

Postdoctoral Research Associate (PDRA) Position in Electrical Engineering at IIT Gandhinagar

Number of vacancies: 1

Project Title

Experimental Characterization of Asymptotic Scaling Laws in Beyond Convex-Hull (BCH) Range-Based Localization

Name and Affiliation of PI

Prof. Raghunandan M. Rao, Department of Electrical Engineering, IIT Gandhinagar

Project Description and Objectives

Accurate localization of targets lying outside the convex hull of anchors is a fundamental challenge in vehicle-centric and infrastructure-free localization systems. Recent theoretical work has established asymptotic scaling laws for Time-of-Arrival (ToA) localization in beyond-convex-hull (BCH) geometries. However, a corresponding theoretical framework for Time-Difference-of-Arrival (TDoA) localization, and its validation under realistic synchronization, bandwidth, and propagation constraints, remains an open research problem. Addressing this gap is critical for practical wideband radio and millimeter wave (mmWave)-based localization systems, where hardware impairments, scaling limitations due to synchronization complexity, and geometry-induced degradation jointly determine achievable performance.

The primary objectives of the this project are to:

1. Develop a rigorous theoretical framework for TDoA localization in BCH scenarios, including Cramer-Rao Lower Bound (CRLB) and Dilution of Precision (DOP) analysis and asymptotic error scaling laws.
2. Lead the development, synchronization, and calibration of a Universal Software Radio Peripheral (USRP)- and millimeter wave (mmWave) radar-based localization testbed.
3. Experimentally characterize localization error scaling as a function of target distance, Signal-to-Noise-Ratio (SNR), bandwidth, and anchor geometry.
4. Refine theoretical asymptotic models using experimental evidence, accounting for synchronization jitter, finite bandwidth, and multipath-induced biases.

Role and Responsibilities of the Post-Doctoral Scholar

The PDRA will play a central role in both theoretical and experimental aspects of the project. Responsibilities include analytical derivations, Monte-Carlo simulations, implementation of signal processing algorithms, integration and debugging of the localization testbed, and execution of large-scale measurement campaigns. The PDRA will also mentor M.Tech and Ph.D. students involved in the project and actively contribute to high-quality journal and conference publications.

Essential Qualification/Experience as per the norms

1. The percentage/grade points with respect to the academic qualifications will be a minimum of 60% or equivalent grade from Graduation onwards and 55% or equivalent grade in class 10th and 12th.
2. Ph.D. in Electrical Engineering or relevant area; Candidates who have submitted Ph.D. thesis are also welcome to apply.
3. Candidates must have a strong publication record in the areas of Communications/ Signal processing.

Desirable Qualification/Experience

1. The percentage/grade points with respect to the academic qualifications will be a minimum of 60% or equivalent grade from Graduation onwards and 55% or equivalent grade in class 10th and 12th.
2. Ph.D. in Electrical Engineering or relevant area; Candidates who have submitted Ph.D. thesis are also welcome to apply.
3. Candidates must have a strong publication record in the areas of Communications/ Signal processing.
4. A strong mathematical background in topics such as Random Processes, Linear Algebra, Communication Theory, and Signal Processing is a plus.
5. Hands-on experience with software radios (USRPs) and RF sensors is a plus.

Duration (Initial appointment)

12 Months

Application Procedure

Complete the application here (<https://forms.gle/pidJTyNR4FRkChtK6>)

Remuneration

72,000 INR per month (consolidated)

Contact

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Application Deadline

1st May 2026