Vaibhav Singh
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Education

Carnegie Mellon University — Pittsburgh, PA
- *PhD Candidate in Electrical and Computer Engineering; GPA: 4.00/4.00* — *Aug. 2018 – Present*
  Advisors: Prof. Swarun Kumar and Prof. Osman Yagan

Indian Institute of Technology Madras — Chennai, India
- *B.Tech(Honors) and M.Tech in Electrical Engineering; GPA: 9.22/10.0* — *July. 2013 – July. 2018*
  Advisor: Prof. David Koilpillai

Research Projects

- **Low Cost Satellite Image Access** — Carnegie Mellon University
  Advisors: Prof. Swarun Kumar and Prof. Osman Yagan — *Feb. 2021 - Oct. 2021*
  Operating/Renting bulky ground stations are a huge barrier to accessing latest satellite images today. In this project, we try to overcome this barrier by combining noisy images received from multiple satellites overhead using a single tiny receiver after correcting for perspective distortion and synchronization effects introduced due to the satellites' location.

- **Democratizing LEO Satellite Signal Access** — Carnegie Mellon University
  Advisors: Prof. Swarun Kumar and Prof. Osman Yagan — *Aug. 2018 - Aug. 2020*
  Satellite signal access is still considered scarce and available to only a few who are willing to deploy bulky base stations on their rooftops with clear view to the sky. In this project, after exploring different commercial groundstations, we design tiny hand held base stations which can be deployed in a distributed manner to coherently receive satellite signals at significantly lesser cost and size.

- **Millimeter Wave Full Duplex** — Carnegie Mellon University
  Advisors: Prof. Swarun Kumar and Prof. Jeyanandh Paramesh — *Mar. 2019 - Aug. 2019*
  mmWave is one of the important components of 5G technology where higher GHz frequencies are used to achieve large datarates. In this project, we demonstrated how existing mmWave frequency bands can be used more efficiently by enabling a full duplex link after effective cancelling all the self interference through novel techniques at the antenna, analog and digital domain.

- **Tire Wear Sensing** — Carnegie Mellon University
  Advisors: Prof. Swarun Kumar and Prof. Anthony Rowe — *Sep. 2019 - Dec. 2019*
  Tire tread Wear is one of the major causes of vehicular road accidents in the US. In this project, we designed a continuous tire tread wear monitoring system based on ISAR images generated from a mmWave radar mounted on the tire well of the vehicle and demonstrated how this system can work even in the presence of debris.

- **LoRa Localization** — Carnegie Mellon University
  Advisors: Prof. Swarun Kumar and Prof. Bob Iannucci — *Aug. 2020 - Oct. 2020*
  LP-WANs are one of the upcoming technologies for enabling IoT applications like sensing,inventory tracking,etc. due to its low cost and long battery life. However, their localization accuracy is limited to 100s of meters due to narrow bandwidths. In this project, we design a LoRa localization system improving the accuracy 10X by leveraging the TV white spaces to emulate a wide bandwidth operation.

- **RFID tags for Speech Recognition** — Carnegie Mellon University
  Advisors: Prof. Swarun Kumar and Prof. Carmel Majidi — *Dec. 2018 - Feb. 2019*
  Most speech assisting technologies require bulky external hardware to assist speech impaired patients. In this project we design stretchable RFID tags that can be stuck on a mute person's face whose response can be used to detect desired speech using ML and NLP models.

Publications

SelfieStick: Towards Earth Imaging from a Low-Cost Ground Module Using LEO Satellites (Conditionally Accepted), *Vaibhav Singh, Osman Yagan, Swarun Kumar*, ACM/IEEE IPSN 2022

A Community-Driven Approach to Democratize Access to Satellite Ground Stations, *Vaibhav Singh, Akarsh Prabhakara, Diana Zhang, Osman Yagan, Swarun Kumar*, ACM MobiCom 2021

OwLL: Accurate LoRa Localization using the TV Whitespaces, *Atul Bansal, Akshay Gadre, Vaibhav Singh, Anthony Rowe, Bob Iannucci, Swarun Kumar*, ACM/IEEE IPSN 2021

Full Duplex Radios: Are we there yet?, *Vaibhav Singh (co-primary author), Akshay Gadre (co-primary author), Swarun Kumar*, ACM HotNets 2020

Millimeter-Wave Full Duplex Radios, *Vaibhav Singh, Susnata Mondal, Akshay Gadre, Milind Srivastava, Jeyanandh Paramesh, Swarun Kumar*, ACM MobiCom 2020

RFID Tattoo: A Wireless Platform for Speech Recognition, *Jingxian Wang, Chengfeng Pan, Haojian Jin, Vaibhav Singh, Yash Jain, Jason Hong, Carmel Majidi, Swarun Kumar*, UbiComp 2020 **(Best Wearables Long Paper)**

Osprey: A mmWave Approach to Tire Wear Sensing, *Akarsh Prabhakara, Vaibhav Singh, Swarun Kumar, Anthony Rowe*, ACM MobiSys 2020 **(Best Paper Honorable Mention)**

Osprey Demo: A mmWave Approach to Tire Wear Sensing, *Akarsh Prabhakara, Vaibhav Singh, Swarun Kumar, Anthony Rowe*, ACM MobiSys 2020 **(Best Demo)**

Scholastic Achievements

- Awarded CIT James Sprague Presidential Fellowship 2021
- UbiComp 2020 Best Wearables Long Paper Award
- ACM MobiSys 2020 Best Paper Honorable Mention Award
- ACM MobiSys 2020 Best Demo Award
- Awarded CIT Dean's Fellowship 2018
- IITM Teaching Assistant Recognition Award 2018
- Prime Minister's Defense Scholarship 2016
- Indian Naval Benevolent Association Scholarship 2016

Internships

- **Microsoft Research** — Redmond, USA
  Networking Research Group — *May 2021- August 2021*
  - Investigated network connectivity solutions for Microsoft's Networking Research group.
- **Qualcomm India Private Limited** — Hyderabad, India
  Modem ML1 Sleep Team — *May 2017 - July 2017*
  - Designed new log packet to analyze the power consumption in different components in a cellular modem.
  - Trained a Neural Network model to identify anomalies in the warm up/down durations of modem.
- **PayPal India Private Limited** — Bengaluru, India
  Activities Team — *May 2016 - July 2016*
  - Extracted activities raw log data from master PayPal server and converted them into interpretable form.
  - Designed a web based UI for the activities team to generate the user defined metrics from the raw logs.
- **Titan Company Limited** — Bengaluru, India
  Central Technology Services Team — *May 2015 - July 2015*
  - Designed a battery operated Walk-In counter to be deployed in Titan Stores.
  - Improved the accuracy of conversion rates in stores and eliminated loss of data due to power outages.
  - Developed a Surface resistivity meter to display the amount of EMI coating on a lens.

Programming Skills

- **Languages**: C, Python, MATLAB **Tools**: mbed, EAGLE, LTSpice, mmWave Studio, Arduino

Teaching Experience

- **Wireless Communications** — Carnegie Mellon University
  Teaching Assistant — *Sept. 2020 - Dec. 2020*
- **Computer Networks** — Carnegie Mellon University
  Teaching Assistant — *Jan. 2020 - May 2020*
- **Introduction to Wireless and Cellular Communications** — Indian Institute of Technology Madras
  Teaching Assistant — *Jan. 2018 - May 2018*
- **Advanced Topics in Signal Processing** — Indian Institute of Technology Madras
  Teaching Assistant — *Aug. 2017 - Dec. 2017*