Robotic Mining Competition – Milestone 6
Liam Sapper (lsapper2020@my.fit.edu)

Faculty Advisor: Dr. Marius Silaghi (msilaghi@fit.edu)
Client: Robotic Drilling team (Previously the Robotic Mining Competition team), NASA
Meeting Times: Wednesdays, 4:30pm - 5:30pm; Fridays, 4:00pm - 5:00pm

Milestone 2 Progress:

Task	Completion %	To Do
1. Implement, test, and demo full system on built robot	90%	Complete math for x and y coordinates for full navigation
2. Work on translating code from simulation to hardware	90%	Complete math for x and y coordinates
3. Complete navigation GUI	80%	Implement GUI with current nav simulation, optimize map
4. Create poster and ebook page for Senior Design Showcase	100%	none
5. Create user/developer manuals	100%	none
6. Create demo video	100%	none

Task 1 + 2:

This was much easier to do than anticipated. We essentially just replaced the Webots manual button movements with functions from the pyPS4Controller library, which allows us to connect our PS4 controller and assign whatever buttons we want. For managing the motors, we replaced Webots' motors library with the adafruit_servokit library. This was usable because of the adafruit hat that was put on the raspberry pi to allow more pins to be used. Finally, Webots' built in time functions were replaced with simple datetime functions. However, the most difficult part has been measuring the x and y coordinates for the robot. In Webots, the simulated encoders on our test bot did all the calculations for us and gave us the information needed. Unfortunately, while we planned to put encoders on the physical robot, there turned out to not be enough space to fit them, so we have been left to do all the math ourselves. Along with this, no sort of wifi receiver has been installed onto the robot's computer, so the GUI cannot be tested without being plugged in directly to the raspberry pi. We cannot have the robot wired into anything when it's running.

Task 1 + 3:

The GUI is nearly complete. A basic framework has been created that allows us to put waypoints in a list and show that list in its own section. There is also a section for notifying the user if the auto navigation is on or off. There are two other separate sections, one for the map and one for the user to input the starting origin of the robot. This may end up getting taken out. Admittedly, I've been waffling on how to go about with the map, how feasible it really is to overlay a 0,0 starting position over the same map in different places. Otherwise the alternative is displaying the map, overlaying the grid over it, and having us input the starting coordinates

ourselves based on where the robot is in our satellite image. The alternative is what I have been working towards, however it is not fully complete, so as of now it simply puts our robot at (0,0) on a blank map with grid lines.

Task 4:

The ebook page and the poster have been fully completed. These were done by team leads Sidney Causey and Shayla Peak, with each team member helping to adjust their respective areas. The area explaining the navigation and some of the software components is at the bottom right of the poster.

Task 5:

The user manual has been created explaining the different components of the GUI, as well as explaining how to work the robot with the controller. The dev manual has been created going deeper, explaining the different functions how they work, and how they're implemented within the program. The code itself has the necessary comments. All of this will be given to next year's team to work off of.

Task 6:

The demo video gives an overview of the simulated navigation system. It gives a brief description of the functions and the controls, before playing a quick example of the robot traversing along a random example path.

Lessons Learned:

These last two semesters have been filled with a lot of ups and downs. Like last semester, time management was important here in the second semester. Unfortunately there were a lot of health issues plaguing me this year that made it hard to concentrate on my work. Those combined with the increased workload from my other professors meant I needed to be very careful with my time. I feel I could have done better managing that time properly.

It was a big learning experience working with this simulation software, and with simulation software in general. But ultimately I was able to get the navigation to a point where I am happy with it; the software is able to successfully keep track of coordinates, plot them in a list when commanded, and allow a robot to traverse to each waypoint with some decent accuracy. It may not be completely polished but it does the work that is expected. The GUI on the other hand was not fully completed and something I should have spent some extra time completing. It functions well with the simulation but the map is not at a stage I would like it to be.

I got to learn about working with a raspberry pi, which was a fun but frustrating experience. It has its own libraries to help integrate software to control hardware, which is extremely helpful. It did take some time getting it to work with the extension that was bought for it, an adafruit hat that gave us additional frequencies and electrical pins for connecting.

This is the biggest group project I've ever been involved in. Communication got a little shaky now and then, and there were several times people were not on the same page about aspects of the project. But overall we managed to build a robot that could at least move, and the navigation worked without too much flaw in our simulations. And I enjoyed working with the rest of the RMC team.

Meetings with Client:

- 3/15/2024
- 3/20/2024
- 3/22/2024
- 4/3/2024
- 4/5/2024
- 4/8/2024 to 4/15/2024

Feedback – Milestone 6

Liam has done an adequate job of giving us software that works. It is unfortunate that we ran into hardware issues and limitations that kept us from utilizing it to its full extent on the physical robot, but he did a great job working with electrical to make sure the physical robot was running as smoothly as possible with what we had.

Meetings with Faculty Advisor:

- 4/12/2024

Feedback – Milestone 6

The navigation system seems to be working well, as the robot can make points and move on its own. The results are very good. The GUI needs some work with the map, but the rest seems fine.

- Faculty Advisor Signature: _____ Date: _____

Faculty Advisor Evaluation

Liam	0	1	2	3	4	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10

- Faculty Advisor Signature: _____ Date: _____