MINUTES OF THE MEETING OF MEMBERS OF HUB GOVERNING BOARD OF NMICPS TECHNOLOGY INNOVATION HUB ON AUTONOMOUS NAVIGATION (TIHAN) FOUNDATION HELD ON TUESDAY 23RD JANUARY 2024 AT ACADEMIC BLOCK, BOARD ROOM, IIT HYDERABAD, KANDI CAMPUS, SANGAREDDY, TELANGANA, INDIA - 502284 AT 11.00 A.M.

Time of commencement of the Meeting: 11.00 A.M.
Time of conclusion of the Meeting: 12.20 P.M.

1. ATTENDANCE

Sr. No.	Name	Designation	Mode of Attendance Physical/Electronic mode
Members:			
1.	Prof. B S Murty	Chairman	Physically
2.	Prof. P Rajalakshmi	Project Director	Physically
3.	Mr. Amit Biswas	Representative, DST, Govt. of India	Through VC from New Delhi
4.	Mr. C S Sharma	Member, Quality Council of India	Through VC from New Delhi
5.	Mr. S K Marwaha	Member, Ministry of Electronics & Information Technology	Physically
6.	Dr. Gopichand Katragadda	Industry Member	Through VC from Bengaluru
7.	Dr. Kumar N. Sivarajan	Industry Member	Through VC from Bengaluru
8.	Mr. Sameer Kumar	Industry Member	Physically
9.	Prof. Chandrashekhar Sharma	Academic Member	Through VC from Hyderabad
10.	Prof. Bheemarjuna Reddy Tamma	Academic Member	Physically
Executive Team:			
11.	Dr. Naga Praveen Babu Mannam	TiHAN - Hub Executive Officer	Physically
12.	Dr. Syam Narayanan	TiHAN – Technical Officer	Physically
13.	Dr. Prakash	MeitY Member	Physically
14.	CA Saurabh Dashottar	Auditors	Through VC from Hyderabad
15.	CA Soniya Dashottar		

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16.	CS Jayata Agarwal	Practising Company Secretary	Through VC from Jaipur

2. ELECTION OF THE CHAIRMAN:

As per article 27 of Articles of Association of the company, the Director of IIT Hyderabad (Host Institute) is deemed to be the chairman of NMICPS TiHAN Foundation, and as per Mission communications, Chairman of Host Institute will be Chairman of the HGB. Thus, **Prof. B. S. Murty** was elected as the chairman of the meeting and occupied the chair.

3. QUORUM:

At 11.00 a.m., the Chairman welcomed the Members present physically and through video conferencing. Thereafter, the Chairman announced that the requisite quorum was present and called the Meeting to order. The Chairman extended a warm and hearty welcome to all members at the Hub Governing Board Company Meeting (HGB).

4. LEAVE OF ABSENCE:

Leave of absence was granted to Mr. Krishna Bodanapu, Dr. Aravind Rengan, Mr. Reji Methai, Dr. Ekta Kapoor, and Mr. Rohit Kumar, for not attending the meeting due to unavoidable circumstances and had requested the same.

5. CONFIRMATION OF MINUTES OF THE MEETING OF MEMBERS OF HGB HELD ON 30TH OCTOBER 2023:

Minutes of the Hub Governing Board meeting held on 30th October 2023 duly initialed by the Chairman placed before the Board and approved. Prof. P Rajalakshmi explained the activities and decisions taken in the previous meeting to all the members.

6. INTRODUCTION OF NEW MEMBERS:

CS Jayata Agarwal introduced and welcomed Shri S. K. Marwaha Scientist 'G' & Group Coordinator Ministry of Electronics & Information Technology (MeitY), Dr. Reji Mathai Director, Automotive Research Association of India (ARAI), Pune, and Mr. C.S Sharma, Joint Director, Project Analysis Documentation Division (PADD), Quality Council of India.

7. TiHAN TARGETS AND ACCOMPLISHMENTS SO FAR:

Prof. P Rajalakshmi informed the members of the HUB regarding the targets and accomplishments achieved to date as per the target set.

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She explained that the Research and Technology Nurture the R&D portfolio of the hub and promote commercially viable translational research. She explained the increase in CPS Research Base Hub projects - 25 collaborative R&D projects. Periodic project reviews have been done through an expert project review committee. 14 collaborative R&D projects (6 R&D Women Scientists and 8 R&D Collaborators) are selected, and under administrative process is ongoing for project execution. She informed the board about the: -

Technology Development: No of Technologies (IP, Licensing, Patent Etc.) – 28 (includes copyrights, patents, Software IPs- and Trademark), Technology Products - 74, Publications, PR and other Intellectual activities - 214, Increase in CPS Research Base – 84.

Entrepreneurship Development: Technology Business Incubator (TBI) - 4, Start-ups & Spin-off companies – 29, GCC - Grand Challenges & Competitions- 8, Promotion and Acceleration of Young and Aspiring technology entrepreneurs (PRAYAS)- 2, CPS-Entrepreneur in Residence (EIR)-17, Dedicated Innovation Accelerator (DIAL)- 2, CPS-Seed Support System (CPS-SSS)- 1, Job Creation – 319.

Human Resource Development: Graduate Fellowships – 264, Post Graduate Fellowships – 94, Doctoral Fellowships – 56, Faculty Fellowships – 19, Chair Professors – 4, Skill Development - 3595, Postdoctoral Fellowships – 17.

International Collaborations: International Collaborations - 21.

Technology Development:

TiHAN Testbed on Autonomous Navigation (Aerial & Terrestrial) at IIT Hyderabad, TRL – 9 and Deployed:

Prof. P Rajalakshmi explained about the Testbed on Autonomous Navigation (Aerial/Terrestrial) which is set up at IITH and informed about the Testbed with the Mechanical Integration Facility, Test circuits/tracks and required Equipment, Area to set the testbed in the IITH Campus and Master Plan and Design. TiHAN has also registered copyright on Testbed as it is one of its kind in the country.
The potential end users of such testbed are Tata Technologies, Suzuki Motor Corporation (SMC), DRDO, Adani Ports & Logistics, CDAC, L&T Technologies Services, Skydrive and Ashok Layland.

Multi Model Data Collection and Data Acquisition Systems (UAV, RoV, etc), TRL – 9 and Deployed:
She gave information about Autonomous navigation and data acquisition systems referring to technologies and systems that enable ground vehicles, robots, UAVs/drones, or other autonomous platforms to navigate and collect data without human intervention. Key features include sensors,

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Perception Algorithms, Mapping and Localization, Path Planning, Control Systems, Data Acquisition, Machine Learning and AI, Communications, Data Privacy and Cyber Security etc. She also informed about Multi-modal sensor data collection across India which include Lidar-camera fusion, Radar-camera fusion, Lidar-based real-time object detection, and Radar-based object detection.

AI-ML Based Annotation & Tagging Framework, TRL – 9 and Deployed: Potential End User – Tata Technologies Limited (TTL).

Autonomous Ground Vehicles – M1 Category, TRL – 9 and Deployed: She also explained to the members about the OEM - Collaboration project - ADAS for Point-to-Point Autonomous Navigation System Adaptable to Indian Scenarios and SOP/Regulatory/Policy Frameworks for Autonomous Navigation.

Off-Road Autonomous Vehicles with Thermal Camera:
She informed the board that this survey aims to gather insights and opinions regarding the utilization of Thermal and RGB cameras mounted on Unmanned Ground Vehicles (UGVs) for various applications. The thermal camera can detect different temperatures within the pipelines and identify any potential leakages.

5G C-V2X Communication Platform, TRL – 9 and Deployed:

Prof. P Rajalakshmi informed that the 5G C-V2X Communication Platform is required to implement advanced safety-critical applications for on-road vehicles. It is more consistent performance under traffic congestions, longer range, enhanced reliability, Fast Network Acquisition, and Low Latency and High Reliability. It would be Indigenous development leading to cost-effective solutions and Enhanced road safety and traffic control. Industry Meet is also organized based on this technology.

Autonomous Vehicles - Traffic Sign and Traffic Light Detection, TRL – 9 and Deployed:
To develop an accurate and robust traffic sign and light detection and classification system using computer vision techniques to enhance road safety and optimize traffic flow in real time.

Edge Cloud and 5 G-Based UAVs: Prof. P Rajalakshmi further explained the Edge Cloud and 5G Based UAVs, Used 5G/TiHAN Edge server for real-time object detection inference via the Internet, 5G/Cloud-based Drone Swarm - Leader-Follower Technology, Edge-based Traffic management use case via Drones.

Unmanned Aerial Vehicles (UAVs) Activities at Testbed, TRL – 6 and Deployed: Prof. Rajalakshmi explained the usage and development of Unmanned Aerial Vehicles (UAVs) in the fields of agriculture, health care, Defense, etc. Based on the weight, UAVs are classified as Nano, Micro, Small, Medium, and Large Aerial Vehicles. More precisely, Nano, Micro, and small UAVs

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are widely used for defense applications such as Intelligence, Surveillance, and Reconnaissance. Micro Aerial Vehicles (MAVs), which come under a weight less than or equal to 2kg, are preferable for Surveillance applications. Due to the lightweight and flapping effect, the autonomous flight of MAVs is a major challenge in robotics. She also gave information about the Autonomous Navigation of Micro Aerial Vehicle (Mav) in Indoor Navigation, Autonomous Personal Air Vehicles/Air Taxis, Heavy Payload Drone Stability Testing Facilities, Coaxial Drone with Thermal Cameras at Night/Low Visibility, TiHAN In-House Drone Simulator**.**

Autonomous Surface and Underwater Vehicles, TRL–5 and Field Deployment: The main aim of the project is to Track Underwater subsea Pipelines using Sonar Imaging.

She further informed about **Futuristic Technologies** – Software-Defined Vehicles (SDVs) and Autonomous Navigation of Armored Vehicles (ATV) – Proposed Architecture. She further mentioned the board about end-to-end connectivity multi-modal transportation solutions for the Indian Scenario going forward. Energy-efficient autonomous navigation enabled different modes of electric vehicles, i.e., e-bikes, to be integrated as navigation systems.

On **Entrepreneurship**, TiHAN IITH attracted private funding like CSR, VCs, and equity-based Incubation activities. She further informed about the technology commercialization, promotional outreach, and Accelerator programs for early-stage start-ups. For the Technology Business Incubator, the collaboration between TiHAN & iTIC, ISEED IRMA, and AIC STPINEXT, Pune for Entrepreneurship activities like startups, GCC, PRAYAS, EIR, DIAL, and CPS-Seed Support System is working successfully.

On **Industry relations**, Prof. Rajalakshmi informed the board about the joint R&D initiatives on a cost-sharing basis and consultancy projects with both govt. and private entities. To date, TiHAN has made collaborations with 42 Industries. Suzuki Motors Corporation sent vehicles from Japan for RnD on ADAS for Indian Scenario and testing in the TiHAN testbed, and for this research and development, Data collection and algorithm developments are going on. She also Informed Collaboration between TTL, DYSL, NATRAX, and LTTS.

Prof. Rajalakshmi informs the members about the success stories of the TiHAN Foundation to date, about the start-ups and Collaboration with Government/Industry/Line Ministries & and PSUs.

8. BUDGET DISCUSSION:

Prof. Rajalakshmi presented the funds received from DST and utilization of the same to date. The total fund allotted was 89.43 crores for four years and the total expenditure to date is 85.91 crores.

9. SUGGESTIONS FROM THE MEMBERS, DISCUSSION, AND ACTION PLAN:

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Prof. Murty suggested creating a video showing a monthly progress report of TiHAN. So that the updates can be circulated easily everywhere. Also suggested that the Skill development course must have a test which leads to some course completion certification also mentioned that the USP of TiHAN should be developed.

Mr. Gopichand Katragadda believes that entrepreneurship development is more important than human resource development and so quality matters more than quantity. He further suggested patents (National and International) and revenue streams should be focused more.

Mr. C S Sharma mentioned that standards for BVLOS UAVs need to be jointly developed along with QCI. He also explained that skill development needs to be linked to employment ability.

Mr. Samir Suggested that an Autonomous Campus Shuttle should be deployed in First-generation IITs on a cost basis.

VOTE OF THANKS:

Prof. Rajalakshmi announced the summary of the discussion, recommendations, and decisions taken in the meeting. Before the conclusion of the Meeting, CS Jayata Agarwal, Company Secretary, made the roll call after the meeting and ensured the presence of a quorum throughout the meeting.

With the agenda item being transacted, Jayata thanked the members for making it convenient to attend the meeting and thanked them for their active participation.

Thereafter, the members declared the meeting as concluded.

Signatures:

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Prof. B. S. Murty	**Prof. Rajalakshmi**
Chairman of HGB	**Project Director/Member Secretary**

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