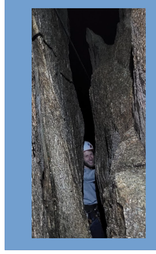
Team



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DistoY

Cave Surveying Device

Abstract

DistoY is a cave surveying device aimed at providing cavers with a larger variety of functionality for surveying at a much lower cost than current products on the market. The DistoY will allow for taking distance measurements that can also record angles, track cardinal direction, and store data for later use. Furthermore, it will also be built to survive in the harsh conditions of caves, such as being dropped from heights, exposed to lots of dust, cold temperatures, and wetness or submersion in water.

Purpose

- Bring more robust technology to a niche field
- Create an open-source solution that allows for further community development
- Accelerate time needed to survey caves where conditions are not ideal
- Designing a simple and effective device that anyone can use

Milestones

1. Sensor & Accessory Selection

- Selected microcontroller, sensors, battery, physical connectors, and I/O needed for the device.
- Identified code libraries necessary for speeding up development time

2/5. Physical Device Simulation

- Originally was meant for physical device prototyping, but became a simulation due to shipping times
- Allowed for the project to continue being developed
- Mimicked the required inputs and expected outputs based on sensors documentation
- Standalone program from the device software
- Added the ability to send input commands to the simulation, as well as receive output data

6. Storage & Metadata

- Implemented a method for converting the sensor data into a standardized JSON format
- Added additional metadata such as timestamps, measurement IDs, and other information
- Allowed for the device to push data onto the SD card for later use

3. Sensor API Implementation

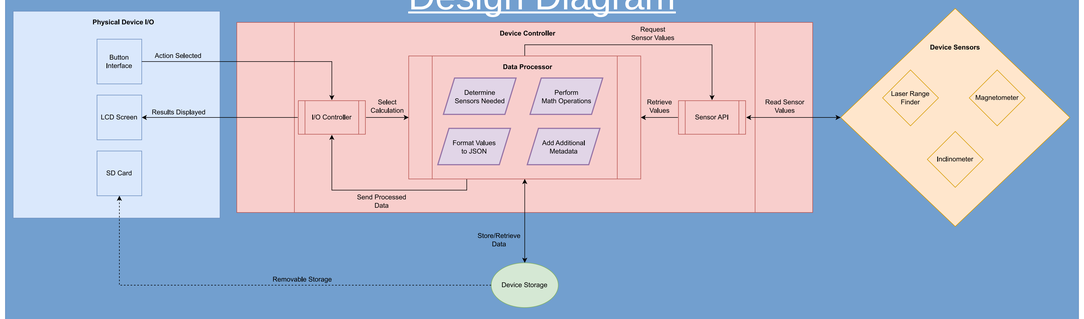
- Implemented the ability to request and read values from all the sensors
- Backbone for all feature developments
- Could be switched to use a physical device without needing to modify the logic

4. Measurement & Calibration

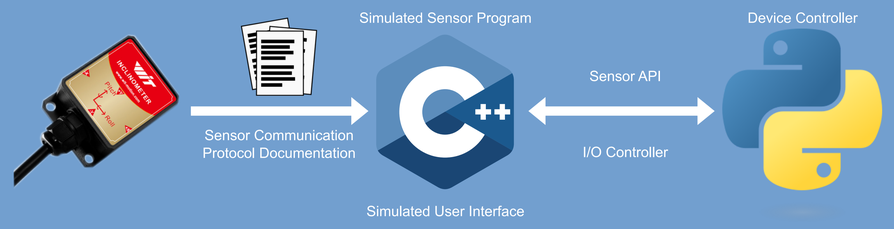
- Developed a measurement method that combines readings from all the sensors to give a full data point
- Designed a basic calibration function that would ensure the sensors were within appropriate tolerances
- Due to using simulated sensors, the calibration would need to be tested and reiterated upon once the physical device was prototyped

How It Works

Design Diagram



Device Simulation



Technology

Hardware

- Raspberry Pi
- Laser Range Finder
- Inclinometer
- Magnetometer

Software

- Git
- GitHub
- C/C++
- Python

Challenges

- Supply chain issues with obtaining sensors and components
- Designing mock-ups and simulations based on available documentation
- Ensuring proper calibration and tolerances in harsh environments

Future Work

- More rigorous testing for calibration and sensor accuracy
- Increased functionality, such as comparison measurements, burst measurements, and multi-step measurements
- Constructing a final physical design