

# **IITM PRAVARTAK TECHNOLOGIES FOUNDATION**

#### A SECTION 08 COMPANY FUNDED BY DEPARTMENT OF SCIENCE AND TECHNOLOGY, GOVT. OF INDIA UNDER NATIONAL MISSION ON INTERDISCIPLINARY CYBER PHYSICAL SYSTEMS

FOCUS ON SENSORS, NETWORKING, ACTUATORS, CONTROL SYSTEMS (SNACS) HTTPS://WWW.PRAVARTAK.ORG.IN/

### **IITM PRAVARTAK VISION**



World-wide – Industry 4.0 dominates Research and Product Development in SNACS domain

- 1. Medical-Technology
- 2. Industrial IoT Testing and Characterization
- 3. Smart Manufacturing digital twins
- 4. Next gen communication 5G/6G
- 5. Secure compute and communication
- 6. Collaborative platforms Telerobotics



**Grand Vision**: 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.

- NDT 4.0 Industrial IoT solutions.
- Next-gen high impact medical device technologies with IoT capabilities.
- Next-gen Indigenous Secure intelligent and Reliable Compute ecosystem.

- Opensource scalable data analytics platform for IoT applications.
- Next-gen Indigenous Secure, High Bandwidth and resilient wireless communication networks for IoT deployments.
- Inferential Lensless cameras.

- Collaborative Telerobotics.
- Distributed Acoustic Sensing Systems (DAS).
- Model industry 4.0 Factory (Softand Hard-ware) for Smart Manufacturing.
- Smart Grid based distribution networks.

# GOALS TO REACH

S No	Target Area	Targets					
		1 <sup>st</sup> Yr	2 <sup>nd</sup> Yr	3 <sup>rd</sup> Yr	4 <sup>th</sup> Yr	5 <sup>th</sup> Yr	Total
	Technology Development						
(a)	No. of Technologies (IP, Licensing, Patents etc)	5	11	20	20	20	76
(b)	Technology Products	3	5	10	10	10	38
(c)	Publications, IPR and other Intellectual activities	25	50	75	75	91	316
(d)	Increase in CPS Research Base (#People involved)	10	40	50	75	75	250

#### The following are the IITM Pravartak funded Research Areas

- Communication, circuits and Sensing system
- IIS- Information, Integration and Information, Robust intelligence
- Foundation Research in control of automated systems
- Assistive Integrative Sensing Tools for eye diseases Retinopathy and Glaucoma
- Data-Driven Deep learning methods to Analyse Heterogeneous networked Data with applications to disease and medicine
- Semi-Automated Rehabilitation in the Home using Sensors and Actuators
- Wearable devices with sensors and actuators for medical assistance including rehabilitation, managing sleep disorders and medical visualization with endoscopes.
- Cube satellites

#### **HEALTH : Wearable devices with sensors and actuators for medical**

- Anterior Segment Screening Device
- Advanced Human Performance Monitoring System
- Human Motion Capture Platform

Portable and Disposable Ureteroscopy System



### AGRICULTURE: Regenerative Agricultural Stack Architecture

- Smart Pre/Post cultivation
- Yield sensing prediction
- Pest and diseases detection
- Weed detection
- Soil management
- Policy aiding support systems
- Plant/Vegetation recognition/classification
- Crop Quality Management
- Smart Irrigation Management
- Farm eco-system animal welfare
- [Farm eco-system related] forecasting livestock
- Weather Forecasting

- Crop Monitoring/sowing systems
- MSP decision aiding
- Labour/Packaging/Logistics management
- Credit Risk Management
- Farm/Crop Insurance Management
- Weather forecasting and irrigation monitoring
- BIO safety eco-system interfacing/ integration
- Evidence support systems for Policy governance and implementation

## Sensors / Actuators / IoT

- Industrial Internet of Things (IIoT) enabled, thermally induced drift compensation module for milling machine tool
- IoT Enabled Actively Damped Boring Bar to Mitigate Chatter in Machining of Aerospace Alloys
- Human motion capture platform

# COLLABORATIONS: OUR PARTNERS

## Accenture

#### **Robotics / Digital Twin and Thread / IOT / Automotive**

**Industry X – The Future of making things, and the things we make** *in Smart Connected Products, Engineering,* 

Manufacturing and Production Operations space across various Industries help clients transform their products,

business models, and operations. At the core of Industry X is Robotics, Industrial Internet of Things (IIoT),

Automotive and Digital Twin that fuels next era of industrial revolution.

 Autonomous Robotics Systems focuses to deliver Robotics based solutions at scale that empower the workforce

to automate operations

§ Usage of **IoT connected systems** in industrial automation, operational optimization, intelligent manufacturing &

asset management enables newer service and revenue models across Industries.

 Automotive R&D powers solutions for OEMs and EV manufacturers across Infotainment, Body Electronics

Modeling, Engine Control and Diagnostics and **Electric Mobility** services for the next automotive revolution.

• **Digital twin and thread** aims to digitize and trace product's lifecycle, designs, performance data, supply chain

#### Technology Vision (Tech Trends 2021)

Accenture has released its **Technology Vision (Tech Trends 2021)** across 5 broad areas – Stack Strategically, Mirrored World, I Technologist, Anywhere Everywhere, From Me to We. Tech Trends are futuristic in nature with very select Global Corporates taking the lead to be front runners and far away from

§ **Trend #1: Stack Strategically** *specifically calls out how the Industry leaders in the future will compete on their chosen Architecture and hence the choices they make would be as critical if not* 

§ With the onset of post-Digital world upon us, technologies such as Cloud (incl Green Cloud) and Edge

**computing** with Cybersecurity will play a key component of most Tech Stacks and help accelerate the digital transformation in myriad ways

data, and software that goes into creating the product.

# COLLABORATIONS: OUR PARTNERS

# SAMSUNG

### Samsung – IITM Pravartak Fellowships

Samsung India has launched the Samsung Fellowship award at Samsung Innovation Campus to promote research and enable youth to use technology for social good

#### The number of students benefited

- 120 UG Candidates
- 21 PG Candidates

# "Keyword Spotting Under Playback for Samsung Soundbar"

- Deliverable:
  - Integration and Tuning algorithm support on different TV and soundbar model on Samsung platform

# COLLABORATIONS: OUR PARTNERS

## SONY

SAMVEDAN 2021 - "Sensing" Solutions for Bharat

A Grand Challenge Competition, jointly organized by <u>Sony India Software</u> <u>Centre Pvt. Ltd.</u> and IIT-Madras Pravartak.

The Department of Science and Technology under its National Mission on Interdisciplinary Cyber-Physical Systems (CPS) aims to create a strong foundation and a seamless ecosystem for CPS technologies by coordinating and integrating nationwide efforts encompassing knowledge generation, human resource development, research, technology and product development, innovation and commercialization.

It has funded IIT Madras to host the Technology Innovation Hub (TIH) for Sensor, Networking, Actuators and Control Systems (SNACS) area. TIHs will be the nodal centres spearheading the activities in a specific domain.

IITM Pravartak Technologies Foundation, which is the TIH for SNACS, in collaboration with <u>Sony India Software Centre Pvt. Ltd.</u> is conducting a Grand Challenge Competition, based on the <u>SPRESENSETM</u> board

## Key Research Personnel : Prof. Mohanasankar Sivaprakasam (IITM)

## Area of Interest : Health

- ✓ Biomedical Instrumentation
- ✓ Waerables for Health and performance monitoring
- ✓ Large scale affordable medical devices
  Projects :
- Comprehensive Anterior Segment Screening Device for Large Scale Eye Screening
- Portable and Disposable Ureteroscopy System
- Advanced Human Performance Monitoring System
- Human Motion Capture Platform

## Key Research Personnel : Prof. Kaushik Mitra (IITM)

## Area of Interest : Imaging Optics

- Develop theory to explore the performance limits of CI systems
- Develop novel CI systems
- Explore the promise of data-driven signal models in CI and computer vision

#### Projects :

Night-Time Image Sensing for Increased Human Perception and Advanced Driver Assistance Systems

## Key Research Personnel : Prof. David Koilpillai (IITM)

## Area of Interest : Communication

- 5G and emerging wireless technologies
- Communications connectivity and networking of devices form the core of CPS

Projects :

Space based Proton and Electron Energy Detector

### Key Research Personnel : Prof. Siva Srinivasu Devadula(IITM)

## Area of Interest : Cyber Physical Systems

- Cyber physical machining system (machining process + machine tool)
- This includes modelling and control of machining systems, development of smart machine tool modules, multi-objective optimization algorithms, machine learning for machining systems.
- Projects :
- Development of an IIoT Enabled Actively Damped Boring Bar to Mitigate Chatter in Machining of Aerospace
- Cyber Physical System for a machine tool spindle with variable preload technology.
- Industrial Internet of Things (IIoT) enabled, thermally induced drift compensation module for milling machine tool
- Regenerative Agriculture Stack Architecture.

## Timeline

SI. No	Project Name	Status	
1.	Comprehensive Anterior Segment Screening Device for Large Scale Eye Screening	Project ongoing	
2.	Portable and Disposable Ureteroscopy System	Project ongoing	
3.	Advanced Human Performance Monitoring System	Project ongoing	
4.	Human Motion Capture Platform	Project ongoing	
5.	Night-Time Image Sensing for Increased Human Perception and Advanced Driver Assistance Systems	Project ongoing	
6.	Space based Proton and Electron Energy Detector	Project ongoing	
7.	Development of an IIoT Enabled Actively Damped Boring Bar to Mitigate Chatter in Machining of Aerospace	Project ongoing	
8.	Cyber Physical System for a machine tool spindle with variable preload technology.	Project ongoing	
9.	Industrial Internet of Things (IIoT) enabled, thermally induced drift compensation module for milling Mmchine tool	Project ongoing	
10.	Regenerative Agriculture Stack Architecture	Project ongoing	

#### Note: All projects are ongoing and scheduled to be completed in 2 years

### Priority Areas for new US India Collaborations

#### • Exploring Mysterious Whistler Mode Waves in Earth's Plasmaspheric Plumes

- NSF Award Abstract # 1847818
- Principal Investigator: Wen Li
- This project investigates how very low frequency radio waves, known as whistler mode waves, affect the Earth's Radiation Belt dynamics. Lightning produces whistler waves, which travel along the Earth's magnetic field lines. The resulting scientific results will lead to improvement of predictive space weather models.

Scope of collaboration: IITM SPEED detector can provide measured experimental data that can validate the phenomenon. NSF+TIH funds can be utilized to launch one satellite mission with an improved version of the SPEED payload in a different orbit.

## Priority Areas for new US India Collaborations

#### • On the Source and Loss of Inner Belt Electrons

- NSF Award Abstract # 1834971
- Principal Investigator: Xinlin Li
- This project is a follow-on to the successful NSF funded Colorado Student Space Weather Experiment (CSSWE) CubeSat. The CubeSat took measurements of energetic electrons in the Earth's radiation belts.

NSF+TIH funds can be utilized to launch one satellite mission with an improved version of the SPEED payload in a different orbit. The payload for the future satellite can be jointly developed with University of Colorado.



## **Applications / Platforms**

- Agriculture
- Health
- Robotics

## **Research Area** Sensors / Actuators / IoT Next-G Communication

