

IITNiF Strategic Applications and Research in Positioning, Navigation, and Timing (STAR-PNT) Summer Internship

An Initiative from IIT Tirupati Navavishkar I-Hub Foundation (IITNiF) an Technology Innovation Hub in Positioning and Precision Technologies

Second Call IITNiF STAR-PNT Summer Internships 2024

We are delighted to introduce the Second Edition of STAR-PNT Summer Internship Program at IIT Tirupati's Technology Innovation Hub. This prestigious program, entitled **ST**rategic **A**pplications and **R**esearch in **P**ositioning, **N**avigation, and **T**iming (STAR-PNT), is meticulously designed to propel forward-thinking students into the forefront of geospatial technology and engineering.

The STAR-PNT Program invites undergraduates and postgraduates to immerse themselves in a rigorous research environment where they will explore and innovate within the fields of positioning, navigation, and timing. Our program aims to harness the sharp minds of ambitious students to pioneer solutions that address real-world challenges in navigation technology and geospatial science.

Throughout the summer, interns will have the opportunity to work alongside renowned experts and utilize cutting-edge technology to conduct strategic research and development projects. This hands-on experience not only enhances their technical skills but also prepares them for high-impact careers in academia, industry, and beyond.

Join us at IIT Tirupati and TIH Spoke institutions for the STAR-PNT Program, where you will contribute to groundbreaking research while building a robust professional network and opening doors to future opportunities in technology innovation.

About STAR-PNT Summer Internship Program

Program Duration	June 20 - August 15, 2024
Eligibility Criteria	Candidates must have completed: 6 semesters of B.E./B.Tech.; 4 semesters of B.Sc.; 2 semesters of M.Tech./M.Sc., in relevant fields
Stipend	Rs 5,000 per month
Accommodation	Boarding, food, and lodging to be borne by the students; hostel subject to availability and must be requested in advance
Travel	Expenses to be borne by the students
Team Size	Maximum of 2 members (will be pooled by the Host Institute project coordinator)
Application Requirements	Adherence to campus rules of Host Institute; unsatisfactory progress for two consecutive weeks may lead to termination of the internship
Internship Locations	<ol style="list-style-type: none">1. IIT Tirupati Navavishkar I-Hub Foundation (IITTNiF), Tirupati, Andhra Pradesh2. International Centre for Free and Open Source Software (ICFOSS), Trivandrum, Kerala3. SASTRA Deemed University, Thanjavur, Tamil Nadu

Note: Each student may participate in only one project.

Additional Details:

Internship Structure: Teams will engage in projects ranging from GIS mapping to advanced navigational tech. These projects aim to enhance technical skills and encourage real-world application and prototyping.

Future Opportunities: Post-internship, there is potential for continuation of projects as capstone assignments with startups and industry, which are paid positions. This enhances resumes and professional networks.

Benefits of Specializing in PNT: Specializing in Positioning and Precision Technologies opens up opportunities in diverse fields such as aerospace, automotive industries, and defense. Skills in GIS, remote sensing, and GNSS/IRNSS are highly valued.

Join Us:

This summer, IIT Tirupati invites you to a journey of innovation and exploration in the world of technology. Embark on projects that challenge your understanding and contribute to technological advancements. Apply today and be part of a summer that could define your future!

Apply Here: [Registration Form](#)

DOMAIN INTERESTS				
Attribute	Details	Location		
Offered At		TIH IIT Tirupati	ICFOSS Trivandrum	SASTRA Thanjavur
Project 1: Integration of GPS with IoT for Precision Agriculture				
Scope	Integrate GPS with IoT for precision agriculture to monitor soil moisture, temperature, and asset tracking.	✓		✓
Objectives	Design IoT modules, integrate GPS receivers, and develop data fusion methods for enhanced spatial analysis.			
Methodology	Develop IoT modules for parameter monitoring, integrate GPS into IoT networks, and create data fusion algorithms.			
Technologies & Tools	IoT sensors, GPS receivers, communication protocols ,data fusion algorithms.			
Timeline	8 weeks			
Outcomes	Integrated IoT solution for precision agriculture, enhanced spatial analysis, improved decision-making.			
Project 2: Web based dashboard to monitor crop health and growth				
Scope	Develop a visual dashboard and predictive model for farmers to monitor crop health and growth			
Objectives	Plot crop types and soil moisture on a geo map, develop predictive models for growth, water needs, disease.			

Methodology	Design dashboard, integrate geo mapping, develop predictive model, create user-friendly GUI.			
Technologies & Tools	Visualisation tools, predictive modeling, GUI frameworks.			
Timeline	8 weeks			
Outcomes	Visual dashboard for crop monitoring, predictive model for growth and disease, user-friendly GUI.	✓		
Project 3: Web based Dashboard for Dead Reckoning Navigation System				
Scope	Develop a MATLAB/Python-based navigation system using inertial sensors for position estimation.			
Objectives	Implement sensor data acquisition, develop dead reckoning algorithm, integrate error correction, validate system performance.			
Methodology	Research, data acquisition, algorithm development, error analysis, integration, testing, documentation.	✓		
Technologies & Tools	MATLAB/Python, Signal Processing Toolbox, Control System Toolbox.			
Timeline	8 weeks			
Outcomes	MATLAB/Python codebase, technical documentation, validated navigation system.			
Project 4: Kinematic positioning for swarm vehicles				
Scope	Develop a MATLAB/Python simulation framework for RTK positioning of swarm vehicles using simulated GNSS measurements.	✓		

Objectives	Implement RTK positioning algorithms, create a simulation environment, evaluate accuracy and reliability.			
Methodology	Algorithm development, simulation environment creation, integration, testing, analysis.			
Technologies & Tools	MATLAB/Python, Signal Processing Toolbox, Mapping Toolbox, Simulink.			
Timeline	8 weeks			
Outcomes	MATLAB/Python simulation framework, insights into RTK positioning accuracy and reliability.			
Project 5: Low-Noise Amplifier (LNA) for IRNSS				
Scope	Design and optimize the Low-Noise Amplifier (LNA) circuitry for the IRNSS receiver module			
Objectives	Achieve high gain, low noise figure, and wide bandwidth to enhance sensitivity and reception of IRNSS signals.			
Methodology	Use RF simulation software to design and simulate the LNA circuit	✓		✓
Technologies & Tools	EDA Tools			
Timeline	8 weeks			
Outcomes	Optimized LNA circuit design with high gain, low noise figure, and wide bandwidth, suitable for integration into the IRNSS receiver module.			
Project 6: Navigation system for visually impaired individuals				
Scope	Develop a GNSS-based navigation aid for visually impaired individuals, offering audio cues and tactile feedback.	✓		

Objectives	Create navigation aid, integrate GNSS for indoor/outdoor navigation, provide audio and tactile feedback.			
Methodology	Design user-friendly interface, incorporate GNSS technology, implement audio and tactile feedback mechanisms.			
Technologies & Tools	GNSS receivers, audio processing software, tactile feedback devices, mobile app development tools.			
Timeline	8 weeks			
Outcomes	GNSS-based navigation aid for visually impaired, enhanced indoor/outdoor navigation experience.			
Project 7: Multiband Band Pass Filter for GNSS				
Scope	Design and develop a multiband band pass filter suitable for GNSS applications			
Objectives	The BPF should be capable of selectively passing signals in multiple frequency bands used by GNSS satellites			
Methodology	Design BPF for specified frequency using EDA tools, fabricate and test the prototype	✓		✓
Technologies & Tools	EDA Tools, Fabrication & VNA for measurements			
Timeline	8 weeks			
Outcomes	BPF prototype which can be utilised for GNSS applications			
Project 8: Law Enforcement GIS Dashboard				
Scope	Create a GIS dashboard to handle law enforcement data.	✓	✓	
Objectives	Facilitate decision-making in law enforcement operations			

Methodology	Develop an interactive dashboard that displays diverse data types			
Technologies & Tools	JavaScript, Python, HTML/CSS, GIS software			
Timeline	8 weeks			
Outcomes	A GIS dashboard designed for efficient law enforcement management			
Project 9: Urban Heat Island Effect Analysis				
Scope	Create a tool to study the urban heat island effect using remote sensing and GIS			
Objectives	Understand and mitigate the heat island effect in cities			
Methodology	Use remote sensing data to map temperature variations and integrate this data with GIS for analysis		✓	
Technologies & Tools	Remote sensing software, GIS tools, environmental simulation software			
Timeline	8 weeks			
Outcomes	Help urban planners identify and address areas with concentrated heat.			
Project 10: Urban Air Quality Monitoring Using GIS				
Scope	Construct a system to monitor and report urban air quality using GIS and real-time sensor data			
Objectives	Provide public access to real-time air quality information and support environmental management			
Methodology	Link air quality sensors with a GIS system to track and display pollution levels	✓	✓	
Technologies & Tools	Air quality sensors, GIS platforms, web development tools			

Timeline	8 weeks			
Outcomes	An online GIS-based system that delivers real-time air quality updates and health advisories			
Project 11: Interactive Open Source GIS-Based Tourist Information System for Local self Government				
Scope	Develop an interactive tourist guide that leverages GIS data to provide information on attractions, routes, and services			
Objectives	Enhance the tourist experience by offering accessible and detailed geographic information.			
Methodology	Build a mobile application that integrates GIS data with multimedia content about tourist sites.		✓	
Technologies & Tools	Web application platforms, GIS software, content management systems.			
Timeline	8 weeks			
Outcomes	A user-web platform that provides tourists with real-time information, navigation, and services based on their location.			
Project 12: Urban Expansion and Land Use Change Dashboard				
Scope	Monitor urban growth and land use changes using a Google Earth Engine (GEE) dashboard			
Objectives	Understand urban expansion patterns to improve planning			
Methodology	Analyze satellite imagery to map urban areas and track land use changes.		✓	
Technologies & Tools	Google Earth Engine, JavaScript, remote sensing data			

Timeline	8 weeks			
Outcomes	An interactive dashboard displaying urban growth and land use changes.			
Project 13: Wildlife Tracking System				
Scope	Create a system for tracking wildlife using GPS and GIS			
Objectives	Monitor wildlife movements and behaviors.			
Methodology	Develop GPS collars and integrate data with GIS.	✓	✓	
Technologies & Tools	GPS devices, GIS platforms, data analytics.			
Timeline	8 weeks			
Outcomes	System providing real-time data on wildlife locations and movements.			
Project 14: Flood Risk Mapping Using Remote Sensing				
Scope	Develop a flood risk assessment tool using remote sensing.			
Objectives	Enhance preparedness for floods with accurate risk maps.			
Methodology	Analyze remote sensing data for flood-prone area identification.	✓	✓	
Technologies & Tools	Remote sensing software, GIS tools.			
Timeline	8 weeks			
Outcomes	Map showing flood risks in selected regions.			
Project 15: Wearable Human Health Monitoring System				
Scope	Develop a GNSS-based wearable for monitoring health.		✓	
Objectives	Provide a safety net for individuals via monitoring.			

Methodology	Integrate GNSS with health sensors in a wearable device.			
Technologies & Tools	GNSS modules, sensors, wearables, apps.			
Timeline	8 weeks			
Outcomes	Wearable device tracking location and vital signs, with emergency alerts.			
Project 16: Drone based GIS Data Collection System				
Scope	Design a system using drones to collect GIS data for mapping hard-to-reach areas.			
Objectives	Enhance the accuracy and efficiency of GIS data collection.			
Methodology	Use drones equipped with cameras and sensors to gather geographic data.		✓	
Technologies & Tools	Drones, camera and sensor technologies, GIS software.			
Timeline	8 weeks			
Outcomes	Drone system capable of collecting detailed geographic data.			
Project 17: GIS-Based Water Quality Monitoring System				
Scope	Design a system to monitor water quality using GIS and IoT sensors.			
Objectives	Provide real-time data on water quality to government and public agencies.			
Methodology	Integrate water quality sensors with a GIS system to monitor and analyze water data.	✓	✓	
Technologies & Tools	IoT sensors, GIS software, data analytics platforms.			
Timeline	8 weeks			
Outcomes	System that constantly monitors water quality and provides actionable insights.			

Project 18: Disaster Response Drone System				
Scope	Create a drone system designed for rapid deployment in disaster zones to gather real-time data.			
Objectives	Enhance disaster response efforts with immediate aerial data collection.			
Methodology	Equip drones with cameras and sensors; develop software for real-time data transmission to rescue teams.		✓	
Technologies & Tools	Drones, real-time video processing software, GIS integration.			
Timeline	8 weeks			
Outcomes	Interactive dashboard with insights into crop conditions and soil health.			
Project 19: Beam steering Algorithms				
Scope	Evaluation and Implementation of beam steering algorithms for linear/planar array			
Objectives	Steering antenna arrays towards desired signal sources			
Methodology	MATLAB or Python for testing and validation.			✓
Technologies & Tools	MATLAB/SystemVue/Python			
Timeline	8 weeks			
Outcomes	Optimized algorithms for real-time performance.			
Project 20: Array Antenna Feed Network				
Scope	Design of the feed network topology.			
Objectives	To optimize the feed network for desired characteristics such as gain,			✓

	bandwidth and side lobe levels.			
Methodology	Design & Simulate feed network			
Technologies & Tools	EDA Tools			
Timeline	8 weeks			
Outcomes	Experimental validation demonstrating the functionality and performance of the prototype feed network.			
Project 21: Radio Source Tracker				
Scope	Develop a Radio Source Tracker system capable of identifying and tracking Radiofrequency source.			
Objectives	Design and develop a hardware (SDR) platform for RF signal detection.			
Methodology	RF signal detection and measurement, including antennas, receivers, and signal processing units.			✓
Technologies & Tools	Radar technology, signal processing, Python/MATLAB/SystemVue.			
Timeline	8 weeks			
Outcomes	Radio Source Tracker system capable of detecting, identifying, and tracking the desired RF source.			
Project 22: SDR-based FMCW Transceiver				
Scope	Develop a Software-Defined Radio (SDR)-based Frequency Modulated Continuous Wave (FMCW) transceiver.			✓

Objectives	Hardware architecture for the SDR-based FMCW transceiver, including RF frontend units.			
Methodology	Gather requirements and define the specifications for the SDR-based FMCW transceiver.			
Technologies & Tools	USRP/Blade RF, Spectrum Analyzer			
Timeline	8 weeks			
Outcomes	SDR-based FMCW transceiver capable of generating, transmitting, receiving, and processing FMCW radar signals.			
Project 23: NAVIC Waveform Generator				
Scope	Develop a NAVIC (Navigation with Indian Constellation) waveform generator system.			
Objectives	Simulate/generate NAVIC signals.			
Methodology	Integrate hardware and software components to create a functional NAVIC waveform generator.	✓		✓
Technologies & Tools	Python/Matlab/SystemVue, Microwave Analyser, Vector Signal Source			
Timeline	8 weeks			
Outcomes	NAVIC waveform generator.			
Project 24: GPS Jammer				
Scope	Design a GPS jammer	✓		✓
Objectives	To Jam GPS receivers in a laboratory environment.			

Methodology	Integrate hardware and software components to demonstrate a GPS jammer.			
Technologies & Tools	SDR, Vector Signal Source, Microwave Analyser			
Timeline	8 weeks			
Outcomes	A functional GPS jammer.			
Project 25: GPS Spoofer				
Scope	Develop a GPS spoofer.			
Objectives	Detecting and analyzing GPS spoofing signals			
Methodology	Integrate hardware and software components to create a functional GPS spoofing system.	✓		✓
Technologies & Tools	SDR, Python			
Timeline	8 weeks			
Outcomes	A functional GPS spoofer.			
Project 26: GNSS data processing and analysis				
Scope	Develop algorithms and software modules for processing and analyzing GNSS raw data.			
Objectives	Implement algorithm for acquisition, tracking and position estimation			
Methodology	Research GNSS signal processing techniques, implement algorithms in MATLAB, Python, or C/C++			
Technologies & Tools	MATLAB, Python, C/C++, GNSS simulation software	✓		✓
Timeline	8 weeks			

Outcomes	Functional GNSS data processing software and validate algorithms using simulated and real-world GNSS data			
Project 27: Kalman Filters for NAVIC				
Scope	Design of Kalman filters for enhancing the accuracy and reliability of NAVIC satellite-based navigation systems.			✓
Objectives	To process NAVIC satellite measurements and estimate the user's position, velocity, and timing (PVT) solutions.			
Methodology	Integrate Kalman filters into NAVIC-compatible receiver.			
Technologies & Tools	GIS software, EDA Tools, SDR.			
Timeline	8 weeks			
Outcomes	Enhanced accuracy and reliability of NAVIC-compatible navigation systems.			
Project 28: ML for TEC Estimation				
Scope	Machine learning (ML) techniques for Total Electron Content (TEC) estimation in the ionosphere.			✓
Objectives	Evaluate basic ML method to estimate preprocessed TEC data.			
Methodology	Train ML models using labeled TEC data.			
Technologies & Tools	Python/Matlab			
Timeline	8 weeks			

Outcomes	Trained ML models for TEC estimation.			
Project 29: Microstrip Antenna for Synthetic Aperture Radar in Sea Level Rise Monitoring				
Scope	Design and Develop a microstrip antenna to analyze sea level rise monitoring			
Objectives	Reduce energy consumption and enhance safety in urban areas.			
Methodology	Gather sea level data from government stations and define requirements. Design the antenna and Integrate the optimized design into a SAR model.			✓
Technologies & Tools	EDA Tools, Antenna Design Technology			
Timeline	8 Weeks			
Outcomes	Development of a highly accurate and efficient Synthetic Aperture Radar (SAR) system tailored for monitoring sea level rise.			
Project 30: Ultrasonics for underwater surface topography				
Scope	Design, implementation, and testing of an ultrasonic-based system for underwater surface topography mapping			
Objectives	Design an underwater ultrasonic sensor system capable of emitting and receiving signals & develop signal processing algorithms to extract depth information	✓		✓
Methodology	Develop a hardware prototype implemented with signal processing algorithms to map underwater topology			
Technologies & Tools	Microcontroller, MATLAB, sensors			

Timeline	8 weeks			
Outcomes	Hardware prototype which can measure and map underwater topology			
Project 31: Building extraction & modeling using LiDAR		✓		
Scope	Create 3D models of urban environment			
Objectives	Extract and analyse building features using maps			
Methodology	Use of 3D modeling and aerial LiDAR data			
Technologies & Tools	Modeling softwares & data processing			
Timeline	8 weeks			
Outcomes	Urban 3D models for infrastructure planning			
Project 32: Urban Heat Island mapping using LiDAR		✓		
Scope	Analyse heat island effects in urban areas			
Objectives	Identify and map areas with high temperature effects			
Methodology	LiDAR based surface temperature analysis			
Technologies & Tools	GIS & LiDAR processing software			
Timeline	8 weeks			
Outcomes	Urban heat island mapping and mitigation strategies			
Project 33: LiDAR based transportation planning		✓		
Scope	Determine optimal routes for transportation			
Objectives	Design routes for different forms of transportation			
Technologies & Tools	GIS & LiDAR processing software			

Timeline	8 weeks			
Outcomes	Transportation planning for urban areas			
Project 34: Utility Detection and Mapping using GPR		✓		
Scope	Survey the campus to detect underground utilities and infrastructure			
Objectives	Create a comprehensive map of utilities to aid in campus maintenance and projects			
Methodology	Conduct GPR surveys, process and interpret data, integrate findings into GIS software			
Technologies & Tools	GPR, GIS & Data processing software			
Timeline	8 weeks			
Outcomes	Utility maps for campus, improved planning and reduced risk of utility damage.			
