



Dwight Look College of

ENGINEERING
TEXAS A&M UNIVERSITY

Team 36: Self-Navigating, Obstacle Avoiding Robot Bi-Weekly Update 5

Teammates:

Arkadi Zhanov

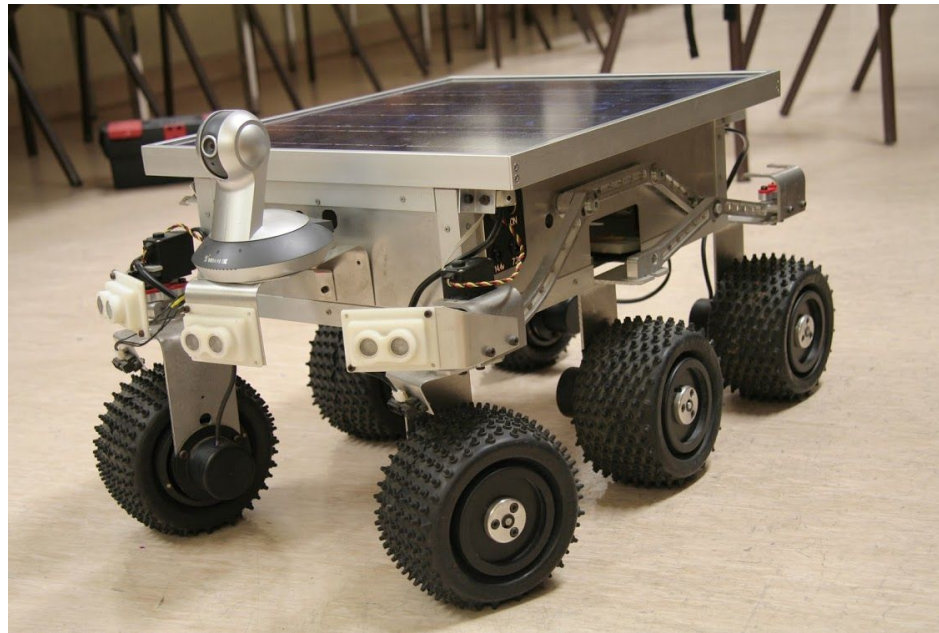
Nathan Sommer

Nikolai Paderin

Sponsor: Stavros Kalafatis

Project Summary

- Create a system that takes in a point on a map as the rover's destination, creates a route for the rover, and gets the rover to its destination and back while avoiding obstacles.
- The main motivation for this project is for application in military settings such as aid delivery to wounded soldiers in the battlefield or local, residential delivery of food or mail.



Integrated System Diagram

App

4G HAT

Raspberry Pi

Route Creation
(On Raspi)

Receives Location

Sends User
Destination

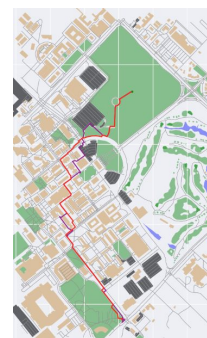
Sends Data

Receives
Route

Sends
Location and
Destination

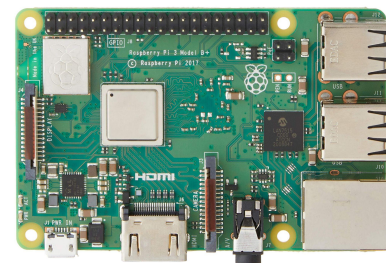
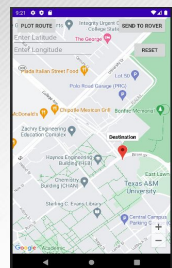
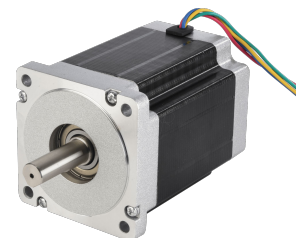
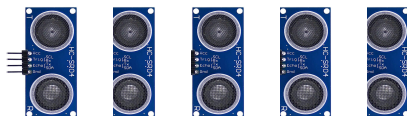
Obstacle
avoidance sensor
array detects
nearby obstacles

Override navigation
movement control and
use obstacle
avoidance movement



-87.615	41.83317
-87.615	41.83317
-87.615	41.83317
-87.615	41.83317
-87.615	41.83317
-87.615	41.83317
-87.615	41.83317
-87.615	41.83317
-87.615	41.83317

Control motor
movement based
on current position
and next node
position





Project Timeline

Subsystem Designs and Testing (completed 9/11)	Integrate Pathfinder and Movement/Controls and test (to complete by 9/20)	Integration with Android App and Raspberry Pi using cellular data (to complete by 10/5)	Final Integration (to complete by 10/15)	Systems Test (to complete by 11/2)	Validation (to complete by 11/26)	Demo and Report (to complete by 12/5)
---	--	--	---	---------------------------------------	--------------------------------------	--

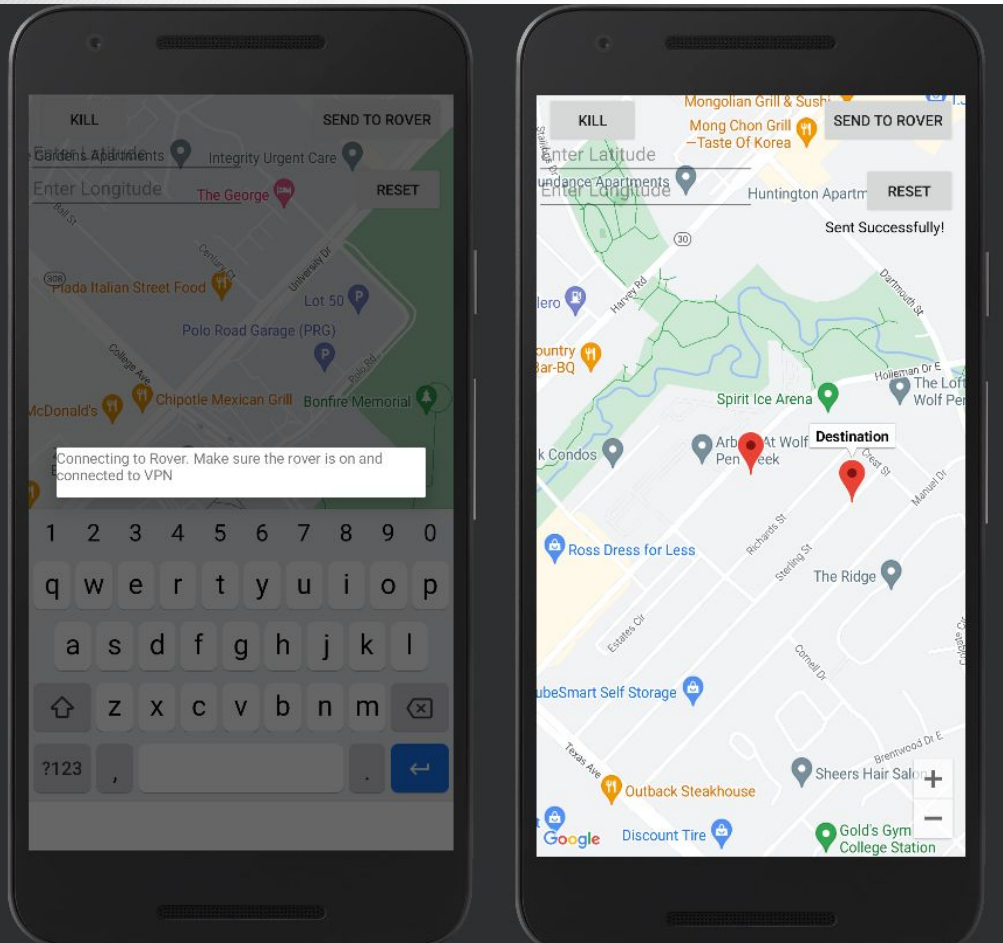


Nathan Sommer

Accomplishments since last update 16 hrs of effort	Ongoing progress/problems and plans until the next presentation
Integration (App - Pi) <ul style="list-style-type: none">- Fully integrated the app with the raspberry pi- Validated that the app is getting and receiving the correct information, as well as updating UI properly Integration (Pathfinder - Pi) <ul style="list-style-type: none">- Fixed library issue by switching from pi3 to pi4	<ul style="list-style-type: none">- Tested whole system to make sure it's working as planned- Error Handling- UI Updates



Nathan Sommer



```
I Connected
I Server Says: 30.616568 -96.311092
I Server Says: 30.616568 -96.311092
I Server Says: 30.616568 -96.311092
I Server Says: 30.616568 -96.311092
I Server Says: sent
I Server Says: 30.616568 -96.311092
I Server Says: 30.616568 -96.311092
```

Sent: 30.616568 -96.311092

Sent: 30.616568 -96.311092

Sent: 30.616568 -96.311092

Sent: 30.616568 -96.311092

Received from client: 30.6162847906465 -96.31057865917681



Pathfinding and Navigation

Arkadi Zhanov

Accomplishments since last update 16 hrs of effort	Ongoing progress/problems and plans until the next presentation
Integration/Validation (Pathfinder-Pi) <ul style="list-style-type: none">- Pathfinder subsystem is complete, verified, and is completely integrated with other subsystems Integration (Obstacle Avoidance-Pi) <ul style="list-style-type: none">- 3D Printed stable housing for ultrasonic sensors Integration/Validation (System Wide) <ul style="list-style-type: none">- Developed main loop to combine all systems and control logic flow of rover operations- Ongoing obstacle avoidance code validation testing on system wide level	<ul style="list-style-type: none">- Pick the better obstacle avoidance procedure by system wide testing- Finalize testing and validation of obstacle avoidance system wide- Test and validate main loop with all system- Help with other subsystems

Pathfinding and Navigation

Arkadi Zhanov

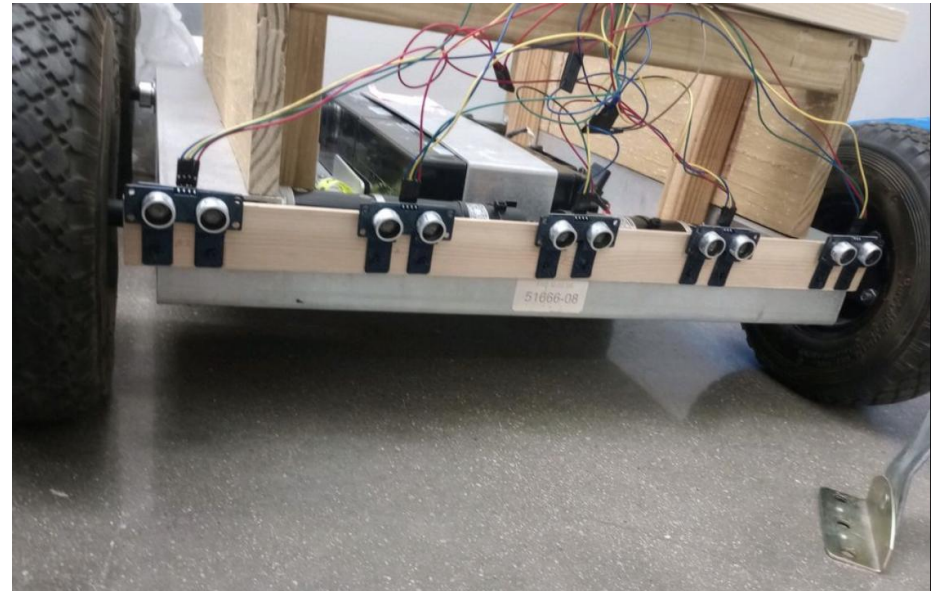
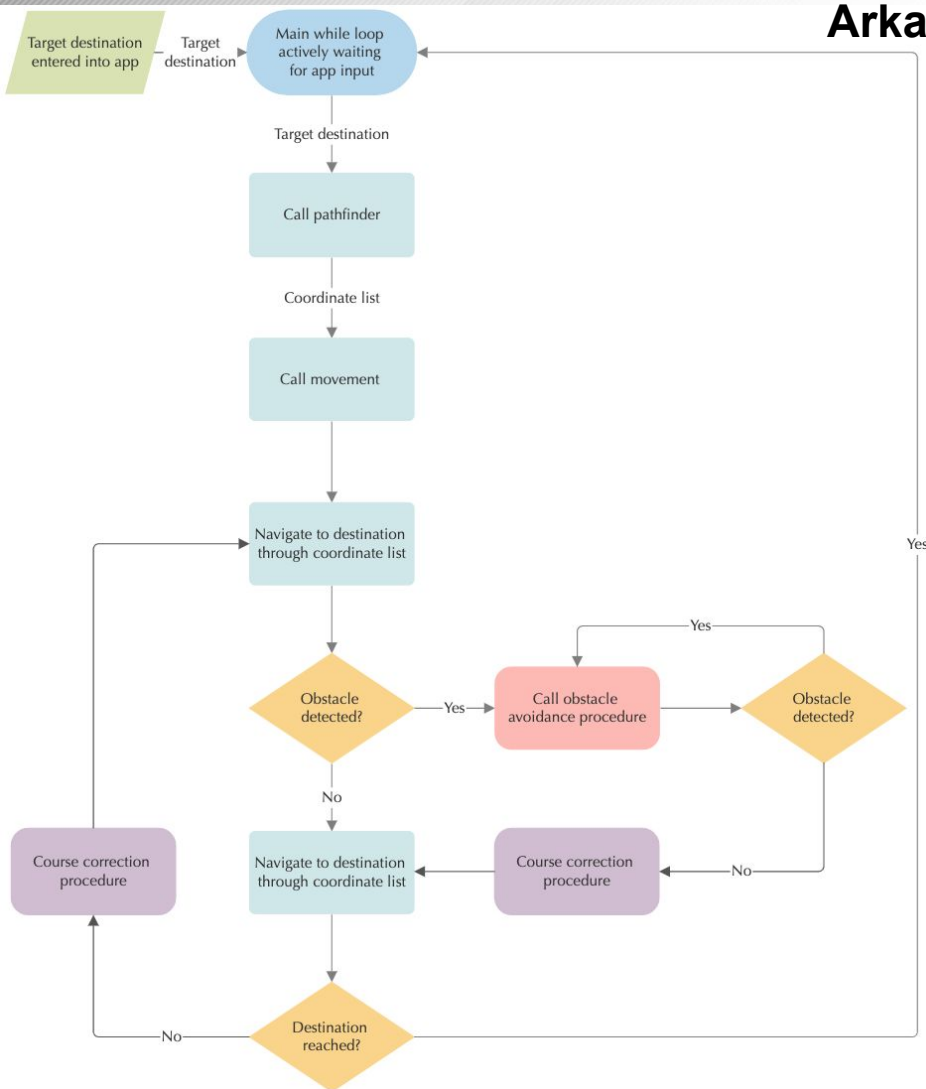


Fig 2. Integrated obstacle avoidance sensor array on rover

Fig 1. System wide control flow and logic diagram of main code



Navigation/Movement/Control

Nikolai Paderin

Accomplishments since last update 20 hrs of effort	Ongoing progress/problems and plans until the next presentation
<ul style="list-style-type: none">-Rover integration with pathfinding and application complete.-Tested Rover movement outside-GPS information being pulled properly-Integrated pathfinder with GPS module-Validated APP to Pi connection + transfers-Validated pathfinding to instruction algorithm	<ul style="list-style-type: none">-Recalibrate movement code for ground outside lab-Re-calibrate GPS(offset)-Allow app full control over rover + pi actions

Navigation/Movement/Control

Nikolai Paderin

Server listening on 100.96.1.38:12345

Accepted connection from ('100.96.1.2', 9986)

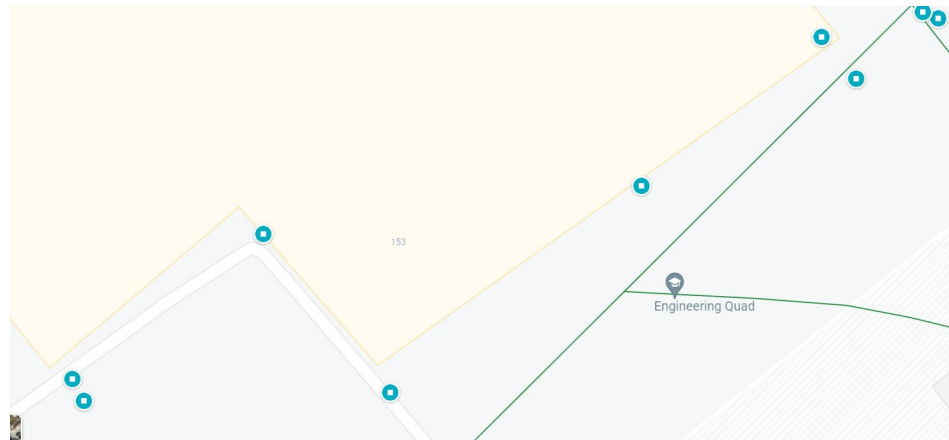
Sent: 30.616568 -96.311092

Sent: 30.616568 -96.311092

Sent: 30.616568 -96.311092

Sent: 30.616568 -96.311092

Sent: 30.616568 -96.311092



```
fwd, 1.74
right, 68
fwd, 9.58
right, 95.11
fwd, 5.54
left, 89.56
fwd, 23.82
fwd, 33.13
right, 90.87
```

Sent: 30.616568 -96.311092

Sent: 30.616568 -96.311092

Sent: 30.616568 -96.311092

Sent: 30.616568 -96.311092

Received from client: 30.6162847906465 -96.31057865917681

Execution Plan

[illegible]



SYSTEM Validation Plan

REQUIREMENT	SUCCESS CRITERIA	METHODOLOGY	STATUS	ENGINEER RESPONSIBLE
FSR Pg10	Have all sensors + movement code working and precise	Test sensors, and rover movement by measuring and calibrating	Complete	Nikolai
FSR Pg10	Add the Connection Page + Help Arkadi with navigation subsystem	Test to see if subsystem is fully operational and working as intended	Complete	Nathan
FSR Pg10	Have the navigation/pathfinder code working as intended.	Using two points create a series of nodes that connect them using the code	Complete	Arkadi
FSR Pg10	Have the Raspberry pi communicate with pathfinding code and integrated	Using the Pi, send info to the pathfinding subsystem to create a path	Complete	Nikolai + Arkadi
FSR Pg10	Have the Raspberry pi integrated with a 4G hat such that it has internet access wherever it is.	Using the Pi and the 4G hat, give the Pi internet access through a cellular network	Complete	Nikolai
FSR Pg10	Have the Raspberry pi send and receive information from the App	Test sending information with Raspi and App using sockets	Complete	Nathan + Nikolai
FSR Pg10	Have the raspberry pi receive accurate GPS information from its antenna	Use google maps to determine whether the GPS coordinates are accurate from its location	In Progress	Nikolai
FSR Pg10	Have the rover move accurately according to the instructions	Measure the distances and angles the rover travels to ensure they align with instructions	In Progress	Nikolai
FSR Pg10	Able to effectively control the rover using the app	Able to send commands over 4G network to the pi, and have it follow the given instructions	In Progress	Nikolai + Nathan
FSR Pg10	Rover is successfully able to move around obstacles	Sending the rover on a give path, determining if it detects objects in path, correctly moves around them	In Progress	Nikolai + Arkadi
FSR Pg10	System is working as intended	See if system works in actual environment	In Progress	Nathan + Nikolai + Arkadi
FSR Pg10	Validate the whole system, and make sure it works	Stress-Check System, and see if everything works as intended	Not Complete	Nathan + Nikolai + Arkadi
FSR Pg10	All subsystems are successfully talking to each other, and can operate autonomously	Use app to get user destination, and see if rover goes to destination using all subsystems	Not Complete	Nathan + Nikolai + Arkadi



Dwight Look College of

ENGINEERING
TEXAS A&M UNIVERSITY

**THANK YOU FOR YOUR TIME
ANY QUESTIONS?**