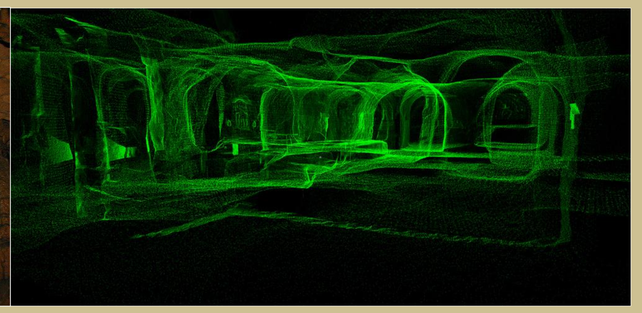
LIDAR Cave Mapper

Team 10

Background

Cave mapping is traditionally done with pencil and paper. A caver will choose a centerline or orientation point, then take measurements from that point or line to the wall. It would takes hours of tedious labor. Once translated the data might not accurately reflect the cave features. Technological advancements like sonar have given way to digital reconstructions of ground features. While sonar provides relatively good visuals, the lasers used by LiDAR increase the accuracy of mapping.



Project Goals an Constraints

Goals

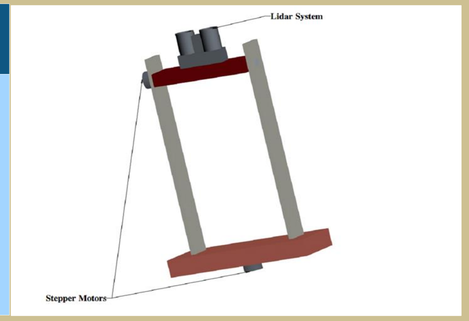
- Create small, portable device
- Run autonomously for duration of scan
- Supply power for at least 2 mapping points (2-3hrs)
- Fit device into waterproof casing for storage
- Weigh under 5 lbs

Requirements

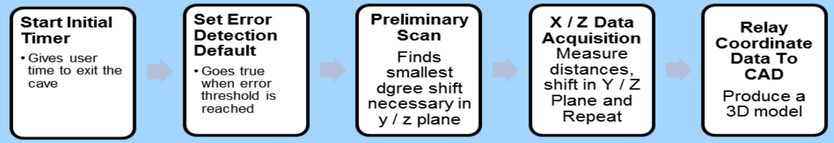
- Map up to 40m away with 0.5m accuracy
- Rotate fully in horizontal (x and y axis)
- Rotate at least 135 degrees down from z-axis
- Convert data into a 3D image
- Cost ~ $500

Mechanical Design

- Frame 3D printed from ABS thermoplastic for its low cost, low density and its durability
- Frame is rotated by a 200 step per revolution pancake motor
- LIDAR base is rotated by a 200 step per revolution NEMA 8 stepper motor

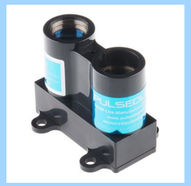


Software Data Flowchart

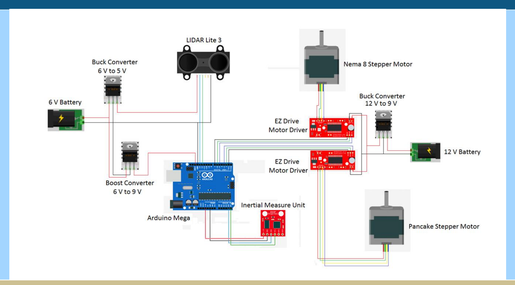


Hardware

- LiDAR Lite 3 (left) provides user with a 40 meter range and 0.5 meters of precision.
- Arduino MEGA 2560 R3 (center) provides an affordable microcontroller with basic functionality and a wide open-source user library.
- Inertial measurement unit (IMU) (right) calibrates data and allows for accurate cave scanning.
- Data-logging shield attachment for microcontroller allows for data storage using a removable SD card.



Electrical Design



Future Objectives

- Finalize electrical wire schematic
- Finalize structural design
- 3D print parts and construct our prototype
- Test different coding options
- Determine uncertainties and error propagation of electrical components

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