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UROP Faculty Supervisor: Joe Steinmeyer
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Affordable Distributed Lab Environment Sensors 2018

Project Overview

For the 2018 spring term, I will be working directly under Professor Steinmeyer in 38-500 for the development of an Affordable Distributed Lab Environment Sensor system (ADLES). The system will be built under the supervision of Professor Steinmeyer. The purpose of the project is several-fold: First it seeks to provide a means of measuring small changes in environmental characteristics including (but not limited to) humidity, temperature, pressure, and various gas concentrations over the scale of inches within environmental chambers for biological experiments via a distributed sensor network. This will be enabled by developing inexpensive small boards which can unobtrusively be placed within confined spaces such as incubators, biological containment chambers, and other locations. The goal is to easily provide researchers with more quantifiable data at higher spatial and temporal resolutions than is currently accessible for the purpose of aiding in supplementing experimental results. A second main goal is to develop a distributed system using the relatively new ESP32 SOC hardware produced by Espressif. The high level architecture of the system will comprise of a main server communicating via Wi-Fi, Bluetooth, or some other form of communication in the ISM band with several battery-powered modules comprised of an ESP32 SOC as well as the BME680 environmental sensor. These modules will frequently update the server with their local sensor readings which will then be integrated in a graphical user interface that researchers can monitor. Because affordability and low footprint are big concerns, custom made PCBs will be used for these modules. The ADLES system looks to expedite the experimental process and aid researchers in determining the causes for any fluctuations in data.

Personal Role & Responsibilities

I will be working under the discretion of Prof. Steinmeyer in 38-500. With his guidance and executive decisions, I will research the necessary components as well as bring out the entire end-to-end system. This includes looking into which chips and sensors would make the system fully functional, designing and minimizing the footprints, as well as creating the web interface through which the sensor data can be monitored.

Goals.

Personally, I want to increase my experience with bringing out end-to-end systems as well as put my systems designing and engineering abilities accumulated over the years at MIT to the test. I also wish to experience working independently with guidance from an experienced professor, and I hope to broaden my own capabilities.

Personal Statement

I have taken interested in this UROP mainly because of its concept, because being able to cut down the time researchers spend debugging their experiments at a low cost can definitely provide a positive impact towards the research community. I hope to learn many skills from

Professor Steinmeyer as well as improve my own design decision skills to be able to build better systems in the future.