Project Title: Minimap

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EECS 149-249A Final Project Proposal

Goal

This project will create a wearable screen that can be used to track nearby friends' locations in real time. The idea is that this can be used in crowded places with limited signal where people in a group might get separated unexpectedly, such as concerts and amusement parks.

Approach

Each device will be equipped with a LoRa transceiver that will be used to broadcast and receive GPS coordinates to/from other bands.

Additionally, each band will be equipped with sensors (IMU and magnetometer) to determine their relative orientation towards each other. This will allow for the positions of each group member to be displayed in a minimap.

Resources

Our plan is to currently use the Raspberry Pi Pico in order to prototype our design. We can use this to connect and test out the LoRa transceiver and build out a barebones communication protocol between the 2 boards. After building out this communication, we will begin working on calibrating, reading, and sending the GPS and Magnetometer readings between the 2 boards. Once this is done, we can use the position of the other board and our current position in order to determine and display the direction of your peer. Finally, we can integrate an additional layer of security on the communication protocol between the 2 boards to stop malicious agents from reading our position data. Our current plan is to use some sort of NFC or other close range communication protocol to initially pair two bracelets, allowing them to exchange symmetric encryption keys and create a secure line of communication. We will be using a small AES library in order to do the encryption.

Schedule

- October 30: Project Proposal (This Document)
- November 8: Choice of controllers, hardware, and software finalized after talk with instructors.
- November 15: Finish proof of concept, and get simple communication working between 2 microcontrollers
- November 22: Update prototype to connect to LCD Display and securely communicate
- December 4: Finish Milestone 2 Document with feedback from prototyping stage
- December 5-11: Update design + make final changes based on 1 on 1 with GSI
- December 10: Test system, make sure design works well over long ranges
- December 15: Finish Poster
- December 17: Finish presentation
- December 18: Submit Final Report

Risks

There are several risks that we need to take into consideration. Setting up communication with LoRa might be more difficult than we expect it to be. We are also concerned about the battery life of the device, as some components may draw too much power, and we are very space constrained so our battery capacity is quite limited. We are also concerned about whether or not the accuracy of our GPS is sufficient. Lora may also have significantly limited range due to non-ideal operating environments (e.g. urban areas, concert venues).

[Link to Github](#)