

Nithish Krishnabharathi Gnani

Technical Associate

✉ nkgnani101@gmail.com
🌐 nithishkggnani.github.io
in [nithish-k-gnani](#)

Education

2013 - 2017 **Bachelor of Technology - Mechanical Engineering**, *National Institute of Technology Karnataka (NITK)*, Surathkal, Karnataka, India
NITK is a top 10 engineering institution under the [National Institutional Ranking Framework \(NIRF\)](#).

Work Experience

2019 - Present **Research Assistant** → **Technical Associate**, *Indian Institute of Science (IISc)*, Bangalore
Department of Electronic Systems Engineering & Center for Networked Intelligence
IISc is India's [top ranked university under NIRF](#)

- Leading industry-funded research projects. I'm sponsored by the Center for Networked Intelligence (CNI), a Cisco CSR initiative at Robert Bosch Center for Cyber-Physical Systems (RBCCPS).

2017 - 2018 **Team Leader, Maintenance**, *Hindustan Coca-Cola Beverages Private Limited*, Hyderabad

- Managed a team of 20+ associates to achieve consistent reliability of utility systems.

Publications

INFOCOM'24 *accepted* EdgeP4: In-Network Edge Intelligence for a Tactile Cyber-Physical System Testbed Across Cities
Nithish K Gnani, Joydeep P, Deepak C, Himanshu V, Soumya R, Kaushal M, T. V. Prabhakar, C Singh

INFOCOM'24 *accepted* Towards a TSN-DetNet Intercity Testbed for Tactile Cyber-Physical Systems
Joydeep P, **Nithish K Gnani**, Deepak C, Chandramani Singh, T. V. Prabhakar, H. K. Atluri, Paventhan A

ACM Journal [🔗](#) 2021 Sensor Identification via Acoustic Physically Unclonable Function, ACM DTRAP
Girish Vaidya, T.V.Prabhakar, **Nithish K Gnani**, Ryan Shah, Shishir Nagaraja

Wiley Journal [🔗](#) 2020 Judicious data management for sustaining an energy harvesting sensor node, Wiley CCPE
K Singh, P Shukla, Sachin S. M., **Nithish K Gnani**, Prabhakar T. V., Joy Kuri

Under review 2023 DIA: Intercontinental Haptic Bilateral Teleoperation
H.J.C. Kroep, **Nithish K Gnani**, RR Venkatesha Prasad, T V Prabhakar

Under review [🔗](#) 2023 μ TAS: Design and implementation of Time Aware Shaper on SmartNICs to achieve bounded latency
Joydeep Pal, Deepak Choudhary, **Nithish K Gnani**, Chandramani Singh, T. V. Prabhakar

Research Experience and Projects [🔗](#)

Cyber-Physical Systems and Tactile Internet

Jun 2023 - Present **Intercontinental teleoperation**, *IISc & TU Delft*, Under Profs. T V Prabhakar & R R Venkatesha Prasad

- Built the *remote domain* consisting of a robotic arm, depth camera using ROS and a dynamic drawing mechanism at IISc and interfaced it with the operator domain consisting of a haptic device at TU Delft.
- Trained two masters students from TU Delft on working with the remote domain
- Novelty - Operator Intent**: A framework that extends Model Mediated Teleoperation to prioritise operator intent to tackle dynamic environments and high latency of up to 1 second.

Mar 2022 - Present **Designing Tactile Cyber-Physical Systems**, *IISc*, Under Profs. Chandramani Singh & T V Prabhakar, Funders: Ministry of Electronics and Information Technology (MeitY), Govt. of India & Cisco CNI
Preprint [🔗](#)

- Built a Tactile Cyber-Physical System (TCPS) testbed with a robotic arm and haptic device to demonstrate teleoperation for real-time interaction between humans and robots in real and virtual worlds for applications requiring ultra-reliable low latency communication (uRLLC).
- Programmed a Geomagic Touch haptic device with C/C++ to asynchronously get coordinates and velocity and send them to the robot as UDP packets. Programmed a UR3 robotic arm using ROS-Python to receive control packets, move to the desired pose, and send position feedback.
- Novelty - EdgeP4**: Developed and implemented edge intelligence algorithms for teleoperation, *pose correction* and *tremor suppression* on P4-programmable network edge switch ports. Reduced control loop latency ($<100 \mu\text{s}$ for *pose correction* task) and network load (99% reduction). Multiple algorithms can be hosted on the same edge switch, which can seamlessly switch between the algorithms depending on the tasks.

Mar 2021 - Present **Time Sensitive Networking (TSN) switch**, IISc, Under Prof. Chandramani Singh & Prof. T V Prabhakar, Funders: Ministry of Electronics and Information Technology (MeitY), Govt. of India & Cisco CNI

Preprint [🔗](#)

- Building an IEEE 802.1 TSN capable ethernet switch by implementing in hardware, a. time synchronization (IEEE 802.1AS), b. Time Aware Shaper (IEEE 802.1Qbv), and c. packet duplication and elimination (IEEE. 802.1CB).
- **Novelty** - μ TAS: Did a P4 - Micro C based system implementation of Time-Aware Shaper onto a programmable SmartNIC. Achieved a latency bound of 20 μ s between two end hosts connected through two switches.
- **Novelty**: Developed packet de-duplication algorithms for SmartNICs to efficiently eliminate duplicates for enhancing the reliability of Scheduled Traffic in Time-Sensitive Networks. For duplicating over two links with 10% packet losses in each, achieved perfect de-duplication for a single 2.5 Gbps stream. For 12 simultaneous streams of total 1 Gbps, obtained de-duplication efficiency of 99.88% with 99.83% packet delivery.

Jul 2016 - Apr 2017 **Yaw Control of a CubeSat Using Reaction Wheels**, National Institute of Technology, Karnataka, Bachelor's thesis project under Prof. Prasad Krishna

- Designed a suspended CubeSat model and achieved precise yaw control using reaction wheels using a PID controller.
- Modeled it in Simulink and implemented Model Reference Adaptive Control (MRAC) using the MIT rule and achieved better settling time, overshoot, and steady-state error compared to PID control.

Wireless communication and video streaming

Mar 2020 - Jun 2022 **5G AMMAZING**, IISc, Under Prof. K J Vinoy & Prof. T V Prabhakar

- An end-to-end 5G mmWave system for infotainment.
- **Novelty**: Data & control plane of a video stream split over 5G and regular Wi-Fi.

Achievement

Won first place (€6,500 cash award) in 5G Hackathon 2020 by Govt. of India (among 1100+ teams). [🔗](#)

July 2020 - Jun 2021 **Wi-Fi modeling**, IISc, Under Prof. Neelesh Mehta & Prof. Chandramani Singh, Funder: Boeing

- Modelling & simulation of IEEE 802.11n & 802.11ac using MATLAB.
- Performance Metrics: throughput, packet error rate & range.
- Implementing Rate Control Algorithms in MATLAB.

Feb 2020 - Jan 2021 **Video casting in dense environment**, IISc, Under Prof. T V Prabhakar, Funder: Boeing

- As 2.4 & 5 GHz Wi-Fi is congested in an aircraft cabin in which 400+ passengers cast media onto seat back displays in close proximity, using IEEE 802.11ad, 60GHz Wi-Fi (Wi-Gig) & 802.11ax (Wi-Fi 6E) was explored.
- MATLAB WLAN Toolbox was used to simulate the physical behavior of Wi-Fi transmissions in a dense environment.
- **Novelty**: Developed an algorithm that dynamically allocates different channels to 400 transmitters such that the packet error ratio is zero (PER = 0).

IoT data management, indoor localization and security

Nov 2019 - Jul 2021, **Acoustic Physically Unclonable Function (APUF) for sensor device security**, IISc, Under Prof. T V Prabhakar

Published at ACM DTRAP [🔗](#)

- APUF is a novel technique to identify sensor devices and their positions by exploiting the physical property variations and acoustic fingerprinting.
- Applications: monitoring calibration-integrity and authentication in sensor-network deployments.
- Applied a K-Nearest Neighbors model to evaluate the accuracy of the uniqueness signature and the position signature for different cases of accumulation and temperature.
- Achieved over 99% identification accuracy with scalability and displacement detection sensitivity of 5 cm.
- **Novelty**: Unlike the usual method of adding PUF circuitry while manufacturing the device, here PUF is extracted using microphones connected to any commercially available device with an ADC.

Nov 2019 - Jun 2020, **Data management of energy harvesting powered IoT sensors**, IISc, Under Prof. T V Prabhakar

Published at Wiley CCPE [🔗](#)

- **Novelty**: Developed an *adaptive sampling* algorithm that adjusts the sampling rate and resolution of the temperature sensor based on the energy available in a vibration and heat harvesting sensor node.
- **Novelty**: *Regulating function* that balances the amount of transmitted data and the reconstruction error at the aggregator based on the node's energy and the data characteristics, such as priority and rate of change.
- *Under publication*: Comparing the performance of Auto Regression, Long Short-Term Memory, and dynamic programming based algorithms with adaptive sampling and regulating function.

Jun 2019 - Feb 2020 **Airplane IoT data management**, IISc, Under Prof. T V Prabhakar, Funder: Boeing

- Developed machine learning algorithms to classify anomalies and take corrective actions using real-time data generated from sensors from a MATLAB/Simulink model of an aircraft environmental control system.
- **Novelty**: Developed an algorithm that does linear interpolation between non-consecutive data points from time series data to adaptively store data based on a cost function that balances storage space savings and error in reconstruction of data. Achieved 96% savings in storage space.


Mar 2019 - **Acoustics Based Localization**, IISc, Under Prof. Chandramani Singh & Prof. T V Prabhakar, Funder:
Jan 2020 Boeing

- Developed an application to locate multiple wireless edge devices with embedded microphones by using audio signals from speakers.
- Simulated a few localization algorithms using MATLAB. Implemented KNN fingerprinting based localization of the receivers (programmed Nordic nRF52940 based nodes using embedded C)
- Achieved localization accuracy of 98%.
- **Novelty:** Unlike the usual source localization, here, the receivers (microphones) are localized.

Manufacturing/Production

Nov 2017 - **Total Productive Maintenance (TPM)**, Hindustan Coca-Cola Beverages Pvt. Ltd.


Apr 2018

- Implemented TPM steps 4 & 5 - resulted in the bottling plant achieving [JIPM TPM Consistency Award](#) .
- Performed root cause analysis and took preventive measures. Achieved 80% reduction in failure in bottle capping.

Teaching Experience, Demonstrations and Talks

2023 **Instructor**, PG Level Advanced Certification Course in 5G Technologies with AI and Cloud, Taught two batches how to design cyber-physical systems leveraging programmable networks, *NSE TalentSprint and IISc*

Dec 2023 **Instructor**, P4 Workshop, Taught 20 participants from Power Grid Corporation of India Limited the basics of P4 with hands-on tutorial, *IISc*

Sep 2022  **Poster**, *Achieving bounded latency for time-sensitive applications*, Accepted in IBM-IISc Research Day, *IISc*

Demo/Talk **"Tactile Cyber-Physical Systems"**

May 2023 ITU Workshop, *IISc*

Mar 2023 IISc Open Day, *IISc*

Nov 2022 Cisco-IISc Day, *IISc*

Jul 2022 6th annual symposium of cyber-physical systems (CyPhySS), *IISc*

Jul 2022 Digital India Week, *Gandhinagar, Gujarat*

Skills



Programming Python, MATLAB, P4, C, C++, Embedded C, Shell

Hardware Netronome Agilio Smart NIC, Nordic nRF52 series, Arduino


Tools Linux, Git, Docker, LaTeX, Autodesk Fusion 360


Creative 3D printing, Shotcut, Snapseed


Certifications

1. Python Specialization – University of Michigan 
2. Deep Learning Specialization – DeepLearning.AI; 4/5 courses complete  1, 2, 3, 4


Interests and Activities

3D Prints  Designing and 3D printing figurines and functional items for home and office.

Flying Club  Built and flew RC planes of different types in NITK. Conducted RC plane building workshops.

Swimming  Gold medal in 800 yards, bronze in 1500 yards and 100 yards relay in Spectrum 2023, IISc.

Close to my heart

Feb 2019  Taught underprivileged girls at Yuwa School in rural Jharkhand, India. Coached students in tackling interviews. Prepared the team to attend the Laureus Awards 2019. Yuwa won the [Sports for Good award](#).