Semi-Autonomous Soil Sampling Robot: Earth Rover

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Concept

Proof of concept for small agricultural robot

Takes data in field whereas current contemporary models take physical samples back to the lab

Primary applications include agriculture and research

Inspiration

Motivation: Riverside Agricultural Park (Ag Park) contains high levels of Polychlorinated Biphenyls (PCBs).

We wanted to create a safe solution to measure the level of PCBs in the area

Responsibilities

Path Detection

- LiDAR (Nicholas)
- 2 MP Camera (Nicholas)

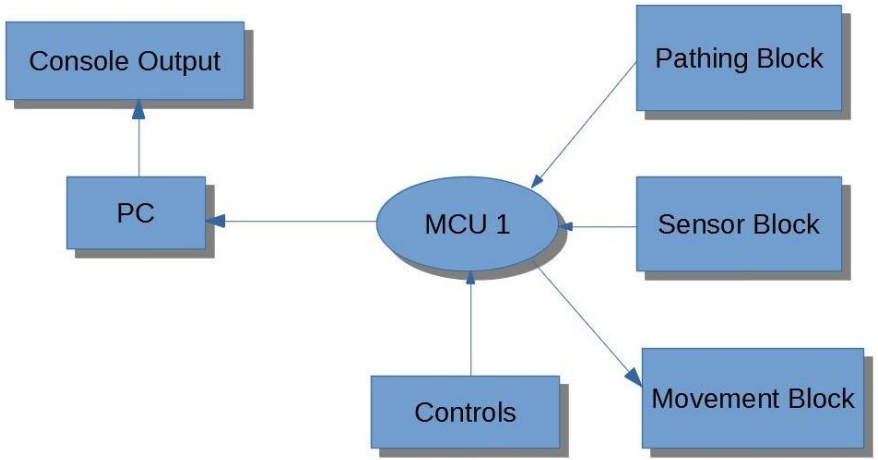
Chassis, Movement, and Radio Communication

- l298n motor board (Iraj)
- 12V DC Motor with Hall Encoders(Iraj)
- 3D Printing (Iraj)
- nRF24 (Nicholas, Iraj, Francisco)
- Servo Motor (Francisco)

Sensors

- Temperature and Humidity (Iraj)
- Accelerometer and Gyroscope (Iraj)
- Soil pH (Francisco)
- Water pH (Francisco)
- GPS (Francisco)

Hardware Block Diagram

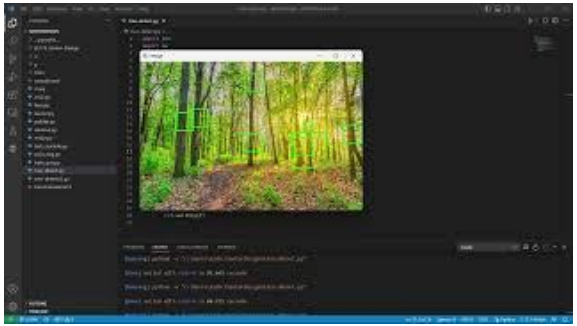


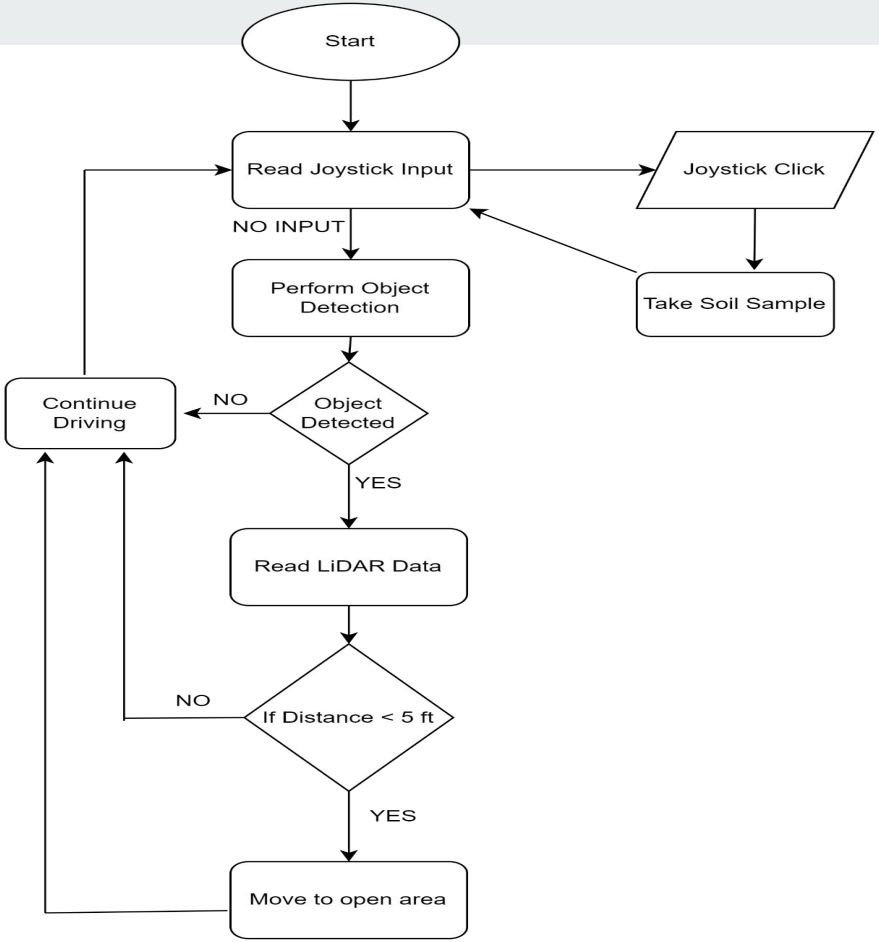
Path Detection

Autonomous logic

Used Lidar

Seperate Object Detection





Manual Mode

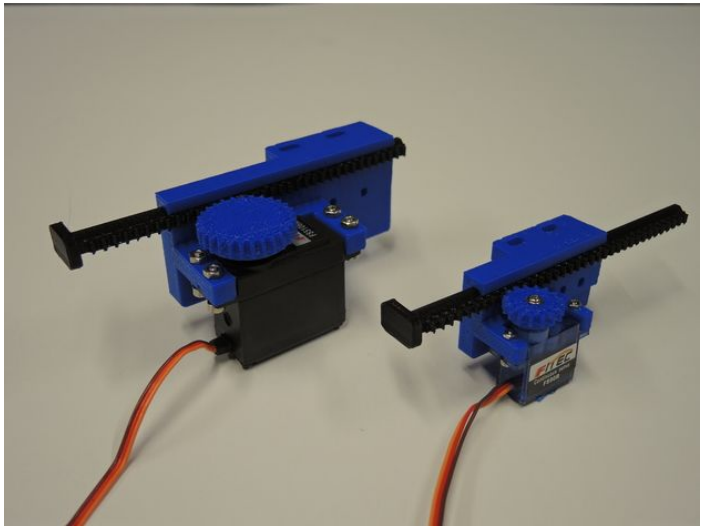
Button with LED to indicate manual

Used a joystick with tank controls

Joystick button controls servo motor the rack and pinion system

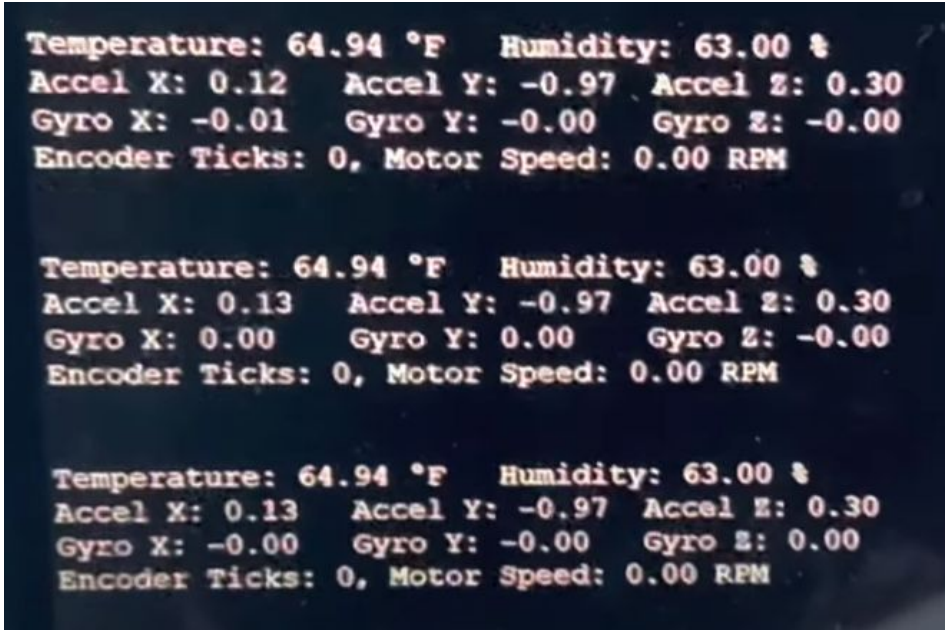
Rack and Pinion

- 3d printed Rack and Pinions system
- operated by a servo motor
- attached to take soil capacitor



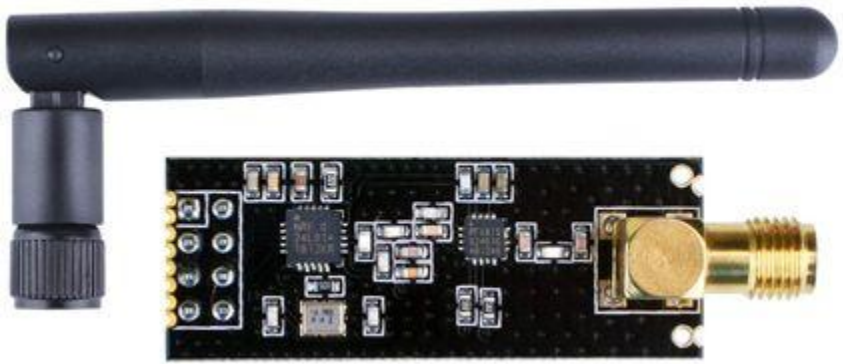
Sensors and Baud Rate

- All the sensors operated at different baud rates
- We chose 38400 to synchronize the outputs
- RPM output calculated by Hall Encoders
- Accelerometer, Gyroscope, Temperature and Humidity output every 2 seconds
- Data is stored in csv file using PuTTy



Radio Module Challenges: RNF24

- Were able to transmit sensor data and send controls from console
- Faulty capacitors that couldn't be repaired in time
- End product was wired



3D printing Challenges

- Wanted to use a WW1 trench tank style design
- Due to warping with larger 3D prints and space concerns we went with a simple plastic box

Demo

LiDAR

Soil Sensor

Summary

We designed a semi-autonomous rover responsible for measuring:

- the moisture of soil
- the ambient temperature and humidity
- position and speed of the rover

Acknowledgements

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