

Invention to Innovation to Entrepreneurship: TiHAN's Pioneering Role in Autonomous Navigation

KID: 20250214

At the forefront of India's autonomous mobility revolution, TiHAN at IIT Hyderabad stands as a beacon of translational research and entrepreneurial advancement. Conceived under the National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS) and supported by the Department of Science and Technology, Government of India, TiHAN is India's first full-stack testbed for Autonomous Navigation. It unifies aerial and ground mobility platforms across a real-world simulated infrastructure, transforming fundamental research into deployable, market-ready solutions.



Figure 1. TiHAN IITH Testbed

TiHAN developed an end-to-end autonomous navigation stack to pilot deployment and entrepreneurial spin-offs. A prime example is the Autonomous Campus Shuttle, deployed at the IIT Hyderabad campus, A.P. Secretariat, Amaravathi, Naval dockyard Visakhapatnam, and LABASANA (Lal Bahadur Shastri National Academy of Administration) Mussoorie, Uttarakhand.



Figure 2. TiHAN IITH Autonomous Campus Shuttle

SAFARI project, which amassed multimodal sensor data over 10,000+ kilometers across diverse Indian terrains. This indigenous dataset now powers AI-driven navigation models suited to India's road and weather complexities, creating foundational IP for startups and industries working in this domain.



Figure 3. SAFARI – TiHAN IITH Data Collection Vehicle

In ground mobility, TiHAN has developed and tested indigenous solutions for GNSS/map-based navigation, AI-based collision avoidance, electric shuttle systems, and real-time traffic coordination using 5G-CV2X.

A notable success includes the commercial transfer of CV2X hardware modules to Indian industry, exemplifying successful technology handoff from lab to market. In aerial autonomy, TiHAN is shaping the future of UAVs with innovations in indoor navigation, drone swarms, BVLOS operations, and heavy payload delivery—paving the way for future Urban Air Mobility (UAM)

“TiHAN provides a robust launchpad for deep-tech startups. It houses a dedicated Technology Business Incubator, fostering ventures in mobility, AI, and embedded systems. Several alumni and research scholars have transformed their doctoral research into real-world startups addressing national challenges in defense, agriculture, healthcare, and logistics”



Figure 4. OBU and RSU

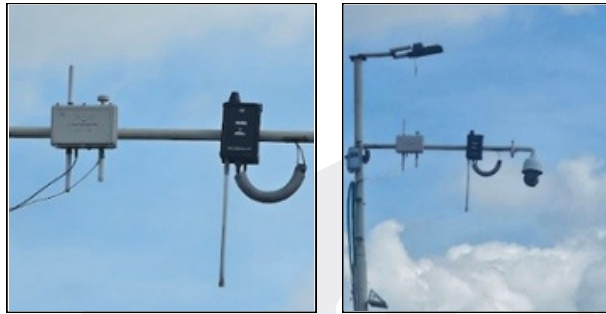


Figure 5. OBU, RSU pole deployment

TiHAN provides a robust launchpad for deep-tech startups. It houses a dedicated Technology Business Incubator, fostering ventures in mobility, AI, and embedded systems. Several alumni and research scholars have transformed their doctoral research into real-world startups addressing national challenges in defense, agriculture, healthcare, and logistics.

In the last 5 years, TiHAN has made significant progress. In Technology Development, 66 patents/IPs and 88 technology products were developed, along with 367 publications, PR, and other intellectual activities. A 106-CPS research base was established. TiHAN supported 58 R&D collaborators, 19 faculty fellows from various institutions, and executed 36 MoUs with industries.

In Entrepreneurship Development, 1 Technology Business Incubator (TBI) was established, supporting 43 start-ups and spin-off companies. TiHAN conducted 9 Grand Challenges & Competitions (GCC) and 3 Dedicated Innovation Accelerators (DIAL). PRAYAS supported 3 aspiring technology entrepreneurs, while the CPS-Entrepreneur In Residence (EIR) program benefited 32 individuals. Additionally, 2 CPS-Seed Support Systems (CPS-SSS) were supported, creating 784 jobs.

In Human Resource Development, 396 graduate, 139 postgraduate, 74 doctoral, and 25 postdoctoral fellowships were awarded. TiHAN also engaged 19 faculty fellows and 6 chair professorships. Skill development programs trained 9,184 individuals, and 31 international collaborations were established.

TiHAN is not just a research facility; it's a movement from invention to innovation to entrepreneurship, positioning IITH as a national leader and global contender in autonomous navigation. As TiHAN continues to scale, it exemplifies how academic research, when strategically aligned with industry, policy, and societal needs, can catalyse entrepreneurial ecosystems of the future.

Prof P Rajalakshmi

Professor, Department of Electrical Engineering

