Metal Detecting Module
For Modular Remote Vehicle
EE Senior Design Spring 2025

Background

The Metal Detecting Module (MDM) seeks to give the Modular Remote Vehicle (MRV) metal detecting capabilities. The MRV has been worked on for many years across multiple senior design teams. Starting in the early 2010s, the MRV is currently controlled via XBOX ONE controller. The MRV has had many modules added to it over the years, including a carbon-monoxide sensor and a LIDAR mapping module. The MDM will be the newest module for the MRV, adding metal detecting capabilities to the MRV.

The goal of the MRV is to be an educational outreach tool. To this end, the MDM seeks to minimize false detections, as this will make the MDM less exciting to potential future engineers. Also, the MDM will seek to alert all bystanders to a detection when it is made.

Team Dr. Rob MD

The team behind the MDM is Team Dr. ROB MD. The team members are Drew Perenich, Team Leader, Quinn Bernhard, Software Lead, Andrew Hilburn, Hardware Lead for circuitry, and Andrew Tucker, Hardware Lead for 3D-Printing and Structure. The team would also like to acknowledge Team Mentor Dennis Hite, as well the TVA and Polaris for Financial Backing.

Technical Information

The MDM is uses Pulse-Induction type metal detection. The basis is that a pulse is sent to an LC-Tank. The pulse will charge the capacitor. After the pulse is done, the LC-Tank will have a decayed oscillation. By measuring the decay and frequency of the decayed oscillation, a baseline can be established for those values. After the baseline is established, the presence of metal can be inferred by a change in frequency or decay rate.

The MDM accurately detects the presence of a quarter sitting on the floor while attached to the MRV. It also has a very low frequency of false detections, with the module going several minutes without a false detection. The buzzer is sounds at 75 dB and 1.5 KHz output. The LED is able to be seen from at least 10 feet. The module port was also reworked to make it easier to put in and take out modules. The Module box is printed from carbon fiber.