

FACULTY MENTOR

Zhang, Xinyu

PROJECT TITLE

A Programmable Millimeter-Wave Massive MIMO Radio for 5G Communications and Sensing

PROJECT DESCRIPTION

The first four generations of wireless networks mainly run on the low-frequency microwave band. For 5G and beyond, millimeter-wave will become the dominant communication medium. The availability of mobile millimeter-wave devices will also enable novel wireless sensing applications, such as automobile radar, and the Google Project Soli gesture sensing hardware. In this project, we will design and implement a hardware platform to enable exploration of such new communication and sensing paradigms. The platform will assemble existing RF chips and FPGA baseband processors into a programmable radio. The radio can be dual-used as a high-resolution imaging radar for security medical applications.

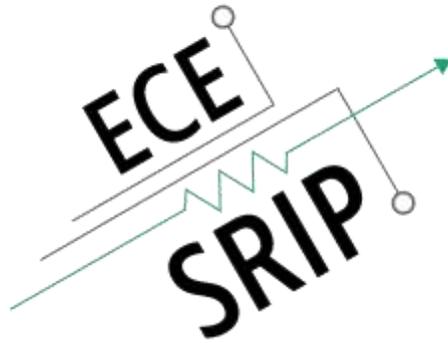
This project can accommodate both remote and in-person students

INTERNS NEEDED

3

PREREQUISITES

1. Experiences in FPGA programming
2. OR experiences in signal processing



FACULTY MENTOR

Zhang, Xinyu

PROJECT TITLE

Motion tracking using smart earbuds

PROJECT DESCRIPTION

In this project, we will use smart earbuds together with the associated smartphone to track the moving direction and distance of a user. We will extract the sensor readings from the devices, process them using a machine learning model (running inside the smartphone), and infer the user's location relative to a known starting point. The resulting system can be used for indoor navigation.

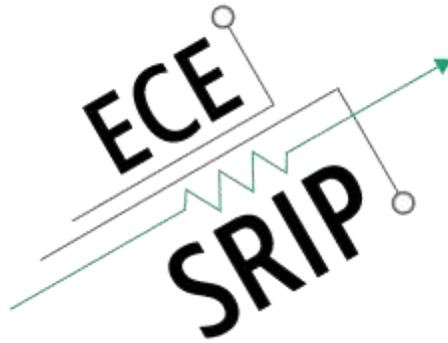
This project can accommodate both remote and in-person students

INTERNS NEEDED

2

PREREQUISITES

1. Experience or interest in learning machine learning techniques
2. Experiences in Java programming



FACULTY MENTOR

Zhang, Xinyu

PROJECT TITLE

Sensing Everyday Activities Using WiFi: A Machine Learning Based Framework

PROJECT DESCRIPTION

Knowledge about what a person does across the day is a critical input for many ubiquitous computing applications, such as life logging, elderly care, in-home patient care, etc. To obtain such information, existing approaches use either specialized on-body sensors which are intrusive and cumbersome to maintain, or cameras which do not work in low-light condition and often impinge on people's privacy. In this project, we propose to reuse WiFi radios as a wireless sensor to remotely track people's activities. The basic observation is that different activities will affect the WiFi signals in different ways. By collecting signal traces on WiFi devices, we can identify the activity based on a pattern recognition algorithm. This project will involve substantial amount of data collection, machine-learning model design and implementation.

This project can accommodate both remote and in-person students

INTERNS NEEDED

2

PREREQUISITES

1. Experiences in machine learning
2. Experiences in high-level language, such as Python