# ECE 4534 Fall 2017 Team 2
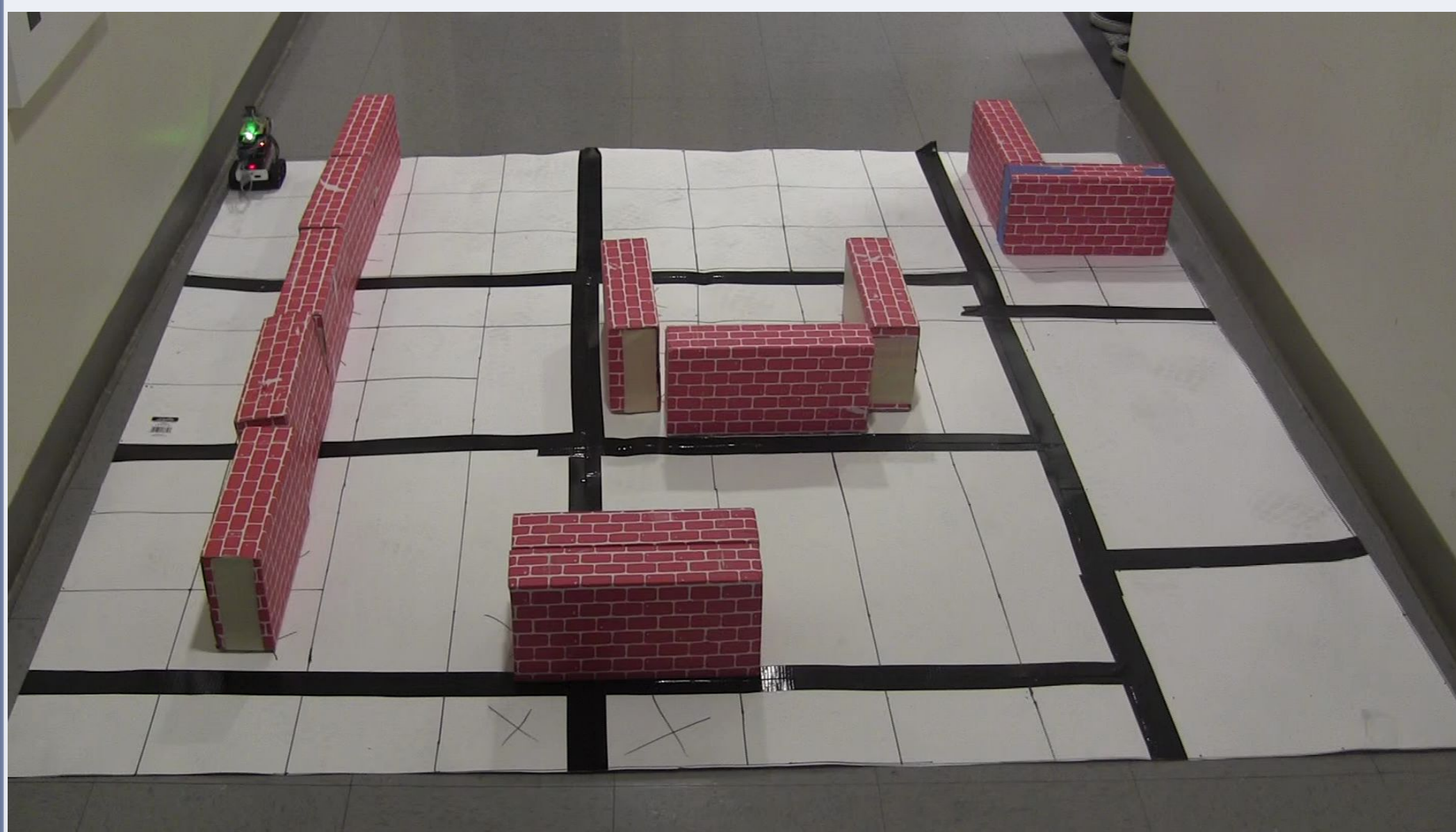## Hide And Seek

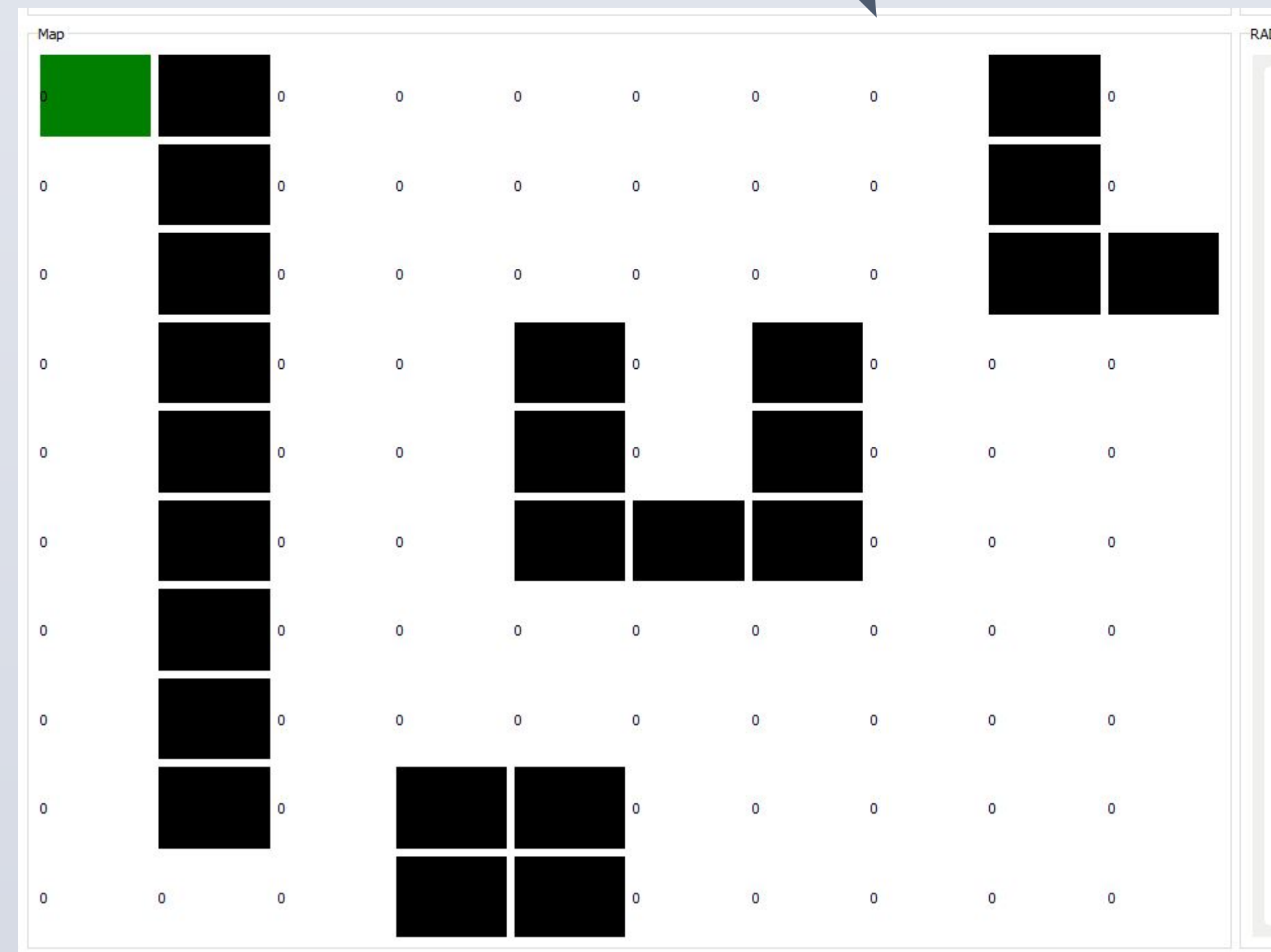Steven Frederiksen, Puvanai Avakul, Zachary Yee

## Scenario

We have a space that has been previously mapped from above. As such, we already know where most of the obstacles in the space are. Using this data we have a map of the space.

Ariel view of the space.



Map representation of the space. Green block is a rover's position



With this map we can deploy our team of three rovers to perform tasks such as navigating around the space safely, confirming the positions of known and new objects (including rovers), and detecting new objects around the rovers. Movement is done using only the map and the motor sensors. Corrections are done with a Human in the Loop (HIL) system of manual corrections on the user interface.
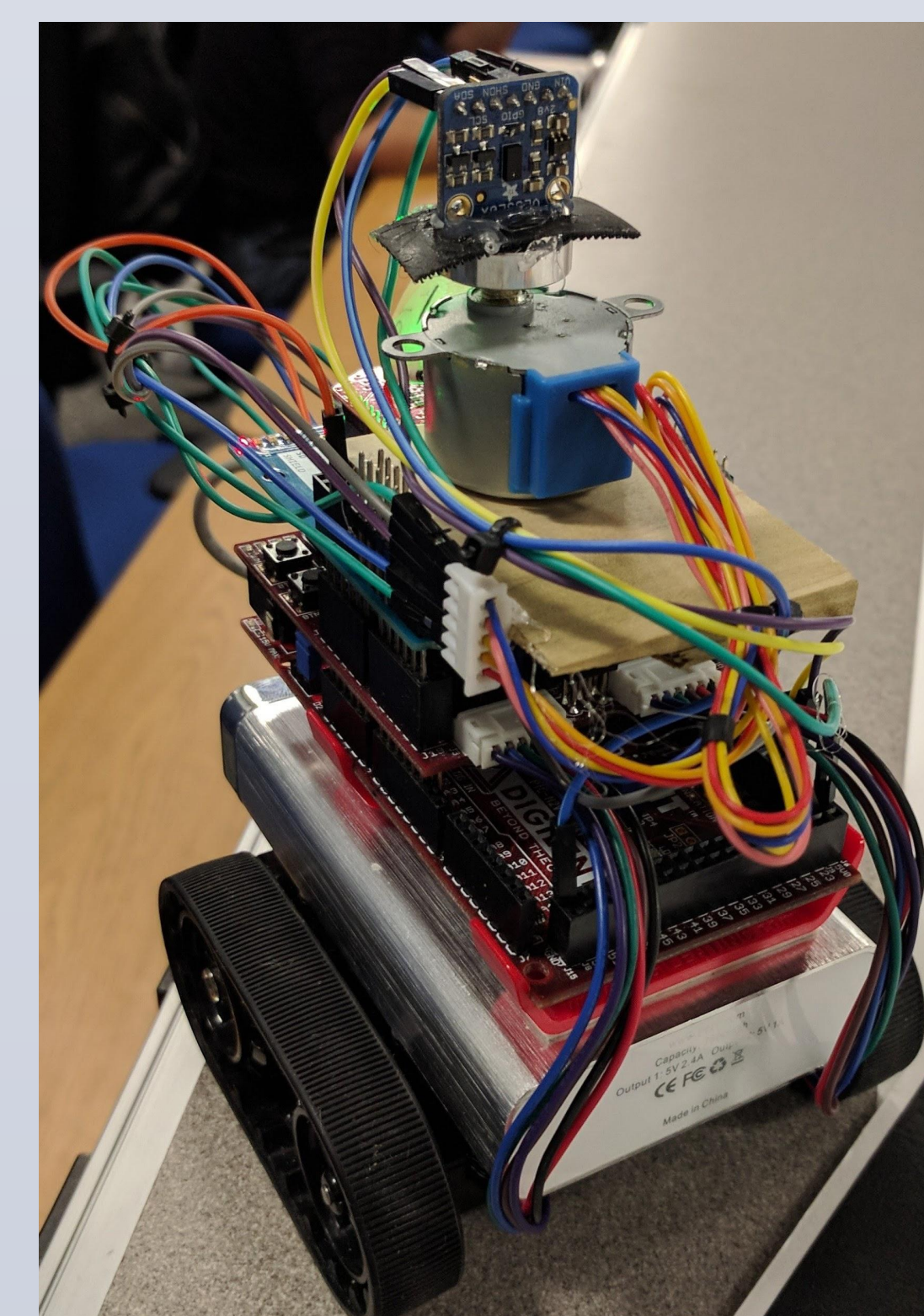
## Base Rover

This is the simplest rover of the three. It has no sensors other than the motor quadrature encoders which allow for precise movement of the rover. It uses the map and the user's input to navigate the map.
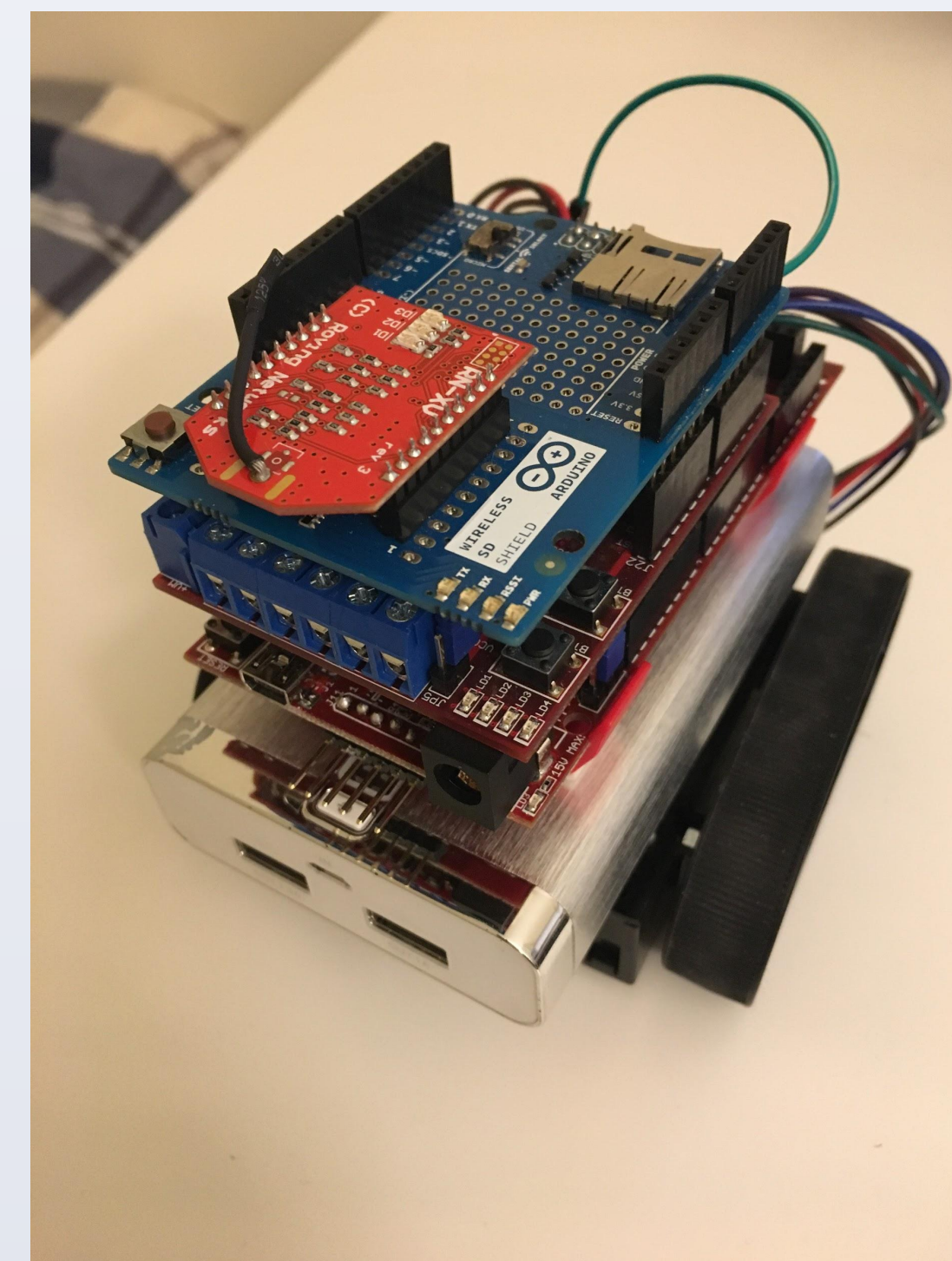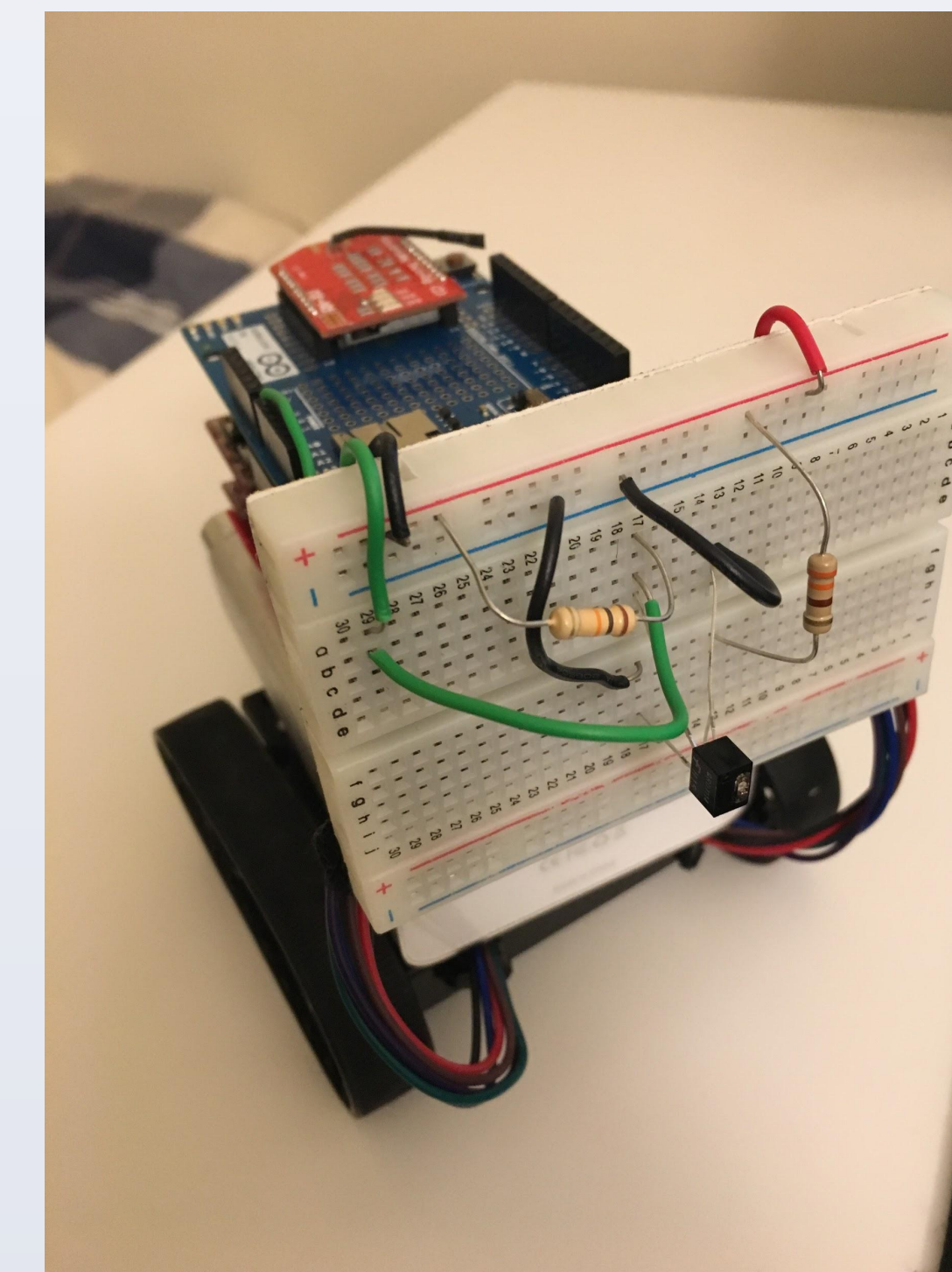


## Mapping Rover

This rover is the most complicated of the three. Just like the other two it navigates the space using the map and the user's input from the user interface. However, it has an IR distance sensor mounted on a stepper motor that acts like a RADAR system, sending information about what is immediately around the rover to the user interface.

This functionality can be used to confirm the positions of objects in the space as well as detecting new objects.



## Seeker Rover

This rover has all the functionality of the base rover, but with an addition of a short range IR sensor. With the IR sensor, the seeker rover is used to confirm an object's position on the map. The rover will stop upon an object in the sensor's range.





Snapshot of the RADAR output on the user interface. Here the rover is facing South and positioned inside of the 'U' formation seen in the center of the map. Additionally the sensor has detected a new object; the rounded object on the bottom of the radar screen.
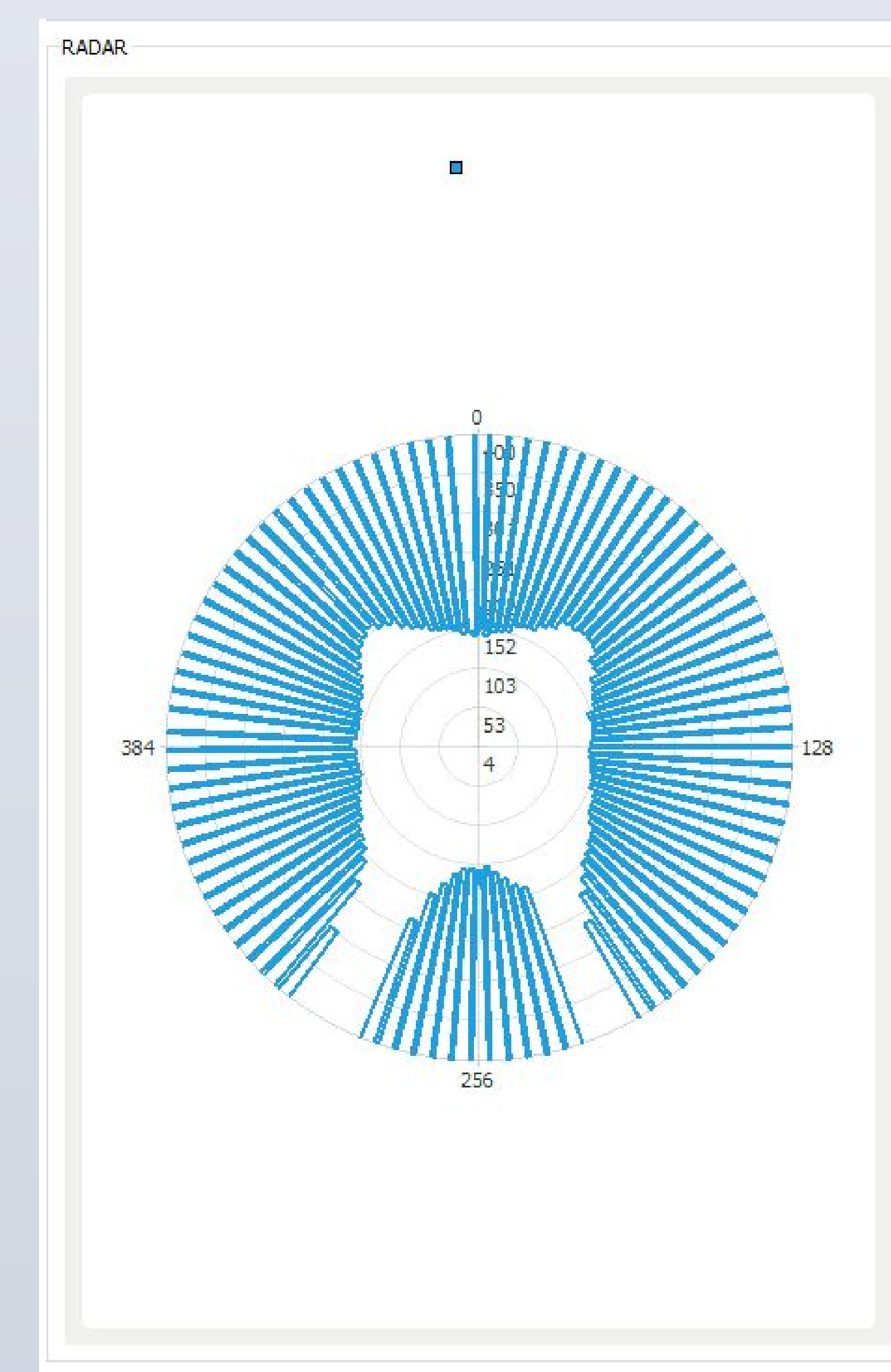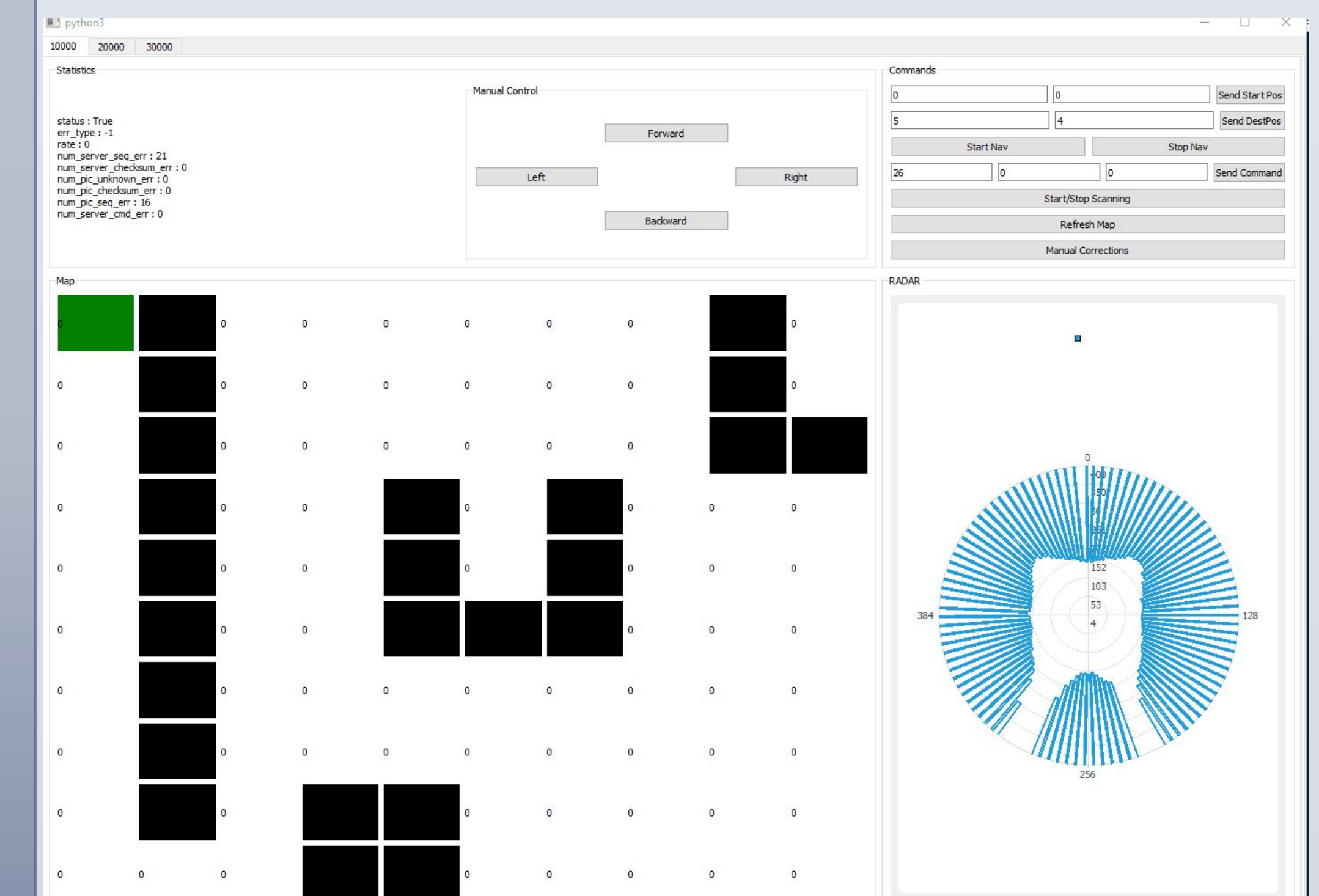
## Finding New Objects

The Seeker and Mapping rover can work together to find new objects and have them added to the map. This process involves the Mapping rover first discovering a new object; this is shown in the screenshot of the RADAR screen. Once a new object is found, the seeker rover is sent to the possible position on the map where the new object is suspected to be. If the short range IR sensor detects an object when the rover enters the location then the new object is confirmed. The user can then add the object to the map and send to to all of the other rovers as well as the database.

## User Interface

The user interface is based on PyQt and allows the user to see real-time state data on each rover. This includes error and message statistics as well as rover position, destination, ect. It also includes all necessary functions to control the rover: destination setting, navigation start/stop, RADAR scanning, and manual corrections.



Seen above is the Mapping Rover's interface.

## Limitations

While our system is functional, it does require a lot of human interaction to function reliably and accurately. Future improvements should include more automation in navigation (automatic motor corrections) as well as automatic map generation using the rovers. Additionally, the IR distance sensor for the RADAR intermittently fails so including automatic recovery code to handle those failures would be an improvement.