FERMILAB-POSTER-22-092-STUDENT

RVR Wheel System and Gantry Arm

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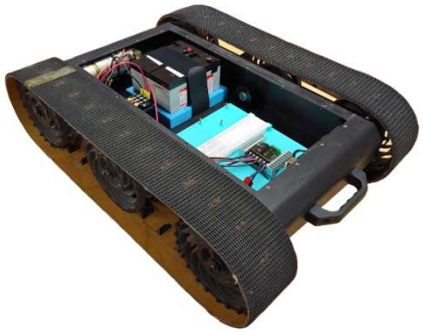
The purpose of the Remove Viewing Robot

The Remote Viewing Robot (RVR) is a mobile robot with the goal of entering the accelerator tunnels to investigate any issues or concerns. The use of RVR will reduce the number of instances people must access the tunnels and be exposed to radiation.

The purpose of the project is to develop a wheel drive system for RVR as well as testing vertical and horizontal actuators for the gantry arm. The improvements made over the internship will allow for RVR to take on additional missions and operate in different environments. Further modification of RVR is explained in posters made by Amanda Hoeksema, Emma Stachowicz, and Maryum Fatima.



A photo of RVR before modifications were made throughout the internship.

Wheel System

RVR started with a track system. However, tracks are not ideal for all situations.

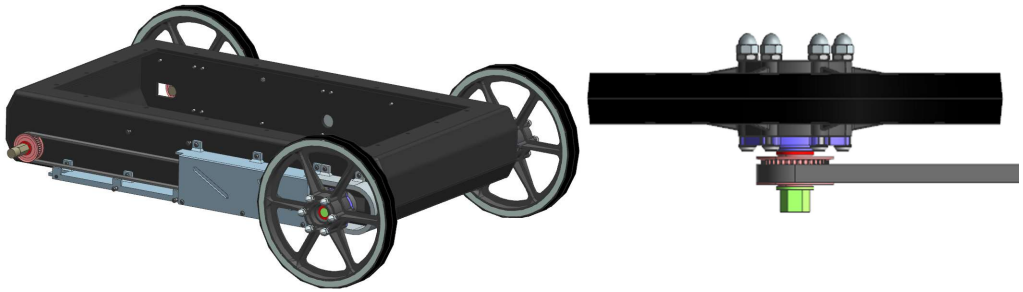
Negatives of the tracks:

- Complex installation
- Expensive
- Easily contaminated
- Low ground clearance

The alternative solution is a wheel system that will have features for different circumstances. It must allow for easy switching from tracks to wheels when necessary.

The qualities include:

- Easy removal of parts
- Simple installation
- High ground clearance
- Pulley and Belt drive system
- Belt cover – safety factor and blocks debris



On the left, the CAD model of the wheel system that will allow for easy transitioning between the tracks. On the right, a close-up of the wheel assembly and how components are aligned.

Testing of Actuators

A gantry arm comprised of two actuated arms, one horizontal and the other vertical. The horizontal arm uses a belt and pinion system while the vertical uses a lead screw. A camera will be attached to the end of the horizontal actuator. The gantry will be used to position this camera to view the accelerators in the tunnels.

The first step of testing of the actuators is done by writing a code using Arduino IDE to control LED lights.

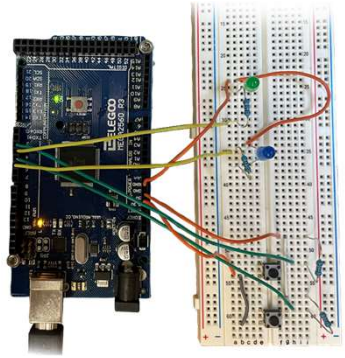
Function of the LED light code:

- Button 1 is pressed = LED light 1 turns on
- Button 2 is pressed = LED light 2 turns on
- Both buttons are pressed = Both LEDs turn on

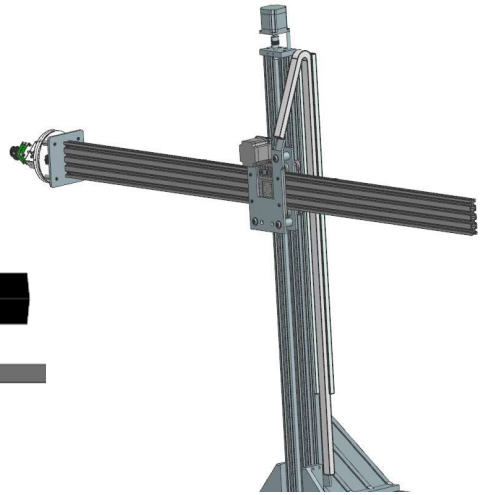
The code for the stepper motors works the same way.

Function of the Actuator code:

- Button 1 is pressed = Stepper turns clockwise
- Button 2 is pressed = Stepper turns counterclockwise
- Both buttons are pressed = Stepper does not move



Breadboard and Arduino set up to allow for a LED light to be turned on when the corresponding button is pressed



CAD view of the gantry arm with the horizontal and vertical actuators with a camera payload. assembled in NX 1980. Cable management shown uses a drag chain.

Cable Management

Stepper motors and different payloads require plenty of wires and cables. Cable management is a necessity and there are plenty of possibilities. Some include retractable cables, drag chain, or festoons.

The design shown on the left uses a drag chain for the vertical and horizontal actuators. Drag chains provide support, protection of cables, and act as a guide.

Conclusion and Future Work

The systems worked on will improve RVR's capabilities to view and analyze problems within the tunnels. They will continue to be evolved and expand upon in time. One future project includes attaching a three-dimensional camera to the gantry arm to compute distance and generate maps of the surroundings.