

Metal Detecting Module

UAH Spring 2024 EE Senior Design Project

Project Overview

The Metal Detecting Module, or MDM, is a senior design project to design a module for the Modular Remote Vehicle, or MRV, for outreach purposes. This device is designed to ride along the MRV and detect metal objects on the ground to show a practical use of Eddy currents and Electro-Magnetic Engineering.

This is the fourth iteration of the MDM, the first iteration being the first device to ride the MRV back in the 2010'. Since then, the MRV has seen many changes, and has since become a quiet tradition within electrical engineering senior design projects. The MRV has seen several major changes since then, and each team has added something a little different. And this year it was team PikaWatts turn.

Hardware Design

The method of detection used by the MDM is an inductance-to-digital method. This method uses an op-amp and a rapidly changing magnetic field to induce Eddy currents in a target conductive material. This then creates its own, opposite magnetic field. This opposing field then creates a virtual change in inductance that can be measured as a change in frequency when compared to a control coil. All of this is similar to a coupled coil circuit. Allowing for quick and accurate metal detection. Team PikaWatt also made use of duty cycling and multi-channel operation to lower the total power cost of the device. Allowing it to operate on a USB at 1.2A

Meet the Team



Our team consisted of five electrical engineers. Left to right, David Upton(Co-Software Lead), Ny Alderman(Team Lead), Jordan Neyman(Co-Software Lead), Logan Evans(Co-Hardware Lead), Jacob Wallace(Co-Hardware Lead).

Software Design

The MDM made use of I2C to control inductance to digital converter integrated circuit, they did this through the use of an Arduino UNO Mini. This device also controlled all the peripheral devices used to indicate detection events to the user. This allowed for easy prototyping and rapid development of the project. The Arduino also allowed Team PikaWatt the design flexibility to achieve the goals of the project in the tight development window.
