LIDAR Cave Mapper

ECE Team 10
FAMU-FSU College of Engineering
Sponsored by:

Earth, Ocean and Atmospheric Science

ECE 10
the LIDAR crew

- EE: Alisha Hunt
- EE: Cesar Rivas
- EE: Jake Ogburn
- CPE: James Oliveros
- ME: Spencer Day
- ME: Hunter Hayden

Cave Mapping

Spencer Day

- A 3D map of a cave is extremely helpful when doing research, search and rescue, or simply planning a hike
- For years professional cavers have used LiDAR to map in three dimensions
- This process, and the equipment needed, is generally very expensive and meant for professionals
- The LiDAR Cave Mapper aims to make 3D mapping both more affordable and user friendly

Product Market

Spencer Day

- The LiDAR Cave Mapper has been designed for the amateur caver, hiker, or scientist
- Utilizes light detection and ranging technology, lightweight design, and simple moving parts
- The construction has been streamlined to lower cost
- Data can be uploaded simply to reveal a point cloud formation that represents the cave
- Cavers, hikers, outdoorsmen, and families will now be able to enjoy and afford a LiDAR Cave Mapper

Components

Jake Ogburn

- Two motors
  - One horizontal stepper motor for azimuth rotation
  - One vertical stepper motor for angular rotation
- Motor drivers
- LIDAR Lite
  - Provides distance data
- Inertial Measurement Unit (IMU)
  - Provides location data for coordinates

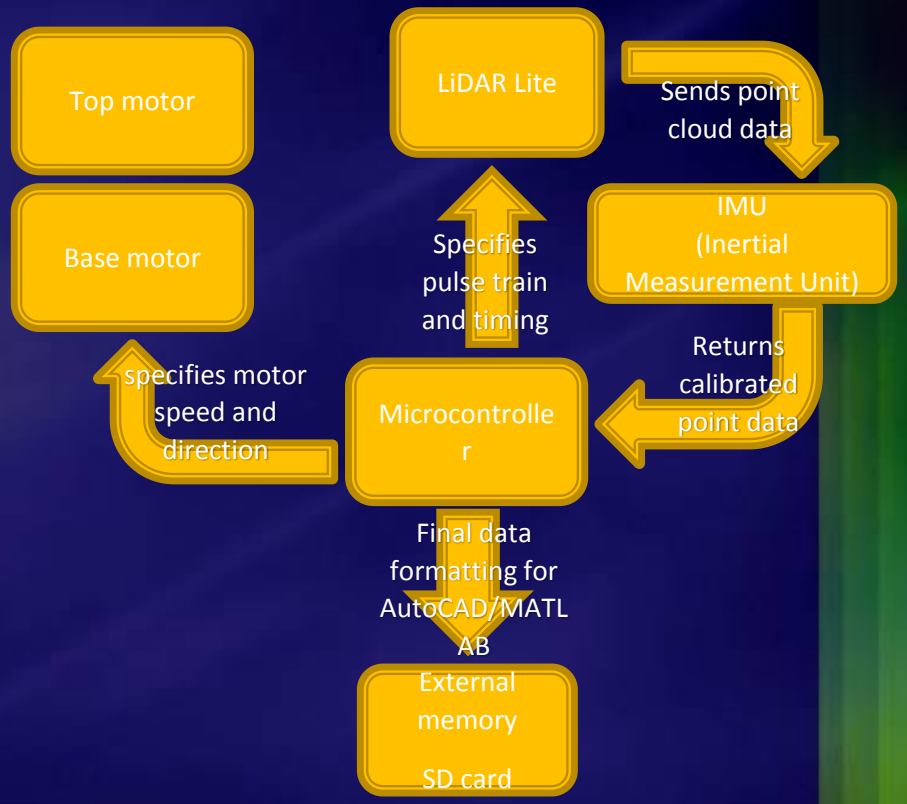
Data Flow Hierarchy

Alisha Hunt

For every step

- Controller steps motor
- Retrieves distance from LiDAR
- Pulls positioning data from IMU
- Stores on SD card

Repeat!!



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Power

Jake Ogburn

- Current Consumption (One Hour): 0.7 Ahr
- Current Consumption (One Target Area): 2.8 Ahr
- Battery: ~ 6 Ahr for two runs

Mechanical Design

Jake Ogburn

- 3D printed housing
- Rotational base
- Case for portability
- Adjustable tripod for stability

Setup

Cesar Rivas

- Position tripod in center of scanning area.
- Ensure tripod is perfectly flat using tripod bubble-level.
- Adjust tripod height as desired.
- Attach scanner module onto tripod mount.

Setup (Continued)

Cesar Rivas

- Attach scanner module cables to corresponding controller module cables.
- Verify that all connections are properly secured.
- Connect negative and positive power cables to respective 12V battery terminals. Both can be found inside of storage box.
- Power on the scanning system by pressing down the button on the buck converter, located inside storage box.
- System is now ready to begin cave-scanning sequence.

Operation

Cesar Rivas

- To initialize cave-scanning sequence, press reset button found on microcontroller.
- Yellow LED will blink if system is scanning properly.
- If Red LED turns on, an error has a occurred and system must be reset.
- Green LED will turn on when cave-scanning sequence is completed.
- Scanning data is saved to Micro SD card attached to microcontroller.

Deconstruction and Storage

Hunter Hayden

- Power off system and disconnect power wires from battery terminals.
- Detach scanner and controller module cables.
- Remove scanner module from tripod, and efficiently position in storage box.
- Fully collapse tripod for transport.

Data Processing

Hunter Hayden

- Once the data has been saved onto the SD card, it will be uploaded to a point cloud software to display the data as a 3D point cloud model.
- Due to the resources available to us, we planned to use PTC Creo Parametric.
- Open source softwares such as Meshlab were also available and considered.

Run Results

James Oliveros

- Show pictures!!

Image is basic scan with full step size.
Microstepping can be used to refine the image.

Potential Improvements

James Oliveros

- Configure different delay times
  - Will improve run time
  - More efficient
- Fix issues with data writing
  - File management needs improvement
  - Automatically write new files with each new scan point
  - Intermittent file writing
- Integrate multiple scans
  - Map large areas with complex geometry

Potential Improvements

James Oliveros

- Deal with wiring management
  - Wire snags cause motors to skip
- Implement Mode Selection
  - Preliminary scan to define modes for rooms and halls
  - Improve memory efficiency
- Add coordinates
  - Map to globe and compile scans to form system of discoveries

Questions?