FERMILAB-POSTER-22-097-STUDENT

AD Robotics – RVR Top Plate and Gantry Arm

Emily Stachowicz under the mentorship of Noah Curfman

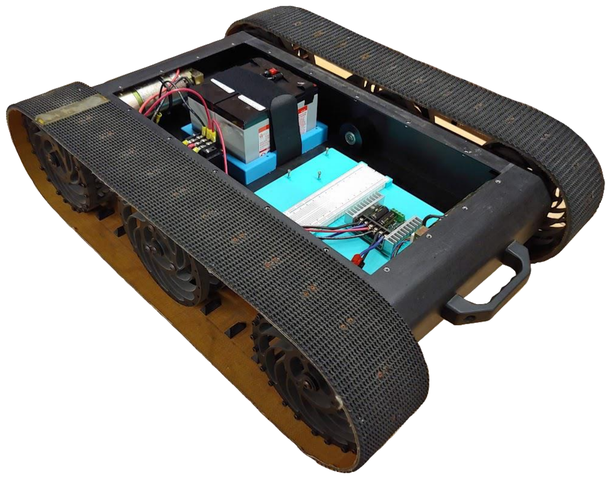
The Need for Remote Viewing

Like all things in life, the work executed at Fermi National Accelerator Lab relies on components that degrade over time, making maintenance inevitable. However, in a facility such as FNAL, contact with radiation must be as low as reasonably achievable. For this reason, there is a Remote Viewing Robot (RVR).

RVR can:

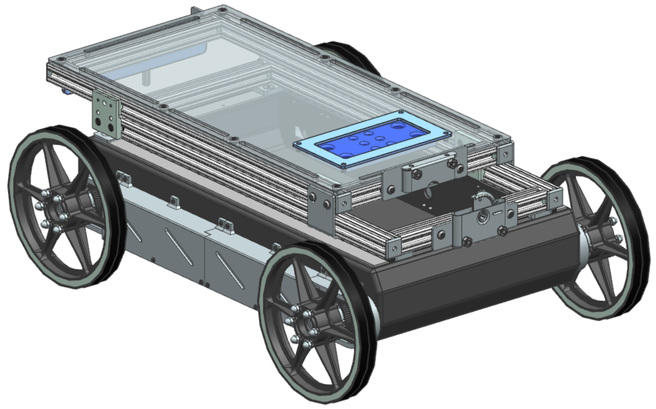
- Navigate through different environments
- Help personnel avoid contact with radiation
- Utilize different payloads depending on the situation

The project's purpose is to prepare RVR for component inspection by attaching a gantry arm while still allowing access to RVR's internal electrical components when needed. Other upgrades to RVR can be found in posters made by Amanda Hoeksema, Magdalena Sarna, and Maryum Fatima.



A photo of the Remote Viewing Robot (RVR) before receiving any upgrades or modifications. This design relied on a track system and had a small cover plate design that often interfered with internal electrical component access. In addition to this, there were only a few specific holes used for mounting of various payloads.

A New Cover Plate

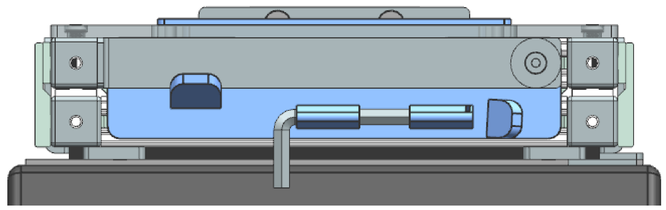


Main CAD model of the fully designed and assembled cover plate using the program NX. This design uses a combination of standardized hardware (as seen in gray) and custom, 3D-printed hardware (as seen in light and dark blue).

After conceptualization, a CAD model was created to combine RVR's original body, standardized hardware, and custom made parts for a secure attachment point.

The final design utilizes:

- Module attachment via 80/20 frames
- Sliding mechanism for internal access
- Protective locking system
- Magnetic Allen wrench holder
- Kickstand to prevent tipping
- Customizable wire management feedthrough



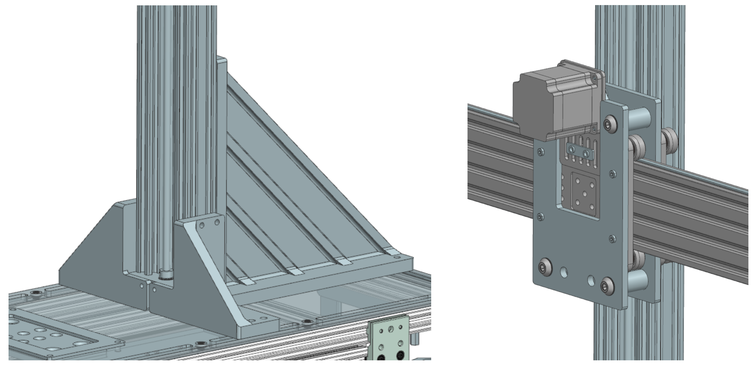
Close up view of the back of the main CAD assembly. This photo gives a better view of the custom 3D printed bracket (as seen in light blue) that serves as a way to prevent over extension of the cover plate, kickstand attachment/holder, and magnetic Allen wrench holder.

Gantry Robotic Arm

Gantry robotic arms utilize a dual actuator system for movement. These two actuators work in different ways, where the horizontal actuator is belt driven and the vertical actuator moves via a lead screw. Being RVR's primary payload, the gantry arm has a camera system attached to the end, making it well suited for inspection.

Work done on the Gantry Arm Includes:

- Attachment of the two actuators
- Attachment of the camera to the arm
- Attachment of the arm to RVR
- Conceptualization for wire management



CAD Assembly of gantry arm attachments. The photo on the left features the 3D printed attachment brackets used to fix the gantry arm to the base, while the photo on the right depicts a more hardware based method of attaching the two actuators together.

Conclusions and Future Work

Through the use of robotics, unsafe environments can be avoided without compromising work efficiency or quality. Depending on the situation at hand, different payloads can be created and modified to suit the need of the particular issue. Combining readily available parts with custom hardware can create effective payloads that, when combined with RVR, will aid in solving a variety of future dilemmas.