ARGHA SEN

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RESEARCH EXPERIENCE

- Experience with **mmWave and acoustic FMCW signal processing** techniques. I have used mmWave and accoustic FMCW sensors for localization, tracking and activity recognition of humans under indoor environments.
- Hands-on experience in **hardware prototyping** including circuit design, circuit debugging, deployment. Developed prototype hardwares for Embedded Pollution Sensors mounted on a drone for air quality assesment.
- Experience conducting **human research studies**. Conducted real-time driver inattenviness study using COTS mmWave Radars by collecting doppler shifts in the mmWave data because of drivers attentive body movements, such as talking, yawning, nodding, etc.
- Experience with design of **UAVs**, control systems, RF communication devices. Developed drones using ArduCopter APM flight controller board and mounted air quality measurement sensors.
- Experience with **Computer Networks**, IoT devices, Distributed Sensor Networks. Worked on energy optimisation in 5G Cellular Networks, using network simulator ns-3.

EDUCATION

Indian Institute of Technology Kharagpur *Jan 2021 - present*
Doctor of Philosophy
Department of Computer Science and Engineering

National Institute of Technology Durgapur *August 2016 - June 2020*
Bachelor of Technology **CGPA: 8.97**
Department of Electronics and Communication Engineering

Higher Secondary School *2016*
Central Board Of Higher Secondary Education (CBHSE) Aggregate Percentage: 95.4
Jawahar Navodaya Vidyalaya, Birbhum

Secondary School *2014*
Central Board Of Secondary Education (CBSE) Cum. GPA: 9.8
Jawahar Navodaya Vidyalaya, Birbhum

PUBLICATIONS

- **Argha Sen**, Anirban Das, Prasenjit Karmakar, Sandip Chakraborty "**mmAssist: Passive Monitoring of Driver's Attentiveness Using mmWave Sensors**". **COMSNETS 2023 (Accepted)**.
- **Argha Sen**, Ayan Zunaid, Soumyajit Chatterjee, Basabdatta Palit, Sandip Chakraborty "**Revisiting Cellular Throughput Prediction: Learning *in-situ* for Multi-device and Multi-network Considerations for 5G**". **Submitted in ACM TOMPECS (Under Review)**

- Basabdatta Palit, **Argha Sen**, Abhijit Mondal, Ayan Zunaid, Jay Jayatheerthan, Sandip Chakraborty "**Improving UE Energy Efficiency through Network-aware Video Streaming over 5G**". **Submitted in IEEE TNSM (Under Major Revision)**
- **Argha Sen**, Sashank Bonda, Jay Jayatheerthan, Sandip Chakraborty "**Implementation of mmWave-energy Module and Power Saving Schemes in ns-3**". **WNS3 2022**.
- **Argha Sen**, Sashank Bonda, Jay Jayatheerthan, Sandip Chakraborty "**An ns3-based Energy Module for 5G mmWave Base Stations**" **IEEE INFOCOM Workshops 2022**
- **Argha Sen**, Abhijit Mondal, Basabdatta Palit, Jay Jayatheerthan, Krishna Paul, Sandip Chakraborty "**An ns3-based Energy Module of 5G NR User Equipments for Millimeter Wave Networks**" **IEEE INFOCOM Workshops 2021**
- Praveen Kumar Sharma, Suraj Gupta, **Argha Sen**, Tanmoy De, Sujoy Saha "**Exploring Collision Avoidance during Communication Over Sound for Healthy Environment**" **SoCIeTY, ICDCN Workshops 2020**
- **Argha Sen**, Monsij Biswal, Shreyan Datta "**Intelligent Traffic Routing Based on Real-time Congestion Analysis**" **IEEE INDICON 2019**

RESEARCH PROJECTS

· **Real-time Multi-User Localization, Tracking, and Activity Recognition using mmWave (Ongoing)**
Abstract: With the recent advancement in 5G technology which builds on top of mmWave-based communication, we observe a massive paradigm shift towards a new form of RF sensing where millimeter-level range-resolution can be achieved in localizing a human subject or in determining their activities. In this project, we study the extent to which we can achieve high granularity mmWave sensing under diverse scenarios such as single or multi-user, macro, or micro-user activities. Finally, we implement a system to accurately localize and track multiple users inside a room and recognize their activities. The system is robust and monitors human activity opportunistically in real time under environment-independent scenarios.
GitHub: `https://github.com/arghasen10/mmWave-Parser`

· **mmWave Sensing for Live Monitoring and On-Device Inference of Dangerous Driving (Ongoing)**
Abstract: In this work, we explore the feasibility of purely using mmWave radars to detect dangerous driving behaviors. We first study characteristics of dangerous driving and find some unique patterns of range-doppler caused by 9 typical dangerous driving actions. We then develop a Fused-CNN model to detect dangerous driving instances from regular driving and classify 9 different dangerous driving actions. Through extensive experiments with 5 volunteer drivers in real driving environments, we observe that our system can distinguish dangerous driving actions with an average accuracy of 97 2%. We also compare our approach with existing state-of-the-art baselines to establish its significance.
GitHub: `https://anonymous.4open.science/r/mmdrive-02B4`

· **Capturing Facial Expression using COTS mmWave Radars (Ongoing)**
Abstract: In this project, we explore the feasibility of a mmWave-based facial expression recognition system. Firstly, we study the variation in the range-doppler of mmWave signals under different facial expressions. For that purpose we have used mmWave frontend radar IWR1642BOOST (77 GHz - 81 GHz) from Texas Instruments (TI) . The captured data gets transferred to the host machine via the DCA1000EVM board for further analysis to recognize the user's facial expression using several pre-processing libraries and, finally, ML/DL models. Currently it is in the development phase.
GitHub: `https://github.com/arghasen10/mmSmile`

WORK EXPERIENCE

Junior Research Fellow (INTEL sponsored Project) Oct 2020 - present

· Traffic Engineering for Enabling Energy-aware Design in Next Generation Cellular Networks
· mmwave-energy module for ns-3 (Completed)
GitHub: `https://github.com/arghasen10/mmwave-energy`

Teaching Assistant Jan 2022 - Apr 2022

· NPTEL, Sub: Computer Networks & Internet Protocol

Summer Research Intern May 2019 - July 2019
Integrated Test Range, Chandipur, DRDO, Govt. of India

· 3D Tracking and Geo-Localization of a target using Unmanned Aerial Vehicles

Winter Research Intern Nov 2018 - Jan 2019
Mobile Computing & Network Research Group MCNRG, NIT Durgapur

· AeT-Drone: Aerial Environment Sensing and Traffic Surveillance using sensor-enabled Drone/UAV
GitHub: `https://github.com/arghasen10/Image-Processing-in-UAV`
Video: `https://www.youtube.com/watch?v=t7wGiFjItSI`

Summer Intern May 2018 - July 2018
Criotam Technologies PVT LTD, Bangalore

· Designed and developed three IoT prototypes for Sports Authority of India. (Starting Block, Force Plate, Timing Gates)
· Developed a Facial Recognition system as a LockOut-Tagout (LOTO) system for Industrial IoT.
Video: `https://www.youtube.com/channel/UCEuhgjsfn7CaBQ2TpSGfjUw`

ACHIEVEMENTS

- Best Project Award at ITR Chandipur, DRDO Project title: 3D Tracking and geolocalization of the target using Unmanned Aerial Vehicles
- Participated in Festival of Innovation and Entrepreneurship (FINE) 2019 at NIF Gandhinagar, Gujarat from March 15 to 18, 2019.
- Presented a poster at the Workshop on Robotics and Assistive Technology (RAT 2019) organized by the National Institute of Technology Durgapur during January 3-5, 2019.
- 1st Position in Techmela, The annual science exhibition organized in AAROHAN 2019. AeT-Drone: Aerial Environment Sensing and Traffic Monitoring with Drone(UAV) complete working prototype presented in Techmela.
- 1st Position in Onspot IoT Hackathon organized in AAROHAN 2019: The first position among 70 entries in IoT Hackathon. An intrusion detection system with a Raspberry Pi Zero working prototype is presented.
- IoT Hackathon Winner: 1st Position in Hackoverflow, IoT Hackathon organized in Aavishkar 2018, Techno-Management fest of NIT Durgapur by GNU LINUX USER's GROUP and HackerEarth.
- District and School Topper in Higher Secondary Examination, CBHSE.

TECHNICAL SKILLS

Strongest Areas - Sensors, Signal Processing, Machine Learning, Embedded Systems, Internet Of Things, Computer networks, Unmanned Aerial Vehicles, Raspberry Pi, Arduino, UDOO Neo
Languages - Python, C, C++, UNIX Shell, JavaScript, Java, HTML, Android.

Tools and Frameworks - MmWave Studio, Matlab, Git, Android Studio, ns3, Mininet
Operating Systems - Linux: Ubuntu, Cent OS, Windows, Android

POSITION OF RESPONSIBILITY

Vice Captain of Team Robocon, NIT Durgapur - Sep 2018-Mar 2019 *NIT Durgapur*

Teaching Assistant; Advances in Operating Systems - July 2022-present *IIT Kharagpur*

Teaching Assistant; PDS - Jan 2021-July 2022 *IIT Kharagpur*

PERSONAL DETAILS

Date of Birth: 20th November, 1998
Gender: Male
Nationality: Indian
Permanent Address: Vill+P.O. Chatra, Rampurhat, Birbhum, West Bengal. PIN: 731238
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REFERENCES

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