solutions based on testbeds for the society and industry viz. City Verticals: Smart Energy & Power, Intelligent Transportation & surveillance, Ubiquitous Healthcare Systems, Intelligent Networks, Communication Systems & Defence Systems. Development of DAPT based environment and user-friendly smart grid infrastructure for optimal power/energy flow and enable India to be a leading resource country in affordable Brain/Mind Health delivery utilizing cyber-physical technology and digital processing are some of the important objectives of I-DAPT Hub Foundation. In addition, it aims at solving societal problems of water, environment and waste management and beyond, for societal and commercial use, nurture start-ups and increase in the job market, produce skilled man power for advanced technology development and deployment of DAPT enabled Intelligent CPS and Smart IoTs.

Technology Innovation & Development Foundation, IIT Guwahati is set up in technology vertical Technologies for Under water exploration.

The Hub proposes projects on the development of underwater robots, which may be used for underwater tracking, surveillance and monitoring purposes. Monitoring of cracks in ship hulls, in industrial pipes and so on is another application area of this project. the Hub deals with the development of an apparatus for underwater operations like cleaning, cutting, etc. at a cost lower than that available today.

Broad areas of applications are
(i) Defence Research and Development
(ii) Earth Science
(iii) Health research
(iv) New and Renewable energy
(v) Tourism
(vi) Shipping
(vii) Skill development & Entrepreneurship

In all these research areas the cyber physical systems will play a major role. Some of them includes (i) under water computer vision system, (ii) wired and wireless communication, (iii) artificial intelligence, (iv) Internet of Things, (v) development of various types of robotic systems for under water exploration. Also, a centre of excellence will be established which will contain 9 laboratories viz., (i) Underwater Natural Resources Laboratory (ii) Product Development Laboratory, (iii) Reverse Engineering Laboratory (iv) Fabrication Laboratory (v) Virtual & Augmented Reality Laboratory (vi) E-Mobility Laboratory (vii) Internet of Things Laboratory (viii) Product Testing Laboratory and (ix) Sensor & Actuator Fabrication Laboratory. The primary focus of this CoE will be on providing the manufacturing facility of different products useful for a CPS.

Mandi I-Hub And HCI Foundation, IIT Mandi is set up in technology vertical Human Computer Interaction. The I-Hub would like to lead research in two high-impact areas concerning multisensory perception

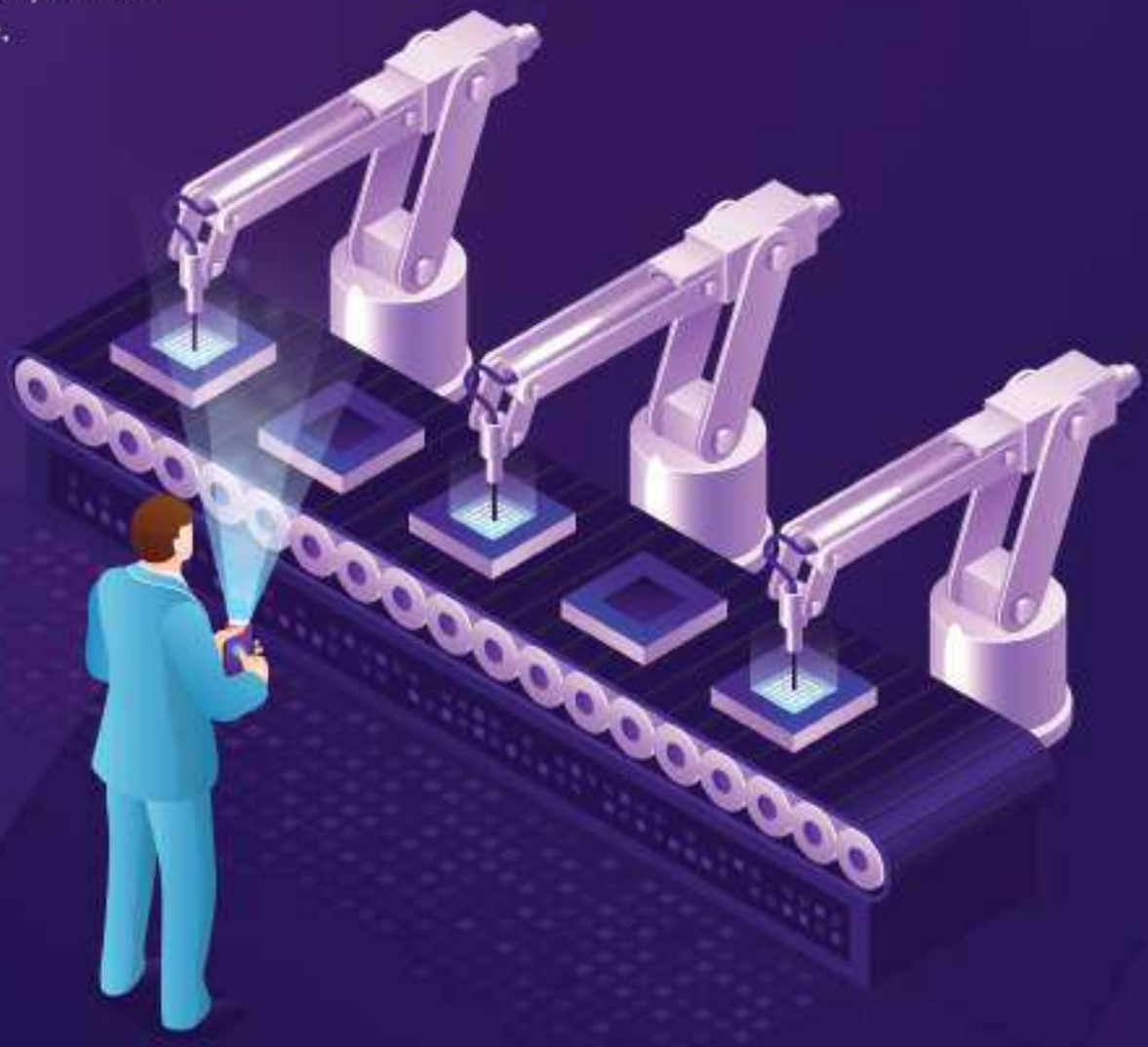
(i.e., integration of a multiple human senses in an interface) as well as technologies and environments concerning brain computer interfaces (BCIs).

Furthermore, the iHub intends to address HCI issues and design effective interfaces to solve problems in application domains' specifically concerning environment (like landslide prediction, air pollution monitoring, and agricultural advisories for different crops) and healthcare (CAD for digital pathology, neuroradiology, and body-area networks). The iHub will focus on creating low-cost mobile-based applications and robust IoT systems to monitor crop health for development and evaluation to disseminate agricultural advisories for different crops, diseases, and economic variables to rural farmers. This would create a farmer- friendly interface, and it would help to enhance the crop management practices. Also, low-cost sensors for visualization of satellite and field-based data for regular or continuous landslide monitoring and the associated machine learning algorithms will help to detect triggering of landslides at an early stage. Furthermore, it would set up modern air-quality sensing systems and warning systems. These systems would monitor air-quality and send cautions and warnings to the people of an area where the pollution levels breach pre-defined thresholds. The iHub also plans to introduce body area network technologies, which will provide useful healthcare monitoring of vital body parameters such as EEG, ECG, EMG, blood pressure, glucose level etc. Collaborations of iHub are emerging with leading international companies like Unity 3D, Denmark; International Technology Research Agency, Japan; Oppo, Global; & WileyNXT in research and skill development areas.

I-Hub Foundation for Cobotics, IIT Delhi is set up in technology vertical-Cobotics.

TIH aims to carry out research in Human-Robot Collaboration for Enhancing Human Capabilities, Reducing Risk and Improving Productivity.

The TIH is tasked with the commercialization of the developed technology into products for application into various target sectors like:
Medical Robotics: Tele operated minimally invasive surgical system (wheeled mobile robots and mounted surgical manipulator),
Agriculture/Disaster Management: UAV application for minefield research, collaborative mobile robotic manipulator for agricultural assistance,
Defence: Robotic teammates (legged like humanoid or wheeled etc.) for reconnaissance, Exoskeleton/wearable robotic augmentation device for soldier support.
Factories/MSMEs: Collaborative mobile robots for material transport, Exoskeleton / wearable for augmentation of factory workers, flexible assembly line.



Technology & Innovation Foundation, IIT Ropar is set up in technology vertical- Technologies for Agriculture & Water (AWaDH).

The main aim of TIH - AWaDH is to provide technical support towards the "environmentally sustainable and profitable agriculture, quality food for all, and the preservation of biodiversity. The prime objective of AWaDH is to improve the overall ecosystem of agriculture in line with the developed countries by deploying CPS Technologies.

Some of the priority areas of the hub are a.water/industry discharge assessment, treatment, and management, b.advancement of rural and urban land resources, c.agriculture automation and precision farming, d.harvesting and post-harvesting crop residues management, e.mapping and remediation of hazardous substances in the soil and water, and f.the application of the Internet of Things (IoT) systems in the domain of Agriculture & Water.

The technology developed at AWaDH will be deployed in (i) Food Processing Industries, (ii) Rural Development, (iii) Fisheries, (iv) Skill Development & Entrepreneurship, (v) Textiles industry for discharge management, (vi) Electronics and IT Industry for the development of IoT devices, (vii) Fertilizer industry for the optimized combinations of nutrients, (viii) Food and Public Distribution, (ix) Atomic Energy, (x) NITI Aayog for implementing different government schemes, & (xi) implementation of correct farming practices in terms of preparation of farmland, pre/post-harvesting, delivery of the agricultural commodities to the consumers, preservation, and storage without affecting the environment. Some of the technologies that are already developed at AWaDH are:

(i) Nano-bubble technology/oxygen generators for water treatment for remediation of rural domestic and industrial wastewater, (ii) CPS enabled stubble management machine, (iii) CPS for the water quality assessment, and (iv) cold-chain management device – AmbiTag for safer transportation of perishable items, such as; vaccines / blood / plasma / body organs and agriculture commodities. These technologies are being tested in the actual settings and are giving highly motivating results.

Technology Innovation in Exploration And Mining Foundation, IIT (ISM) Dhanbad is set up in technology vertical Technologies for Mining.

It aims at
(a) Developing modern and sophisticated exploration methods/ integrated techniques (Geophysical, Geological & Remote Sensing) for
(i) Identifying new and potentially viable areas to mine by locating deep concealed deposits and minimizing exploration drilling, and
(ii) Lower the cost of mineral exploration through pattern matching, predictive analytics, and computer vision systems.

(b) Achieving 3S Mining (Safe, Smart, and Sustainable Mining leading to Mining 4.0) through operation & process optimization across the mining value chain by developing CPS based technologies for
(i) Surveillance and evacuation system for underground mine safety
(ii) Low-cost integrated monitoring systems to predict and prevent accidents / disasters,
(iii) Decision Support Systems for significant improvements in equipment productivity and reduced maintenance costs. Minerals, metals and their products accounted for 25% of total Indian imports, second only to petroleum and its products. Overall, TexMin is aimed at improving resource discovery, mine productivity & safety, and thereby minimize environmental impacts including bridging the demand-supply gap by innovation and adoption of frontier technologies.

Technology Ihub Foundation, IIT Palakkad is set up in technology vertical- Intelligent Collaborative Systems.

Intelligent collaborative systems (ICS) is an amalgamation of robotics, control, machine learning, networks, embedded systems, computer vision &fundamental theoretical models. This unique mix of diverse technologies allows one to address problems in a variety of application areas. The Technology Innovation Hub (TIH) in ICS at IIT Palakkad will address problems in Agriculture, Healthcare, Transportation, Surveillance, Exploration and Communication systems. A section 8 company IIT Palakkad Technology I-Hub Foundation (IPTIF) has been established to carry forward the TIH-ICS activities. Through technology, fellowships, & entrepreneurship targets, IPTIF will upskill students, engineers, and researchers, create job opportunities, develop products and technologies, and generate revenue for further sustainability of the TIH-ICS. All targets would be addressed on equal footing ensuring global standards. A business incubator Technology Innovation Foundation IIT Palakkad (TECHIN) has been established at IIT Palakkad to drive entrepreneurship and startups in the local ecosystem, and will help IPTIF realize its entrepreneurial goals. In alignment with the Startup-India, Make-in-India, Design-in-India, and Atma Nirbhar Bharat ideologies, that are encouraged by the Indian government, TIH-ICS at IIT Palakkad would enable more jobs, improve self-reliance of businesses in our country, enable India to reduce dependence on foreign monopolies, and place India as a global technology leader and enabler.

Comet Foundation - IIIT Bangalore is set up in technology vertical- Advanced Communication Systems.

The hub focuses on enabling the design and development of fundamental technology building blocks of 5G–advanced (5G+) & 6G systems and networks. The prime focus will be on intellectual property (IP) generation that includes product IP for commercial usage and development of patents (IPR) that will not only enable product-oriented innovation but also target adoption into the upcoming 5G advanced and 6G standards. It will also focus on other advanced communication systems R&D which has commercial potential including Smart Radio Environments (SREs), which will provide us with an alternative way to look at the wireless communications by allowing us to view the channel as a control variable, which can be optimized for performance objectives for a given pair of transceivers or more.

BITS BioCYTiH Foundation, BITS Pilani is set up in technology vertical Bio-CPS.

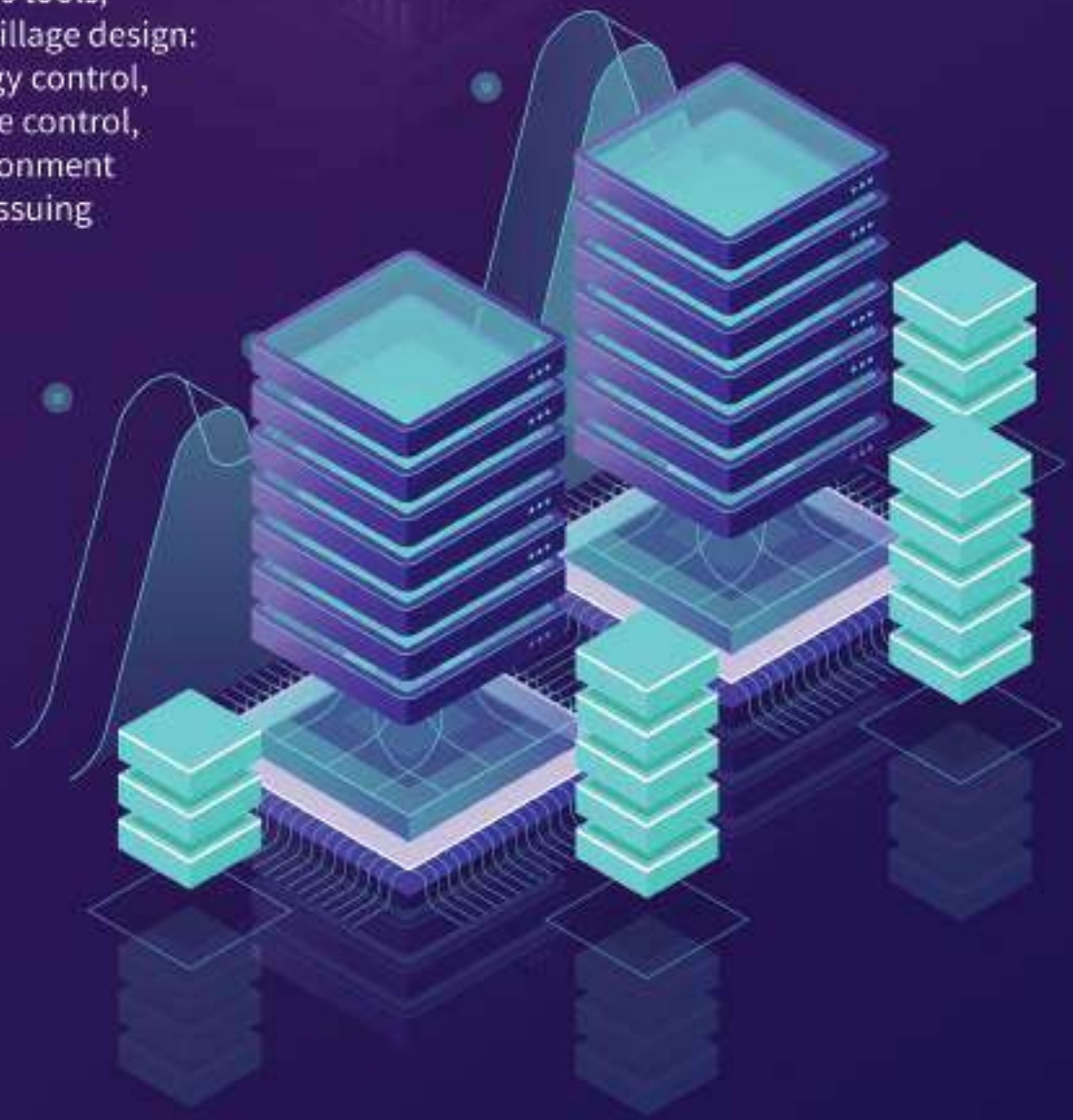
The Hub shall be translating academic R&D into technologies for the industries such as healthcare, diagnostics, medical devices, wearables, biosensors, clean water, food safety and quality and other allied areas. The hub will also undertake development of cutting edge micro and nano bio-sensing technology platforms integrated with IoT and AI. High-throughput and miniaturized micro/nano devices and microfluidics biosensor for early detection of pathogens in water, milk and various crops. Large scale deployment of technologies in healthcare and agri sectors to improve public health and to enhance farmer's income by minimizing post-harvest losses. The hub will form cross-functional and interdisciplinary teams in Bio-CPS domain bringing together experts from academia, industry, MSME, startup and entrepreneurs. There will be emphasis on integrating the devices with IOT based approaches. We focus on newly designed devices to quickly detect infectious diseases like Malaria, Tuberculosis, gut microbes which are of national importance. We would also like to make cheaper and affordable detection system for Covid and other viruses. A group of experts at BITS will also work on cancer detection and therapeutics. Considering a large number of accidental deaths by snake bites in North-East and other rural parts of India, we would like to give a newer detection system for specific snake bite and respective anti venom therapeutics.

IDEAS – Institute of Data Engineering, Analytics & Science Foundation, ISI Kolkata is set up in technology vertical Data Science, Big Data Analytics and Data curation.

It aims to create techniques and strategies to process huge data produced by CPS that are unstructured, decentralized and non-stationary. In turn, these techniques can be used to establish large-scale, self-sustaining CPS framework.

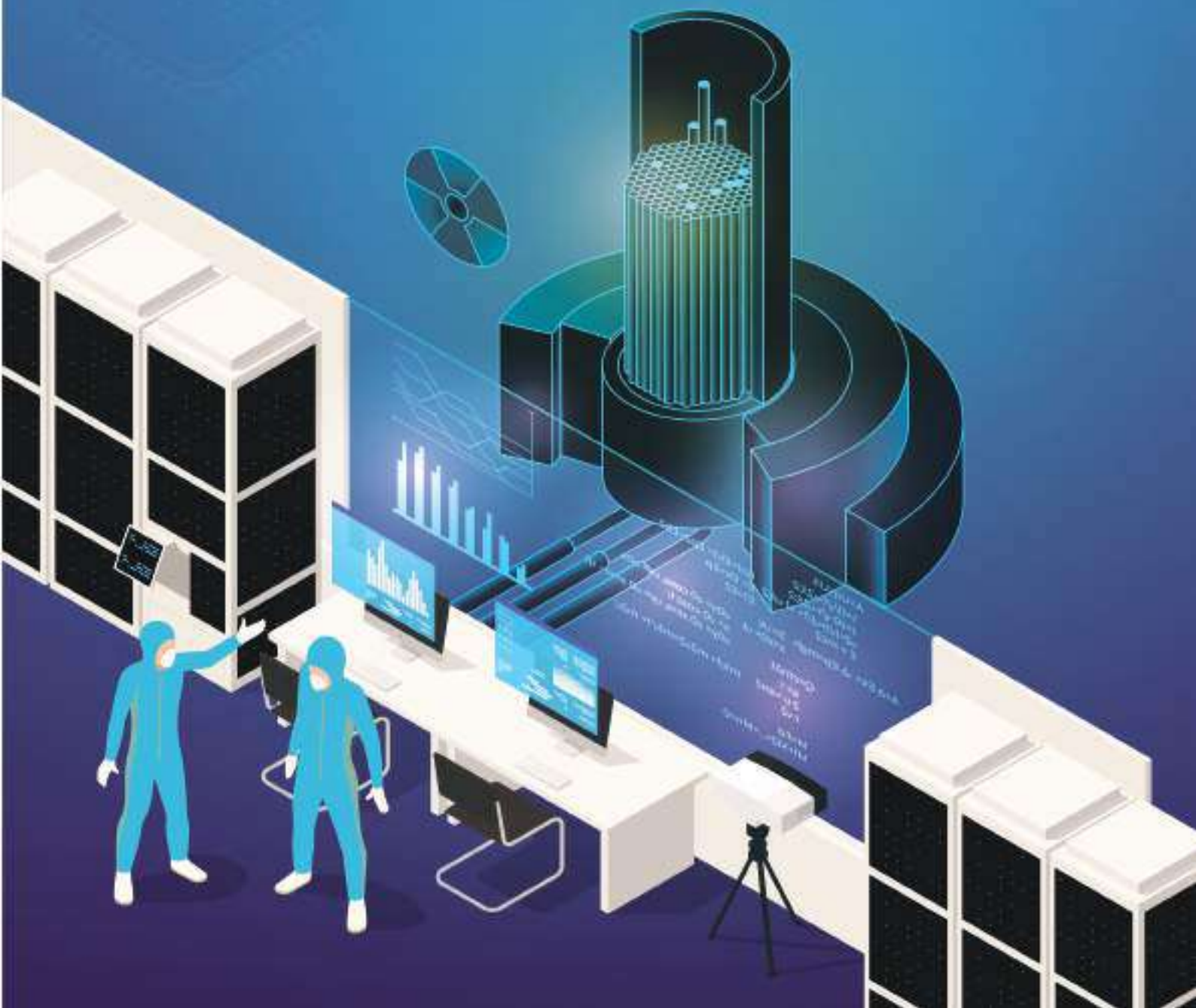
The main developmental contribution (scalable distributed machine learning models) would include

- Smart agriculture: Crop disease detection, irrigation etc.
- Smart camera based surveillance systems: Camera based detectors for fire, vehicles etc., Camera based surveillance systems for elderly people, banks,
- Smart transportation systems: Affordable traffic regulation and monitoring,
- Smart medical diagnostic, and non-invasive therapeutic schemes: Computer aided medical diagnosis tools,
- Smart city and village design: Automated energy control, Automatic vehicle control, Automated environment monitoring and issuing alarms



Drishti CPS Foundation, IIT Indore is set up in technology vertical System Simulation, Modelling & Visualization.

It aims to use CPS based adaptive control as an effective management strategy that employs detailed, site-specific information to precisely manage the inputs to different components in a multifunctional system ranging from agriculture, energy, prognostics and health management (PHM), industrial manufacturing,environmental etc. to data routing in high-performance computing and data centres. Within the advent of Information and Communication Technology (ICT), the realization of simulation-based tools is crucial to enable a sustainable manufacturing and facilitate montary gains. Implementation of simulation-based digital tools can support both factory management and design of a production system.



I-Hub Anubhuti-IIITD Foundation, IIIT Delhi is set up in technology Vertical- Cognitive Computing & Social Sensing.

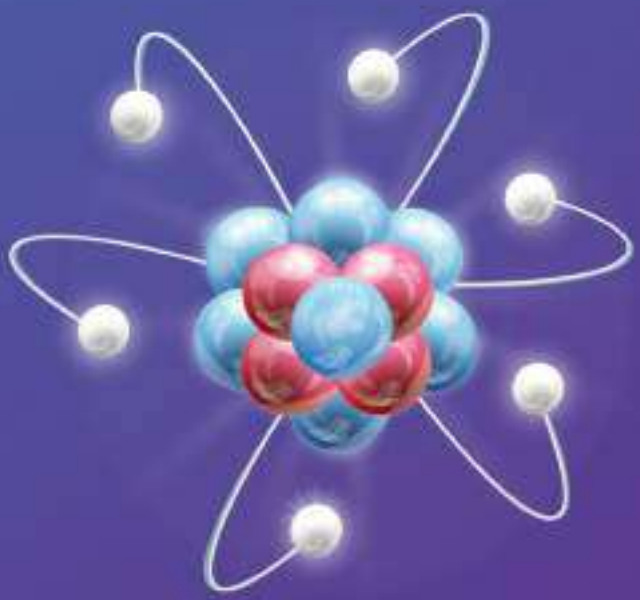
The objective is to establish itself as a Hub of Research, Entrepreneurship, and Innovation in the area of Cognitive Computing & Social Sensing. TIH aims at focusing on CPS based technologies to develop Cognitive Computing & Social Sensing Systems and different applications to solve society's most vexing problems.

The major application verticals are
(a) Legal Information Processing & Management
(b) Challenges in Public Health and
(c) Prediction of Mortality and Diagnostic tools for patients suffering from cancer and liver failure.

It aims to support teams for developing channels and pipelines for data and provide them a common platform to store and host the data so that it can be used by different researchers and industry for diagnosis and prognosis of diseases. It also plans to build a nationwide shared and distributed Cognitive Computing & Social Sensing facility for public research and commercialization. Focus will also be on Skill development and nurturing start-ups through various entrepreneurship programs.

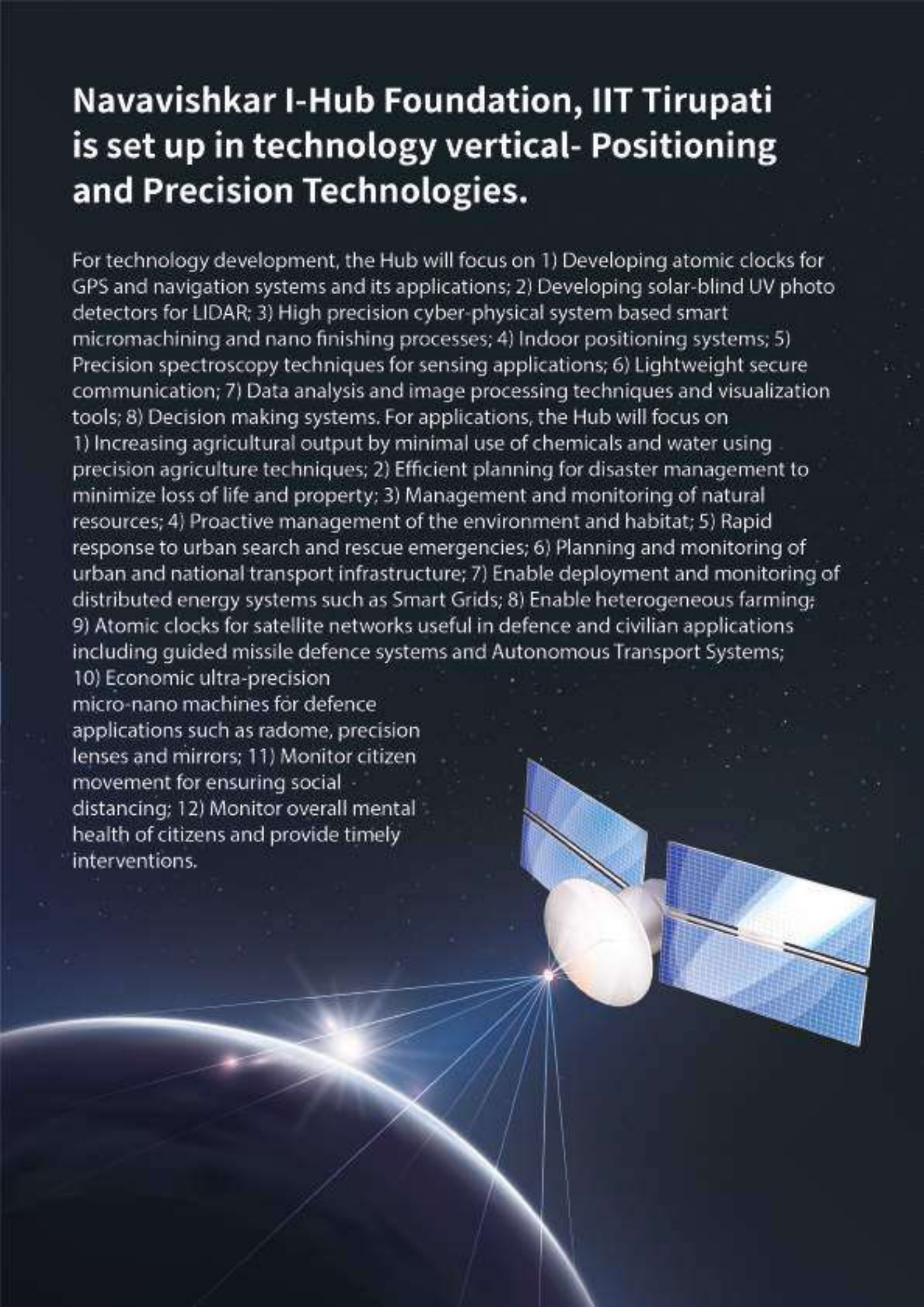
I-Hub Quantum Technology Foundation, IISER Pune is set up in technology vertical-Quantum Technologies.

It aims to develop quantum computers and simulators for applications in Defense, healthcare and financial sectors, Building long distance quantum communication channels, Commercialization of quantum effect enhanced sensors and atomic clocks with unprecedented accuracy and stability. The Hub will demonstrate and deliver several products for operational testing by the partner industries and several national organisations involved in Communications, defense, space and aerospace. In particular, in the initial stages, the Hub is planning to deliver a 20 qubit quantum computer that can be deployed for small scale problems and more importantly it will serve as a stepping stone to begin work on creating bigger quantum computers in India. This will be made available in the public domain through a web interface. Another set of deliverable will be quantum communications over optical fiber over 5 kms, a feat not yet achieved in India. This will provide a first step towards secure communications over commonly used mode for high speed and high bandwidth communications, namely, the optical fiber. Precise measurements of magnetic fields have many civil and defense applications. Some of these can be made portable by incorporating them in integrated chips. The Hub will attempt to deliver quantum technology based sensitive and portable magnetometers for civil and defense applications. The Hub also plans to deliver a gravimeter (device for measuring local gravitational acceleration, typically on the surface of the earth) that is widely used in prospecting underground natural resources (minerals and water) and mapping seismic zones. Another related but distinct deliverable would be an inertial sensor, a device to measure inertial rotations and hence measure acceleration, rotation and other dynamical characteristics of a moving object. These inertial sensors have direct applications in defense and deep space navigation and in day to day consumer systems. The Hub will also build the state of the art atomic clocks for communication and accurate navigation. While these would constitute some of the flagship deliverables at the level of proof of concept, the Hub will also strengthen efforts towards making other quantum technology based product available to the industries.



Navavishkar I-Hub Foundation, IIT Tirupati is set up in technology vertical- Positioning and Precision Technologies.

For technology development, the Hub will focus on 1) Developing atomic clocks for GPS and navigation systems and its applications; 2) Developing solar-blind UV photo detectors for LIDAR; 3) High precision cyber-physical system based smart micromachining and nano finishing processes; 4) Indoor positioning systems; 5) Precision spectroscopy techniques for sensing applications; 6) Lightweight secure communication; 7) Data analysis and image processing techniques and visualization tools; 8) Decision making systems. For applications, the Hub will focus on 1) Increasing agricultural output by minimal use of chemicals and water using precision agriculture techniques; 2) Efficient planning for disaster management to minimize loss of life and property; 3) Management and monitoring of natural resources; 4) Proactive management of the environment and habitat; 5) Rapid response to urban search and rescue emergencies; 6) Planning and monitoring of urban and national transport infrastructure; 7) Enable deployment and monitoring of distributed energy systems such as Smart Grids; 8) Enable heterogeneous farming; 9) Atomic clocks for satellite networks useful in defence and civilian applications including guided missile defence systems and Autonomous Transport Systems; 10) Economic ultra-precision micro-nano machines for defence applications such as radome, precision lenses and mirrors; 11) Monitor citizen movement for ensuring social distancing; 12) Monitor overall mental health of citizens and provide timely interventions.



Innovation & Technology Foundation, IIT Bhilai is set up in technology vertical Technologies for financial sector (Fintech).

The financial technologies and tools are now a days undergoing a sea change at both micro and macro level, keeping pace with the enormous advancements happening in the domain of IT, facilitating easy access to Internet and mobile platforms. These changes are, to a great extent, impacting all forms of trading and financial activities, and are demonstrating great promise to benefit both the government and industrial stakeholders, as well as the retail sector merchants and consumers, in their day-to-day business transactions. IBITF focusses on Fintech solutions in four major verticals, namely, e-Payment systems, Blockchain Technology, Artificial Intelligence and Internet of Things.

The aims of IBITF, IIT Bhilai are as follows.

- Cutting-edge research and development in financial technologies
- Scouting for young professionals and students with entrepreneurial skills, and nurturing them
- Capability and capacity building using HRD and skill development at various levels
- Contribution towards India occupying the leadership position in the financial technology revolution
- Building a sustainable ecosystem with national and international collaboration

Several companies and GoI organizations namely, C-DAC, UIADI, GSTN, NPCI, Tektronix, Infineon Technologies, ARM etc. have given their consent for collaboration with IBITF and help the entrepreneurs, start-ups etc., in terms of mentorship, commercialization & productization of ideas etc.

DEPARTMENT OF
SCIENCE & TECHNOLOGY
Ministry of Science and Technology
Government of India

आज़ादी का
अमृत महोत्सव

25 TECHNOLOGY INNOVATION HUBs ACROSS THE COUNTRY

https://dst.gov.in/