

## Abstract

The Ranger Rover is a mobile robot that collects visual and geographic information on park trails to be processed for detection of trash and relayed to a user interface for park managers' use.

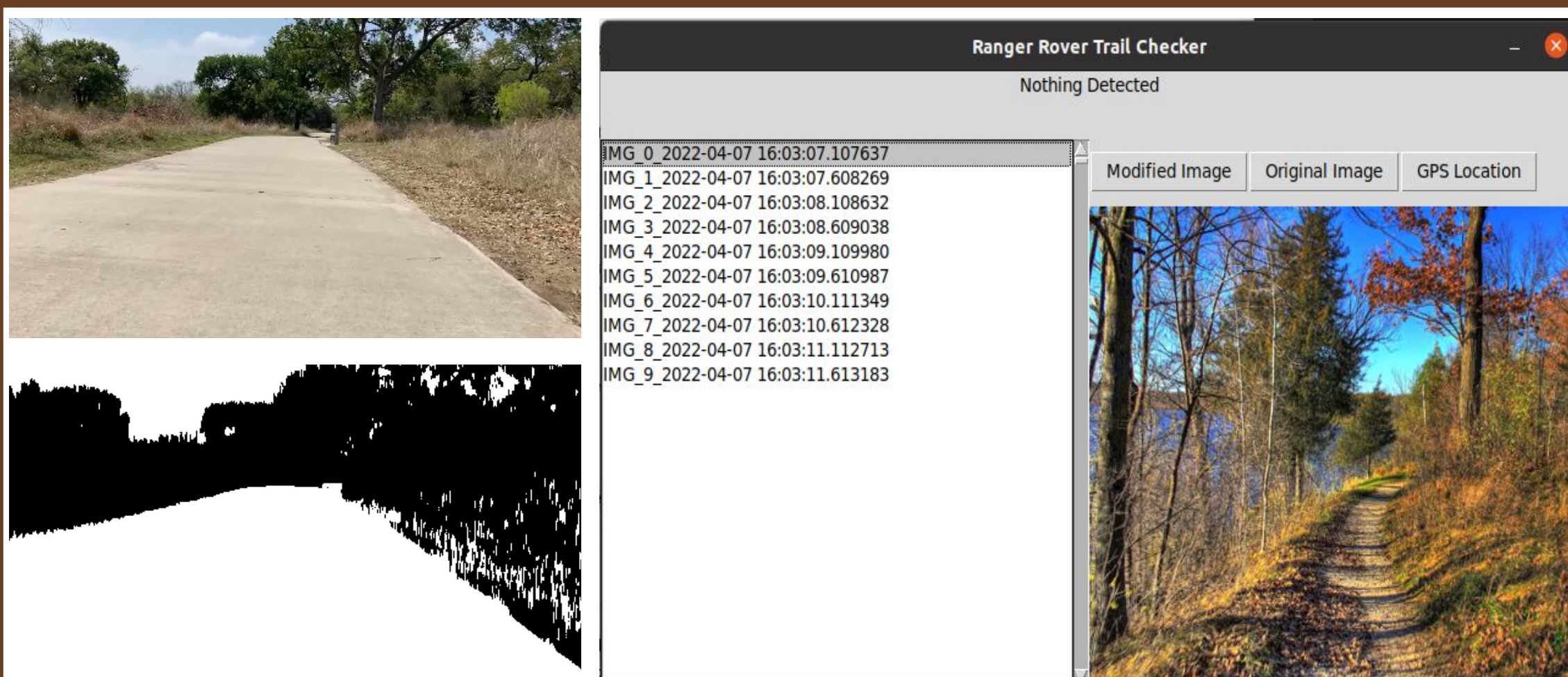
## Problem/Need

Trails need regular monitoring to assess problematic areas that require maintenance such as removal of litter or invasive species.

A robot could do this job, freeing up volunteers and park staff to focus their work on tasks too intricate for automation.

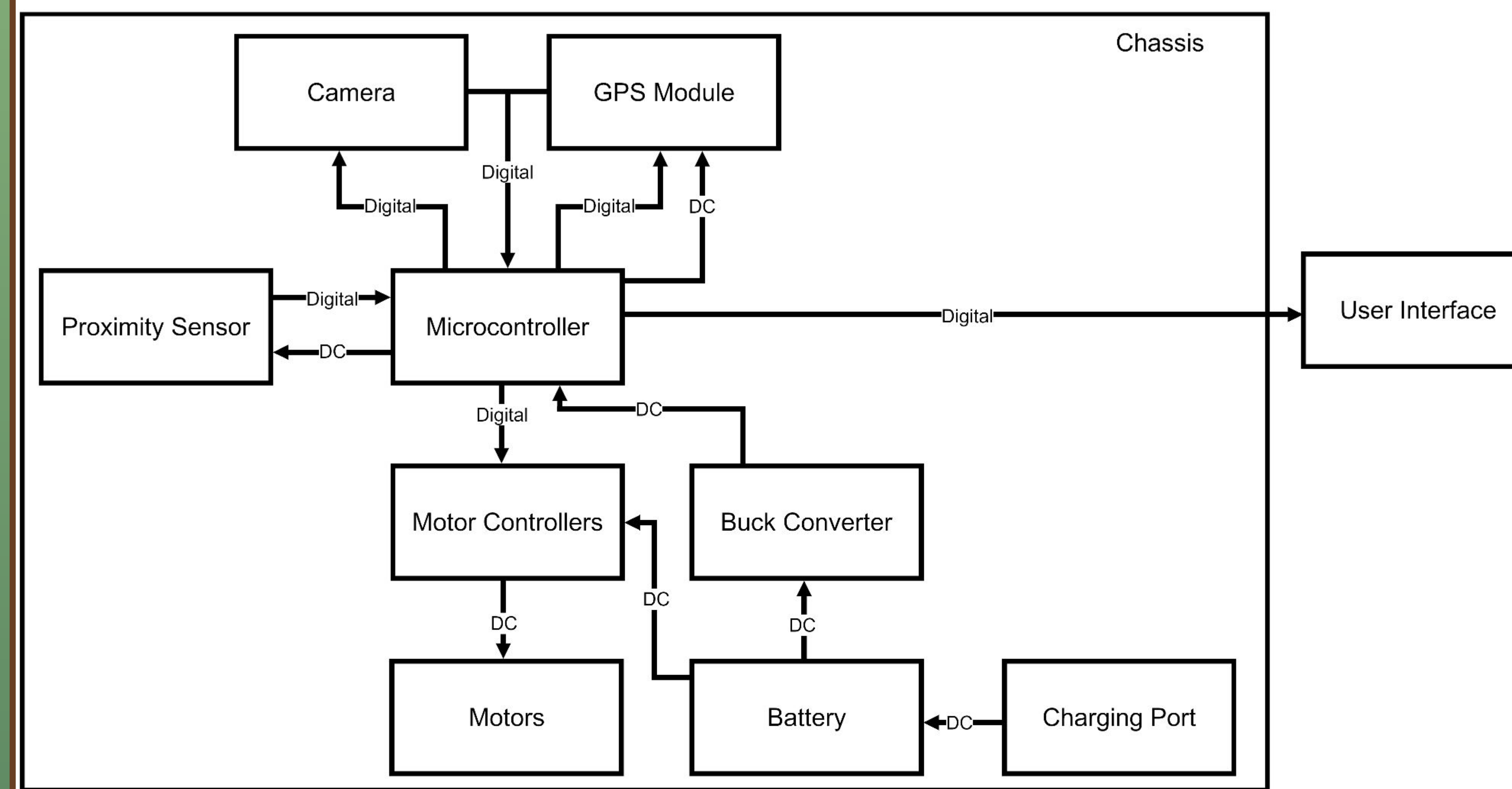


## Design Concept

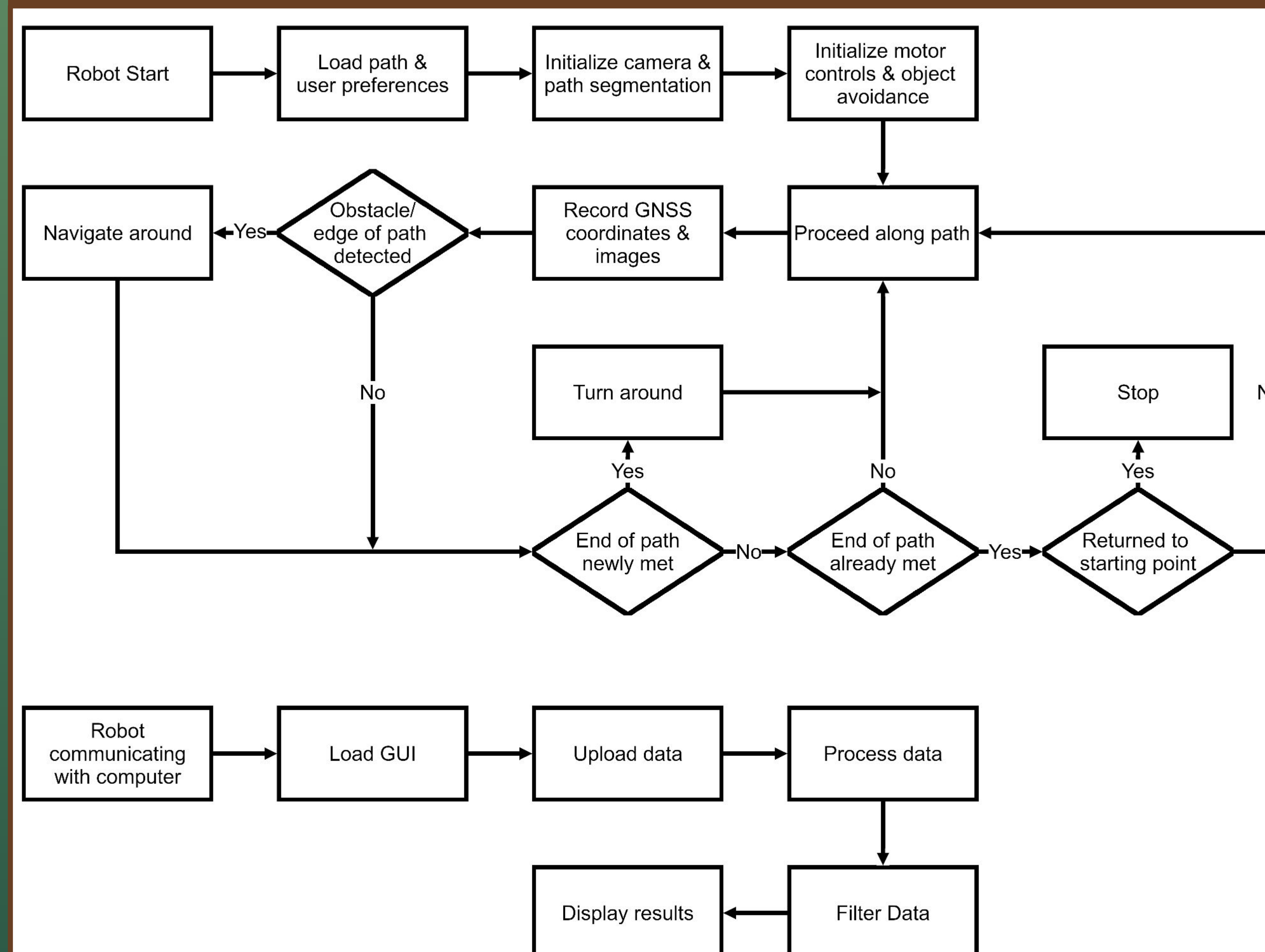


Our robot is an autonomous mobile robot that traverses paved trails using path segmentation and detects garbage along the trails through computer vision. Photos are periodically captured along with GNSS coordinates which are processed at a PC to flag locations of interest upon completion of its patrol. The user interface can then be used to aid people who help maintain the trail, like park rangers and volunteers.

## Functional Block Diagram

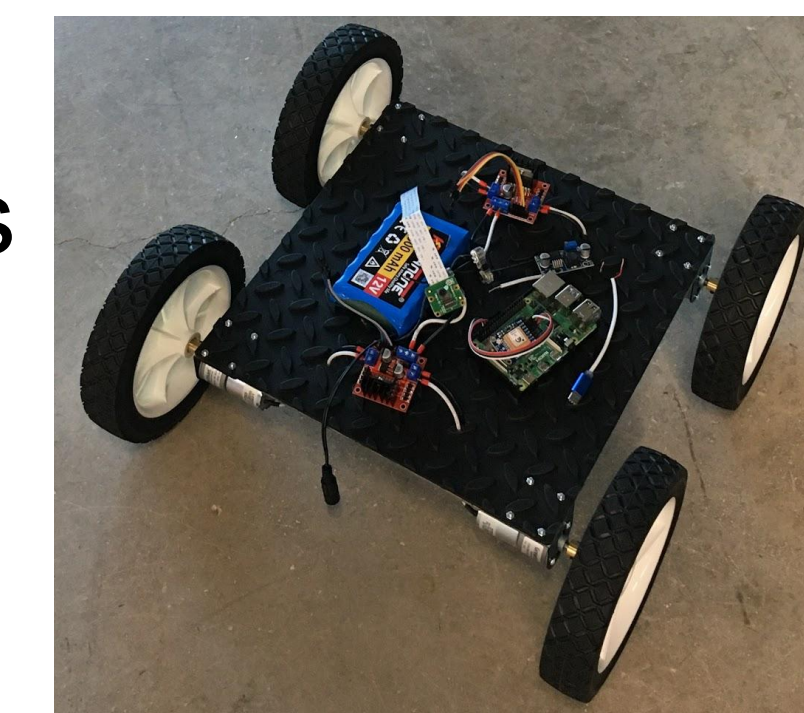


## Software Flow Diagram



## Components

- Raspberry Pi 4 8GB
- Raspberry Pi Camera V2.1
- 12VDC, 441mNm, 100RPM motors
- L298 Motor Controllers
- Infrared Proximity Sensors
- Adafruit Ultimate GPS
- LM2596 Buck Converter
- 30Ah Battery



## Future Work

With this proof-of-concept tool developed for improving the health of ecosystems and providing denizens recreational spaces, next steps for improvement include exterior finishes, solar panels and autonomous docking for recharging, outfitting for off-road capability, an additional camera dedicated solely for object identification, and image processing for invasive plant species.

## Glossary

**GNSS**- Global Navigation Satellite System

**Path Segmentation** - software that processes field of view into contrasting colors to differentiate path from surroundings

**Computer vision** - software that categorizes images using convolutional neural networks

## Acknowledgements

*Releaf Rangers would like to give a special thanks to Dr. Patrick Benavidez for the technical support of our project. We would also like to recognize the UTSA Makerspace, Student Success Center, and UTSA ECE department faculty and staff for providing the resources, instruction, and support related to this project.*