Milestone 1: Minimap

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EECS 149-249A Final Project

Progress

We have finalized our hardware component selection and ordered all necessary components we are planning on using. We outlined the ESP32 GPIO for all peripherals and calculated estimated power consumption. We created a rough draft dependency graph to determine what steps can be parallelized. We have found most of the libraries that we plan to use to interface with our devices and are currently working on basic interfacing/functionality of each device. We have also set up the esp-idf development framework and got simple example programs running on our microcontroller. Hardware artifacts can be found here. Software artifacts are here. Initially we were considering using a RPi Pico W, so we set up a software development environment using pico-sdk; we will most likely not use this in the future.

Necessary Resources

- **Hardware**: ESP-32, RFM9X Lora Module, MPU-9250 9-Axis IMU, 500mAh 1s LiPo, Grove GPS module (or Grove Air530), Teyleten Display
- **Software Libraries**: Screen: esp_lcd_gc9a01, Lora Module: RadioLib, IMU: MPU-9250, GPS: mtk3339
- **Software Design Ideas**: Magnetometer-based heading calculation with IMU, Screen display API for GPS data and headings, Pairing algorithm/protocol, Transmission protocol for shared radio medium.

Schedule of Remaining Time

11/11 - 11/18: Finalize Interfaces with hardware. This involves us getting simple integration done for every hardware component in our system.

- IMU & GPS Integration: Nick
- Screen Display Integration: Varun + Alex
- LoRa Communication and RTOS: Luca

11/18 - 11/25: Build initial prototype that displays minimap with heading and gps data, while simultaneously transmitting its gps and listening for gps data.

- Develop software algorithms for calculating heading and transmit/receive logic
- Ideally try to incorporate everything as RTOS tasks

11/25-12/8: Iterate on prototype to support a basic demo between 2 devices that communicates securely with hardcoded crypto keys. Develop more complex communication and try to implement the pairing functionality.

Major Risks

- Interference of LoRa messages
- Power Management / Battery Life
- Secure Pairing Protocol feasibility
- Difficulty of adopting the ESP-IDF framework compared to something simpler.