



TiHAN - IITH INNOVATIONS CATALOG

*Hub for safe, sustainable, Smart
next Generation Mobility*

**NMICPS Technology Innovation Hub on
Autonomous Navigation Foundation
IIT Hyderabad**



AUTONOMOUS
SYSTEMS



INTELLIGENT
CONNECTIVITY



ADVANCED
ENGINEERING



SAFE & RELIABLE
SOLUTIONS





TiHAN-IITH TESTBED

State of the Art Autonomous Navigation Testing Facility

Welcome to a

New Era of Transportation



Technology Innovation Hub on Autonomous Navigation at the prestigious Indian Institute of Technology Hyderabad (**TIHAN-IITH**), a Section 8 Company under the National Mission on Interdisciplinary Cyber-Physical Systems (**NMICPS**), is at the forefront of cutting-edge technology solutions, empowering a future where autonomous systems redefine the way we live, work, and connect.

We are proud to introduce our AI-enabled cutting-edge real-world Autonomous Solutions, a game-changer in smart mobility. Explore our innovative products designed to shape the future of mobility and connectivity.



ACCREDITATIONS & RECOGNITIONS

ISO

9001: 2025 Certified

Quality Management
System

SIRO

Recognized by DSIR

Scientific & Industrial
Research Recognition

NABL

Accredited Laboratory

ISO/IEC 17025
Compliant Laboratory

FCRA

Registered Organization

Authorized to Receive
Foreign Contributions





TiHAN Testbed


A first of its kind state - of - the - art testbed for Autonomous Navigations (Aerial/Terrestrial).




FACILITIES Includes


 Hangars


 Ground control stations


 State of the art Simulation tools (SIL, MIL, HIL, VIL)

 Multi-radio Enabled Test tracks/circuits


 Road Infra - Smart Poles

 Signalized & unsignalized Intersections

 Environment Emulators

 V2X Communications

 Vertiport

 Drone Control Test center



10

Acres
Integrated Testbed Area



3+

Multi - Modal
Test Tracks



Multiple
Intersections & Scenarios



Dedicated
Aerial Test Zone (Vertiport)

ADVANCED TESTING LABS



Rainfall Simulator

Controlled weather simulation for autonomous mobility testing

- Simulates varying rainfall intensities
- Enables perception & control testing under adverse weather



Wind Shaper Facility

Dynamic wind environment testing for aerial platforms

- Controlled wind generation
- Performance & stability testing for UAVs and eVTOLs



Control Drone Navigation Testing Centre (DroNa)

Precision testing for autonomous drone navigation

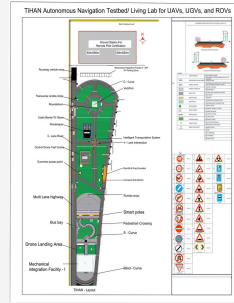
- Indoor & controlled navigation testing
- GNSS-denied & obstacle-rich environment validation



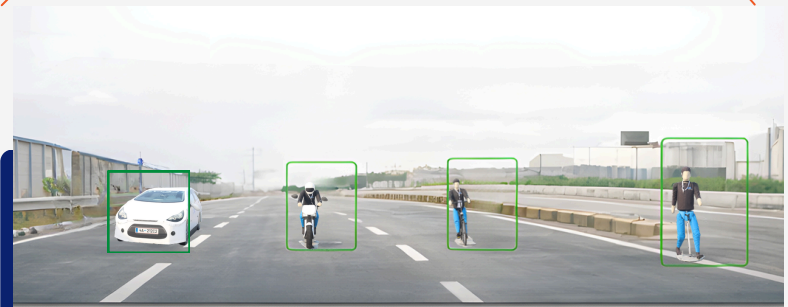
eVTOL Propulsion & Motor Testing Lab

Advanced propulsion validation for next-generation aerial mobility

- Electric propulsion & motor testing
- Thrust, efficiency & endurance evaluation



INTEGRATED TEST TRACK



4 Active Dummies

For Real - World Validation



Car
Dummy



Two Wheeler
Dummy



Cyclist
Dummy



Pedestrian
Dummy



TiHAN Testbed empowers innovation with world-class infrastructure for safe, reliable and scalable validation of autonomous technologies across air and ground.

TiAND MultiModal Dataset

TIAND: TiHAN-IITH Autonomous Navigation Dataset

A Multimodal Dataset for Autonomy on Unstructured Indian Roads

TiAND is a comprehensive multimodal dataset designed to advance autonomous navigation research across diverse real-world environments in India. It includes data from aerial, terrestrial, underwater, and agricultural domains captured using state-of-the-art sensors.



Terrestrial Datasets

Includes data from multiple sources like cameras, RADAR, LiDAR, and GNSS systems.



Aerial Datasets

Focuses on marker-based landing, LiDAR data, and recognizing different growth stages of paddy crops.



Underwater Datasets

Uses data from SONAR systems.



Agriculture Datasets

Comprises image data acquired from cameras, multispectral sensors and hyperspectral sensors.

SENSORS & PLATFORMS



GNSS



LiDAR



Camera



Radar



HSI Camera



10000+ KMS

Data Collection Distance

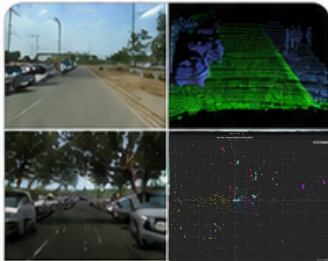


90 TB+

Data Captured

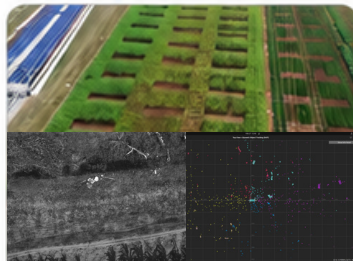
RICH, DIVERSE & REAL-WORLD DATA

Terrestrial Dataset



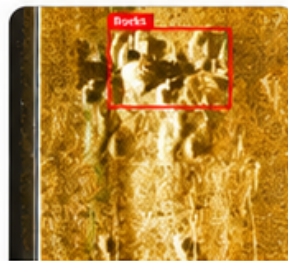
Camera | LiDAR | RADAR

Aerial Dataset



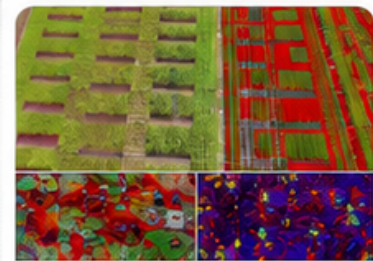
LiDAR | Multispectral | RGB

Underwater Dataset



SONAR | Imaging

Agriculture Dataset



Multispectral | Hyperspectral

Key Highlights



250 HOURS
Recorded Data



MULTI WEATHER
Scenarios



50+ CITIES
Covered



26 CLASSES
Object Annotation



125K IMAGES
45K PCD FILES



SYNCHRONISED
SENSOR SUITE

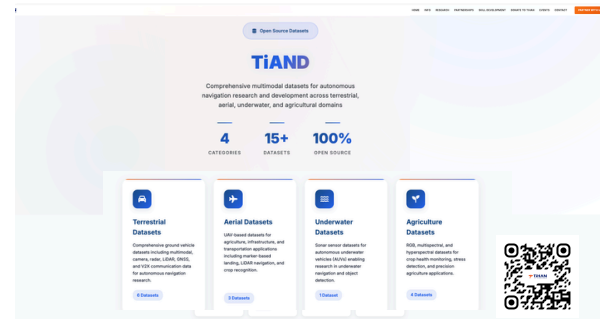


MULTI SENSOR
DATA FUSION



PRECISE SENSOR
CALIBRATION

Web-Based Dataset Access & Download



<https://tihan.iith.ac.in/TiAND.html>



TiAND provides synchronized, high-quality multimodal data captured across varied Indian environments, supporting research in perception, localization, planning, and autonomous decision-making for aerial, terrestrial, underwater, and agricultural applications.

Autonomous Campus Shuttle

End To End Autonomous Driving Stack

Experience the Future of Campus Transportation

An intelligent, fully autonomous electric shuttle designed for safe and efficient campus mobility. Equipped with advanced perception, navigation, and control systems, the vehicle operates without human intervention in controlled environments.



Unique Features

All weather, light conditions,
Autonomous platooning, Autonomous parking.



Safety Redefined

Autonomous driving stack, multi sensor fusion,
Automotive industry standards compliant.



Real-Time Control

Includes images from cameras, multispectral sensors,
and hyperspectral sensors.



Customer-Centric

Edge cloud based real-time monitoring, futuristic
software defined vehicles.



ADVANCED AUTONOMOUS CAPABILITIES



LiDAR Enabled Perception



Fail-Safe Mechanism



Live Tracking



In house Drive by Wire System



LiDAR-Enabled Prediction and Detection



ROS - based control architecture



Multi - Sensor Fusion

OPERATIONAL SINCE AUGUST 2023



97%

Passengers Feel Safe



7km/Trip

6 Trips per day



30000+

Passengers served



95%

Satisfied Users

DESIGNED FOR SMART CAMPUS MOBILITY



Smart & Autonomous

Fully autonomous operation in controlled campus environments.



Connected & Intelligent

Cloud-based monitoring and real-time data analytics.



Safe & Reliable

Multi-sensor fusion and fail-safe mechanisms ensure passenger safety.



Sustainable & Efficient

Zero-emission electric shuttle for a greener campus.



Seamless Experience

Intuitive interface and real-time tracking for better user experience.



Empowering Campuses with **Safe, Smart & Sustainable** Autonomous Mobility

C-V2X Communication Ecosystem

Revolutionize Road Safety by bringing vehicles and smart infrastructure together



Vehicle-to-Everything (V2X)

Connect vehicles, infrastructure, and more.



Reliable Communication

Short and long-range communication.



Smart Roads

Enjoy low latency, and fast network acquisition.



Secure Connectivity

Robust data security.



Real-Time Insights

Get immediate alerts for a safer journey



Best Efficiency

Enjoy shorter commutes and lesser fuel consumption.

C-V2X Applications - Use Cases Implementation



V2I for Pedestrian Detection

Roadside sensors (CCTV camera)
→ Cloud infrastructure → RSU →
OBU → GUI alert to a driver



V2V for Collision Avoidance

OBU1 integrated sensors (GNSS)
→ OBU1 → OBU2 →
GUI alert to driver



C-V2X Green Corridor

- Emergency vehicle priority via V2I
- OBU-RSU triggers automatic signal control
- Real-time green corridor creation
- Enables traffic signal communication



LOW LATENCY

< 20 ms

Ultra-reliable communication



HIGH RELIABILITY

> 99.9%

Packet delivery ratio



REAL-TIME DATA

10,000+

Messages per second



WIDE RANGE

300 m - 1 km+

Short & long-range connectivity



SECURE & SAFE

End-to-End

Encrypted & authenticated

C-V2X ECOSYSTEM COMPONENTS

On Board Unit (OBU)



Installed in vehicles to communicate with everything around

Road side Unit (RSU)



Infrastructure node for V2I communication and traffic management

Traffic light & Sensors



Smart infrastructure for real-time data collection & control

Cloud Infrastructure

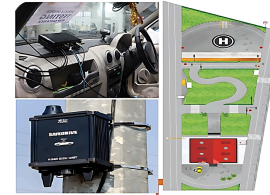
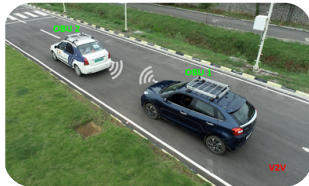


Centralized data processing, analytics & decision making

User Interface (GUI)



Real-time alerts, visualization & monitoring. dashboard for operators



OBU kept inside the car, and RSU mounted on the pole. © THAKX Testbed



Enabling Intelligent Transportation with Connected • Cooperative • Secure

TiNAN

TiHAN Trajectory-driven Autonomous Navigator

End-to-End Autonomous Driving for Indian Road Conditions

Traditional modular pipelines for autonomous driving are prone to error propagation. End-to-end driving unifies perception, reasoning, and control, allowing the model to understand complex scenes, anticipate risks, and generate safe, human-like trajectories.

Synthetic Data: For Edge Cases That Matter

TiCRAD (TiHAN Crash & Risk Aware Driving) defines 158 safety-critical scenarios grounded in Indian driving via TiAND and extended with 8-second synthetic videos generated using GenAI models (Veo 3.1).

TiNAN leverages TiCRAD's crash and pre-crash scenarios to model high-risk driving events, enhancing awareness of safety-critical situations and enabling robust trajectory prediction in complex and unpredictable environments.

TiCRAD can serve as an evaluation standard to assess autonomous driving systems on Indian-specific scenarios, improving safety and trajectory prediction capabilities.

 Normal 45

 Pre - Crash 69

 Crash 44

14.5 +

MILLION

Training Samples

TiAND | Waymo
nuScenes | CoVLA
Synthetic Data



Data-Driven End-to-End Approach

Learns perception to control in a unified framework.



High Accuracy Trajectory Prediction

Understands intent, context & interactions for safer decisions.



Robust in Indian Conditions

Trained on real & synthetic data capturing India's diverse road scenarios.



Scalable & Generalizable

Works across cities, road types, and traffic complexities.



Real-time & Deployable

Optimized for real-world autonomous driving systems

TRAJECTORY PREDICTIONS - REAL CAPTURED DATA



Accurate Trajectory Prediction at Roundabouts under Navigation Commands



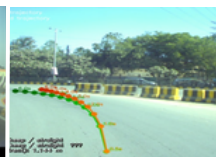
Trajectory Prediction in Low-Light Conditions with Oncoming Traffic Awareness — Kota city



Trajectory Prediction Under Unpredictable Animal Road Crossings in Urban Indian Environments



Road-Aware Trajectory Prediction: Following Curvature Despite Straight Road



High-Fidelity Trajectory Prediction Under Curved Road Constraints



Accurate Trajectory Prediction During Lane Change Transitions

TRAJECTORY PREDICTIONS - SYNTHETIC DATA



Trajectory Prediction in Complex Accident Scenario



Trajectory Prediction Under Pedestrian/Cyclist Interaction Scenarios



Robust Trajectory Prediction for Sudden Collision and Obstruction Events

TITAN DELIVERS



Safer Decisions



Human-like Driving Behavior



Better Generalization



Reliable Performance in Edge Cases

BUILT ON STRONG FOUNDATIONS



Real & Synthetic Data Fusion



End-to-End Learning Architecture



TiCRAD Scenario Evaluation Standard



High Performance & Real-time Inference



Designed for Indian Road Conditions

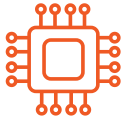


TITAN - Enabling Safe, Intelligent & Human-like Autonomous Driving for India

Software Defined Vehicle (SDV)

*The Future of Automotive Architecture
From Hardware-Centric to Software-Driven Mobility*

TiHAN Software Defined Vehicle (SDV) Solutions enable next-generation mobility through a modular, software-first vehicle architecture, separating hardware from intelligence. The platform supports software-controlled vehicle functions, secure OTA updates, and scalable feature deployment, forming a unified foundation for autonomy, connectivity, and data-driven vehicle intelligence.



Software-Centric Architecture

Vehicle functions defined, managed and updated by modular software.



OTA-Enabled Modularity

Secure, scalable over-the-air updates for continuous feature improvement.



Intelligence-Ready Platform

Native support for autonomy, connectivity, analytics and advanced vehicle services.

Why SDV?



Agility & Flexibility

Rapid feature development and deployment.



Improved Safety & Security

Secure software pipelines and encrypted communications.



Cost & Efficiency

Reduced hardware complexity and lifecycle cost.



Future Ready

Built to evolve with autonomy, connectivity and AI.



Key SDV Capabilities



Centralized
Compute
Architecture



Decoupled
Hardware &
Software



Continuous
Integration &
Deployment



Cybersecurity
by Design



V2X & Cloud
Connectivity



AI/ML Ready
Platform



Building the Foundation for *Intelligent, Connected & Autonomous* Mobility

Urban Air Mobility Solutions

Shaping the Future of Urban Air Mobility

TiHAN's Urban Air Mobility Solutions combine autonomous flight, advanced sensing, and intelligent communication to deliver reliable, scalable, and secure aerial operations for tomorrow's smart cities.

AIR CORRIDORS



Ensures safe, regulated flight paths for UAVs, preventing collisions and minimizing airspace congestion.

UAV IMAGING FOR CROP PHENOTYPING



Advanced UAVs with RGB, Multispectral, and Hyperspectral sensors accelerate crop phenotyping, enabling precise analysis of traits.

DRUG DELIVERY DRONE - BVLOS



Operates beyond visual line of sight using long-range communication (satellite, LTE, or RF) with fail-safe systems and smart flight planning.

SWARM OF DRONES



Distributed Surveillance: Local drone collaboration for scalable, reliable monitoring.
Centralized Surveillance: Central drone control for coordinated and efficient monitoring.



IN-HOUSE FLIGHT CONTROLLER TI-CIRCLE

A modular, indigenous flight controller compatible with open-source firmwares, enabling advanced control and autonomous navigation.



VISION-BASED PRECISION LANDING

A UAV landing system using deep learning for real-time marker detection and safe, GPS-independent landings.

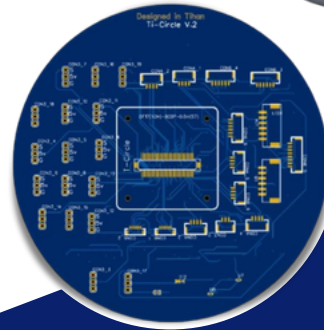
HANDHELD DRONE TELEMETRY WITH ANTI-JAMMING

- **Static Link Vulnerability:** Single-frequency telemetry is highly susceptible to **jamming and disruption**.
- **Dynamic RF Environment:** Urban interference (**Wi-Fi, cellular, multipath**) degrades link reliability.



TIHAN FLY GCS

An indigenous Ground Control Station with multiple functionalities such as fail safety, BVLOS, and Swarm



Anti - Jamming Telemetry

Secure. Resilient. Reliable Communication for Mission-Critical UAV Operations.

TiHAN's indigenous handheld telemetry system delivers secure, long-range, and anti-jam communication for drones operating in high-interference and adversarial environments.



STATIC LINK VULNERABILITY

Single-frequency telemetry is highly susceptible to jamming and disruption.



DYNAMIC RF ENVIRONMENT

Urban interference (Wi-Fi, cellular, multipath) degrades link reliability.



SECURITY THREATS

Drone systems are susceptible to replay attacks and denial-of-service (DoS) attacks.



OPERATIONAL REQUIREMENT

Autonomous UAVs demand secure, resilient, and adaptive communication.



LOW-POWER LONG-RANGE NEED

Integration of LoRa-based communication for extended range and efficiency.

PRECISE TIME SYNC

PTP for coordinated frequency hopping

ADAPTIVE HOPPING

FHSS + AFH across multiple frequency bands

SECURE COMMUNICATION

RSA + AES-256 encryption with replay protection

LONG-RANGE & EFFICIENT

LoRa-based duplex link for extended range

EDGE INTELLIGENCE

On-board processing with Intel NUC



9 km

Autonomous Flight
with Corinuous
connectivity



STABLE TELEMETRY

Real-time monitoring
and command
execution



STABLE TELEMETRY

Robust performance against
single & multi-tone jammers



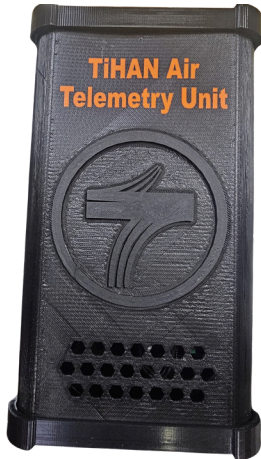
**SECURE COMMAND
EXECUTION**

Verified in real-world flight
tests



**REPLAY PROTECTION
& SECURE
COMMUNICATION**

Validated under test scenarios



**SECURE COMMAND
& CONTROL (C2 LINK)**

Reliable and encrypted
control of UAV missions



**TACTICAL FIELD
COMMUNICATION**

Real-time communication by
soldier in dynamic
environments



**CRITICAL & DEFENSE
APPLICATIONS**

Mission-critical operations with assured
communication

TiHAN Surveillance Solutions

TiHAN - Shadow

Autonomous Surveillance Enhanced Security

Ti-Shadow is a high-performance quadcopter designed for autonomous surveillance missions. Built for reliability and precision, it delivers real-time intelligence with advanced payload integration and robust flight capabilities.



2 kg
Payload Capacity



7 kg
Max Take-off
Weight



5 kg
Empty Weight
(including batteries)



50 min
Endurance



100-200 m
Max altitude



15 m/s
Max Velocity



Manual /
Autonomous



Autonomous Surveillance

Intelligent missions with minimal human intervention



ENHANCED SECURITY

Secure data links and encrypted communications



HIGH PRECISION PAYLOADS

Stabilized imaging for day and night operations



VERSATILE DEPLOYMENT

Ideal for multiple domains and environments



IDEAL FOR



DISASTER MANAGEMENT & SURVEILLANCE

Real-time aerial monitoring for disaster response, risk assessment, and situational awareness.



AGRICULTURE

Crop health monitoring, field analysis, and precision agriculture for improved productivity.



ENTERTAINMENT SURVEILLANCE

Event monitoring, crowd management, and aerial coverage for large gatherings.

Precision Air - Drop Solution for Critical Mission

Ti - KALA

Precision Delivery from Sky to Target

Ti-KALA delivers critical supplies with high-payload capacity, precision navigation, and reliable autonomous air-drop capability.



15 kg
Payload Capacity



35 kg
Max Take-off Weight



20 kg
Empty Weight
(including batteries)



30 min
Endurance



100-200 m
Max altitude



15 m/s
Max Velocity



Manual /
Autonomous



PRECISION DROP

High-accuracy payload release at target coordinates



RELIABLE & ROBUST

Stable in challenging environments with redundant systems



AUTONOMOUS NAVIGATION

GPS-denied navigation with smart mission planning



SECURE MISSIONS

Encrypted communication and fail-safe payload mechanisms



Empowering Critical Operations with **Precision, Reliability & Safety.**



IDEAL FOR



DEFENCE & MILITARY

Tactical resupply, ammunition delivery, mission support



DISASTER RESPONSE

Emergency supplies, medical kits, food & water delivery



REMOTE & ISOLATED AREAS

Last-mile delivery in difficult and inaccessible terrains

Heavy Payload Solutions

Ti- Chakravyuh

Take your Cargo to New Heights

Ti-Chakravyuh is a heavy-payload coaxial UAV platform designed for reliable transport of critical cargo in challenging and mission-critical environments, offering high stability, endurance, and advanced safety systems.



100 kg
Payload Capacity



320 kg
Max Take-off
Weight



170 kg
Empty Weight
(including batteries)



30 min
Endurance



100 m
Maximum Altitude
from AGL



10 m/s
Max Velocity



**MANUAL /
AUTONOMOUS**
Operating mode

KEY STRENGTHS



RELIABLE & SECURE COMMUNICATION

Redundant RF, 4G/5G
& GPS/GLONASS



POWERFUL PERFORMANCE

High take-off capacity for
heavy-duty missions



RUGGED DESIGN

Weather-resistant and
reinforced structure
(Aerospace Grade
Aluminium).



FAILSAFE LANDING

Automated return-to-home
and emergency protocols.



Empowering Critical Operations with **Precision, Reliability & Safety.**



BUILT FOR MISSION CRITICAL OPERATIONS



DEFENCE & SECURITY

Strategic payload transport for critical defence missions and forward operations.



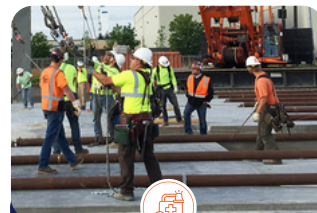
LOGISTICS & TRANSPORTATION

Last-mile and remote area cargo delivery with high capacity and reliability.



INDUSTRIAL ENTERPRISES

Transport heavy equipment, tools and materials across industrial sites.



EMERGENCY SERVICES

Deliver essential supplies in disaster relief and emergency response scenarios.

AIR AMBULANCE

Ti- Palyanka

Personalized Aerial Vehicle

A next-generation coaxial autonomous aerial mobility platform designed for safe human transport, emergency response and urban air mobility, delivering reliable, high-stability, and traffic-free operations.



100 kg
Payload Capacity



320 kg
Max Take-off
Weight



200 kg
Empty Weight
(including batteries)



30 min
Endurance



120 m
Maximum Altitude
from AGL



10 m/s
Max Velocity



**MANUAL /
AUTONOMOUS**
Operating mode



SAFETY & REDUNDANCY

- *Safety: Emergency landing with smart decision-making.*
- *Reliability: Failsafe mechanism with single & dual motor failure.*



CONTROL & AUTONOMY

- *Power: Lithium-based batteries.*
- *Features: Live tracking and mission planning.*



SAFE. RELIABLE. FAST. | TAKING CARE BEYOND BOUNDARIES.



APPLICATIONS



AERIAL AMBULANCE

Rapid medical evacuation when every second counts.



AIR TAXI

Safe, traffic-free, and efficient urban travel for the future.



DISASTER RESPONSE

Access to remote and crisis zones for quick relief and support.



Innovation Hub on Autonomous Navigation



178 Cr +

Support from DST NMICPS



13000 +

Manpower Trained



350 +

Members Working



56

Startups Incubated



100 Cr +

Startups Evaluation



10 Cr +

Revenue Generated



66

IP Generated



100

Products Developed

End-to-End Connectivity Multi-Modal Transportation Solution for Indian Scenarios

Energy efficient autonomous navigation enabled different models of Electric vehicles



e - Bike



Autonomous Campus Vehicle



UAM-Based PAV



UAM-Based PAV



Autonomous Car



e - Bike



SUSTAINABLE MOBILITY

Energy efficient and eco-friendly



SEAMLESS CONNECTIVITY

Integrated solutions across all modes



SAFE & RELIABLE

Autonomous navigation for secure travel



FUTURE READY

Building intelligent transport ecosystem

Experience Innovation.


Embrace Tomorrow.

Connect with TiHAN-IITH Today

Contact us for product demonstrations, inquiries, and customized solutions. Partner with us to drive the future of autonomous mobility and advanced technologies.

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