



Theme Diary

Smart Mobility @IIT Hyderabad

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IITH has many Smart Mobility initiatives, including RnD, skill development, and entrepreneurship activities. As part of many funded projects from DST, Meity, DRDO, and Industries, various activities are carried out at IITH. Recently Department of Science and Technology (DST), under the National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS), Government of India has sanctioned the prestigious Technology Innovation Hub to IIT Hyderabad in the technological vertical of Autonomous Navigation and Data Acquisition Systems (UAVs, ROVs, etc.) (TiHAN).

TiHAN Testbed on Autonomous Navigations (Aerial & Terrestrial):

IITH has made a magnanimous effort in building a unified and first of its kind state-of-the-art Testbed to develop autonomous navigation technology for ground and aerial vehicles. The testbed is one of the collaborative platforms with Industry/ Academia/ R&D labs in our endeavours aiming at translational research & commercialization of technology development at both national and international levels.

The Facilities, as shown in **Figure 1 & Figure 2**, include Proving Grounds, Test tracks, Mechanical integration facilities like Hangers, Ground control stations, Anti-drone detection systems, State of the art Simulation tools (SIL, MIL, HIL, VIL), Test tracks/circuits, Road Infra - Smart Poles, Signalized & Unsignalized Intersections, Environment Emulators like Rainfall Simulators, V2X Communications, Drone Runways & Landing area, Control Test centres.

Technology developments:

UAV: In Nano/Micro category drones, Bio-Inspired drones like Quad-wing UAV (Dragonfly based) and Flapping Wing Micro Aerial Vehicles (Aerial Birds based), Nano drone swarms are being developed as in **Figure 3**. In Medium/Large category drone, the focus is on developing solutions air cargo (**Figure 4**), urban air mobility, etc., as a means of solving traffic congestion in the downtown of large cities. In medium category drones (**Figure 5**), high-end sensors like hyperspectral, multispectral cameras, RGB cameras, and LIDAR are integrated for various applications like agriculture, land survey, health monitoring, etc.



Figure 2: Test-tracks for Autonomous Vehicles

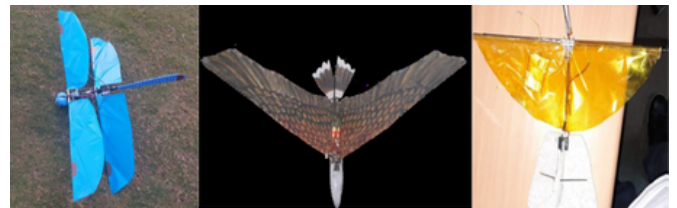


Figure 3: Bio-Inspired Drones



Figure 4: Heavy payload Drone – Air cargo



Figure 1: Mechanical Integration facility for UAV testing including control room



Figure 5: Small category drone with Hyperspectral camera (L) & Lidar (R)

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UGV: ADAS features are built into passenger vehicles, campus shuttles, and bicycles (for last-mile connectivity). ADAS features include pedestrian detection, emergency braking, LDWS, and LKA. They used a test scenario of ADAS function assessment in the SIL framework for an Indian setting. GPS-based autonomous navigation for drive-by-wire enabled vehicles using waypoints. Algorithms for obstacle avoidance and path planning are being developed, as in **Figure 6 & Figure 7**.

UAV and UGV Training Kits:

UAV and UGV training kits are developed in-house for skill development programs. It is easy to assemble a DIY [Do It Yourself] kit that can be used by students and others interested in working with UGV and UAV, as shown in **Figure 8 & Figure 9**.

Human Resource & Skill development:

IITH has established a New Interdisciplinary 2-year M. Tech program on Smart mobility (SM) from Aug 2020. Students from multiple departments like Artificial Intelligence, Civil Engineering, Computer Science and Engineering, Design, Electrical Engineering, Mathematics, Mechanical and Aerospace Engineering, and maths are eligible to apply for this program. The first batch of Smart Mobility students SM20 batch has got 100% placement during the campus placement by core companies in the area of mobility.

Also, 24 Doctoral fellows have joined from multiple departments, including EE, CSE, CIVIL, AI, and MAE, and are working in the area of Autonomous Navigation and Data Acquisition. 4 Post-Doctoral Fellows are working in this area.

Prof. Srikant Saripalli, Professor from TAMU, is the TIHAN Chair at IITH in the area of Autonomous Navigations.



Figure 6: Electric Car with LiDAR assisted Pedestrian Detection & Emergency Braking in Testbed (Above) & Autonomous/ Smart Campus Shuttle E-Card (Below)



Figure 7: Electric Bicycle with autonomous driving enabled in Testbed at IITH

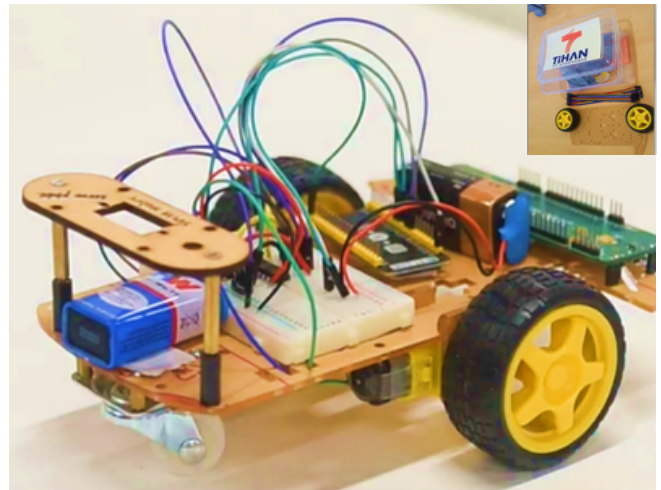


Figure 8: UGV kit developed by TIHAN Skill Development Team

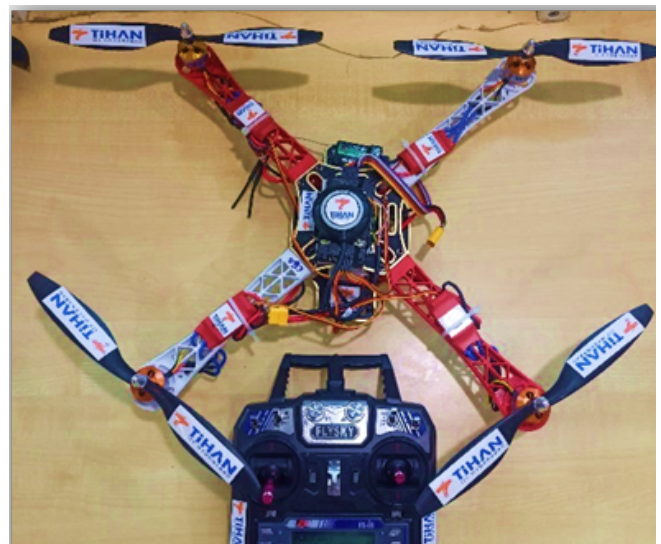


Figure 9: UAV kit developed for skill development