Rabbit Burrow Mapping

Presentation Overview

- Topics of presentation
  - Design Goals
  - Concept Design
  - System Overview
  - Design Specs
  - Budget

Design Goals

- Mapping
  - Create “floor map” of tunnel with three dimensional data
- Volumetric Measurements
  - Measure overall volume of tunnel system
- Imaging
  - Produce video footage of the tunnel interior

Concept Design – Burrow Mapping

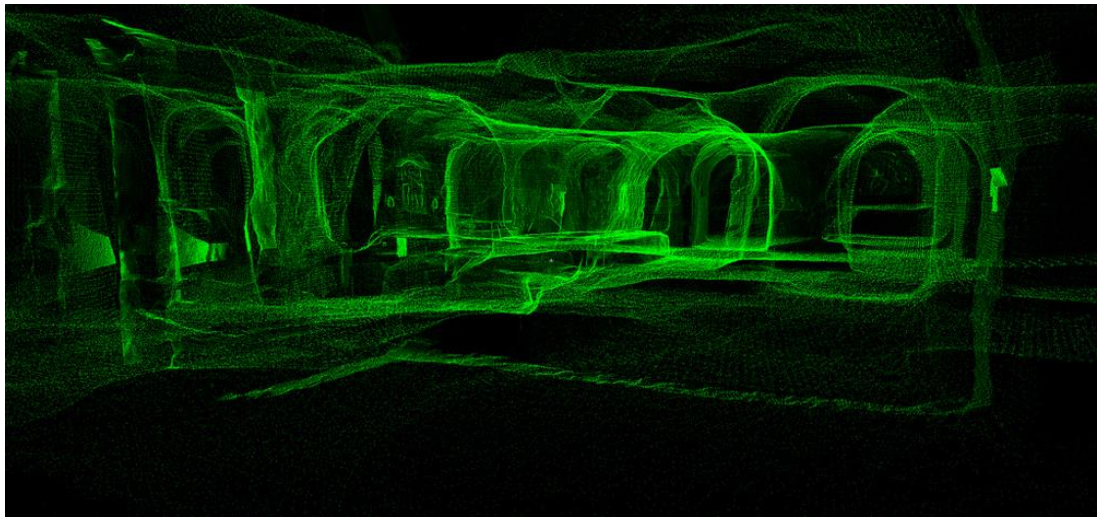
Dead Reckoning

- By measuring the distance and direction the robot has traveled, a map of the burrow system may be generated
- This data may be made more accurate by using location data for each burrow entrance

Concept Design – Volumetric Measurements

Point mapping

- Point maps have been used extensively to produce 3D maps of varying environments
- A low resolution point map can be used to measure the volume of the burrows either using 3D modeling software or by algorithm

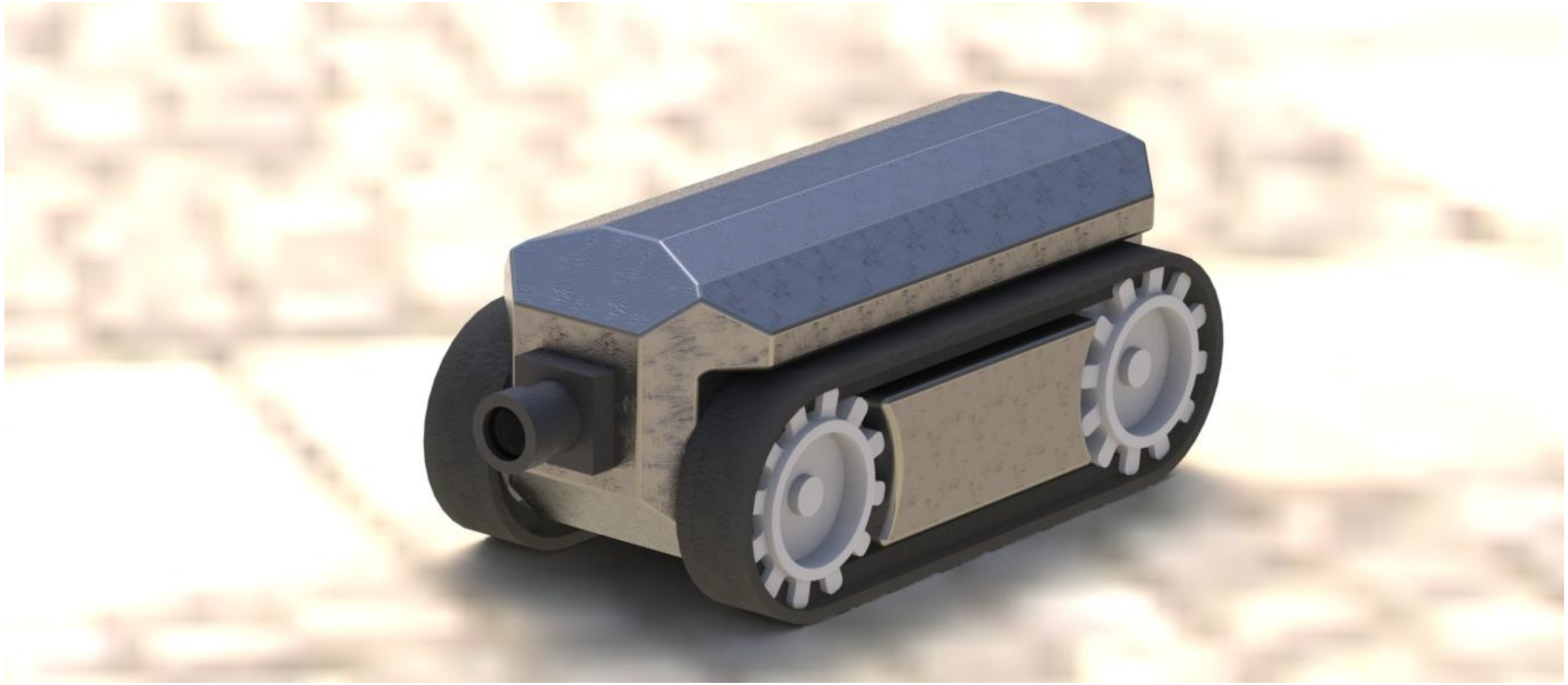


Concept Design – Video Imaging

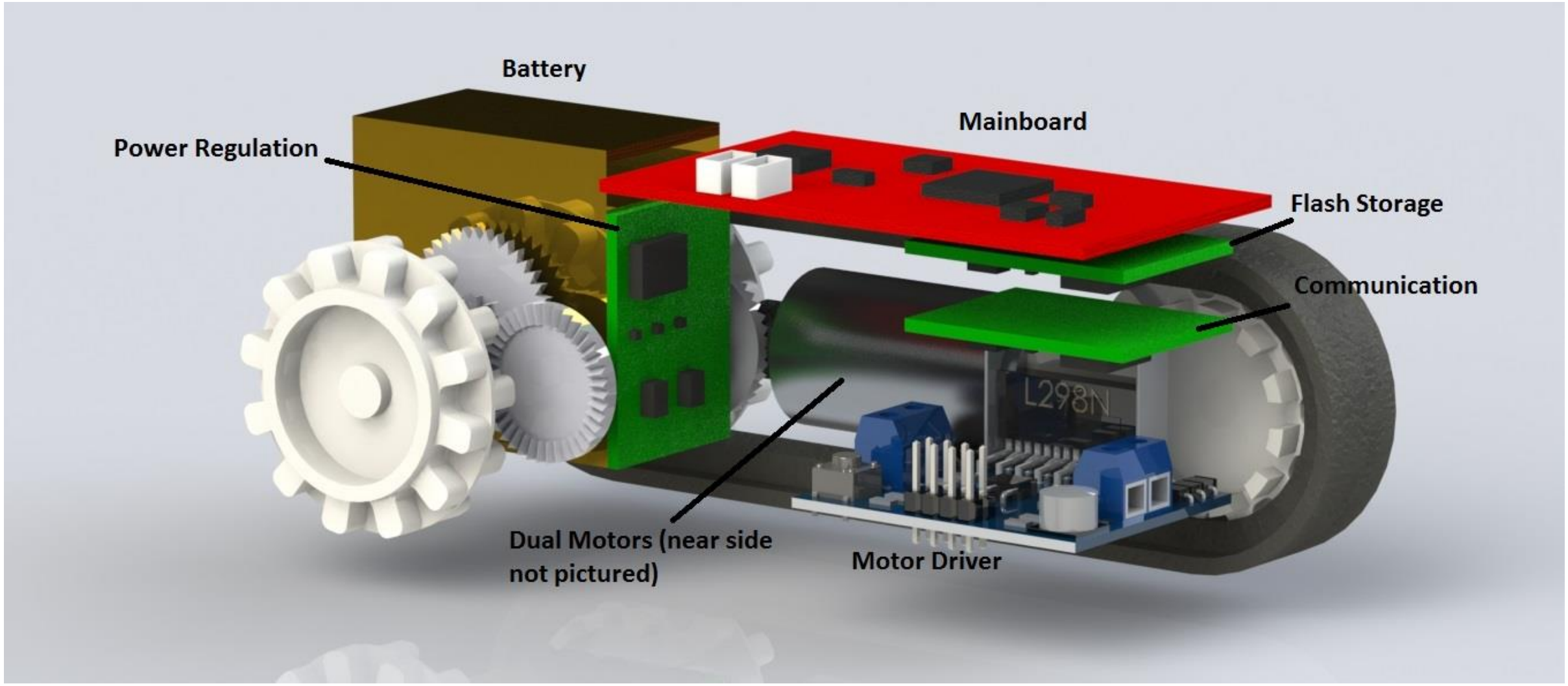
Video Camera

- Cameras will be used to watch for obstacles, and to navigate the burrow via remote control
- Composite video will be transmitted via tether to an external computer where the video stream may be viewed and recorded

Alice-01



Component Layout



System Overview- Body and Drive Train

Chassis

- Measures about 3” across and 5” long
- Constructed from steel to give the robot more mass, allowing it to pull a larger payload (control tether)

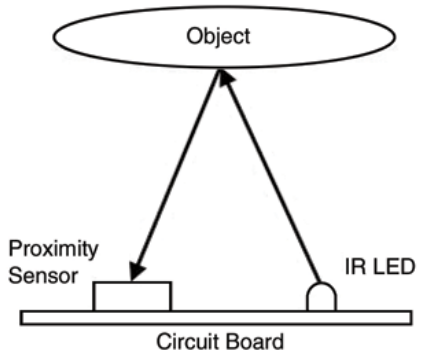
Drive Train

- Dual motors, on the left and right sides of the robot provide power to rubber treads
- Moving only one tread at a time allows the robot to be steered by rotating the robot in place

System Overview- Sensors

Infrared proximity sensors

- Multiple pairs of IR sensors will measure distance from the robot to the burrow walls, allowing us to measure the size of each burrow
- Each pair of sensors is made up of one short-range and one long range sensor, allowing accurate measurement of any burrow from 3” to about 30” across
- Each sensor will take multiple measurements each second, generating many points which may later be connected to generate a map and volume measurements



System Overview- Sensors

Location Detection

This is tied to sensor range data to define xyz coordinates and a directionality

- Accelerometer
  - Measures acceleration in XYZ coordinates, as well as angular acceleration about those axes
- Magnetometer
  - Works as a 3D compass to give pitch and direction information to be used in building a map of the Burrow
- Wheel encoder
  - Measures distance traveled by monitoring wheel rotation

System Overview-Video

Camera

- 640X480 Black and White composite video
- Front and rear cameras
- Will be sending visual data back to controller to allow piloting of robot
- Records to the robot's memory, allowing the video to be accessed later

System Overview- Power and Communication

Battery

- The robot will be powered on a rechargeable battery, which has an estimated use time of one hour

Tether

- The robot will be pulling a cable which will relay data to and from the robot.
- Special considerations for the tether (Two options exist and will be presented with the budget)

System Overview- Operation

Control

- The robot will be controlled via computer interface by way of simple directional inputs
- Video streams may be recorded
- Data acquisition is manually start/stopped
- All location and proximity data is stored on the on-board SD card

Design Specs

Measurement Accuracy

- These measurements are expected to fall within 10-15% accuracy depending on burrow size and complexity
- Location data is the largest limitation in measurement accuracy

Runtime

- An average burrow of four entrances is expected to take 30 minutes to explore

Post Processing

- Data sets will output xyz coordinate information, and a volumetric calculator will be supplied

Summary

- Concept Design
  - Generating a point map
  - Determining Volume through IR proximity sensor data
  - Video- 640x480 Black and White

- Next- We will discus the planned budget