Thickness Measurement with Ultrasonic Transducers
and
Optimization of Mini Rover Electronics

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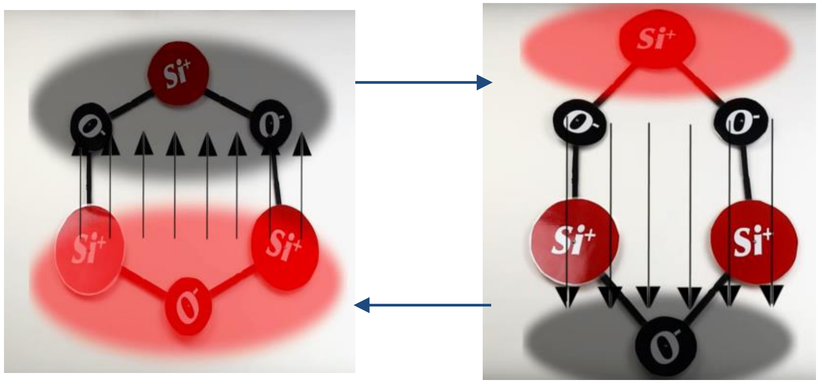
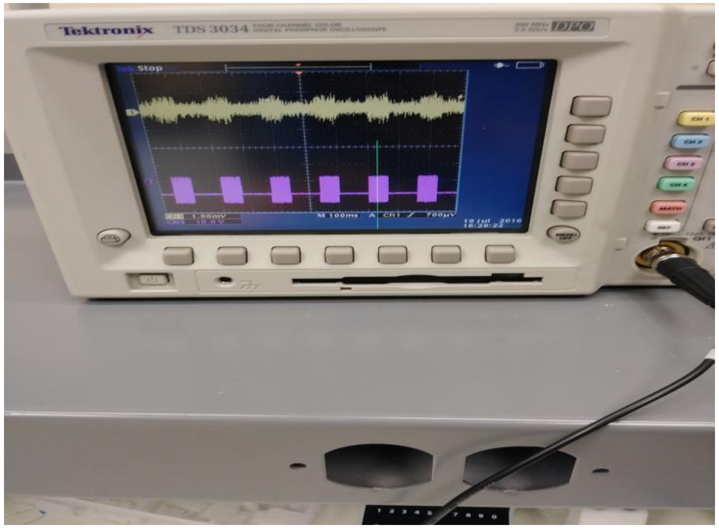
Project Background (Part 1) Ultrasonics

- Measuring thickness of carbon steel pipes through ultrasound technique.
- Using piezo crystals, we turn an electrical signal into acoustic signal which travels through the medium and back.
- Measuring the time of flight (travel time) and knowing the speed of sound in the medium/material, we can calculate the thickness of the material.





Project Background (Part 2) Mini-Rover

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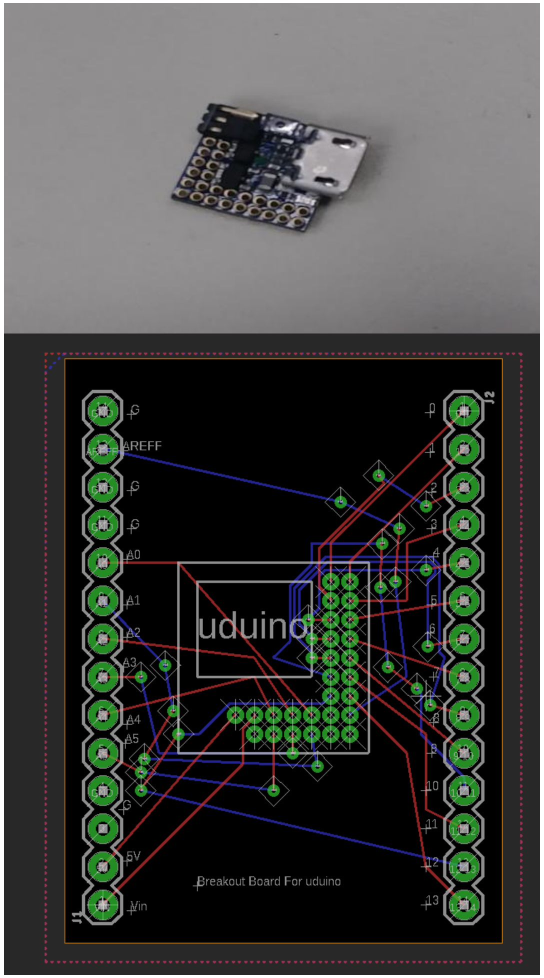
- Optimization of light emitting electronics on mini-rover
- Design of PCB to test new microcontroller and on board motor controllers
- Reduce electrical interference between signals by moving electronics onto the mini-rover itself

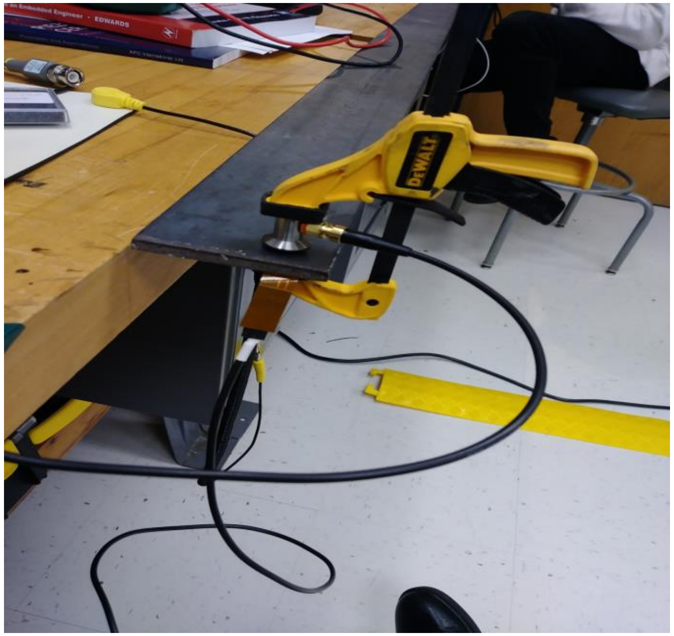


Scope/Objectives

- **Erosion Detection:**
  – Use of UT sensors to detect erosion/corrosion in carbon steel pipes by measuring the pipe wall thickness in real time
- **Mini-Rover:**
  – Devising a way to keep electrical noise out of the system, by putting the components together inside the mini-rover

Method / Approach

- **Erosion Detection:**
  - currently able to measure input and output response, we will attempt to do signal processing by transferring the data to the computer, our current setback is interfacing the oscilloscope with the computer



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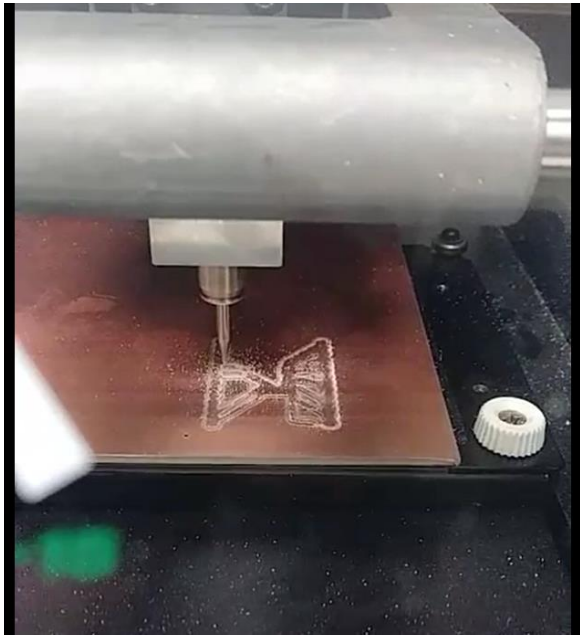
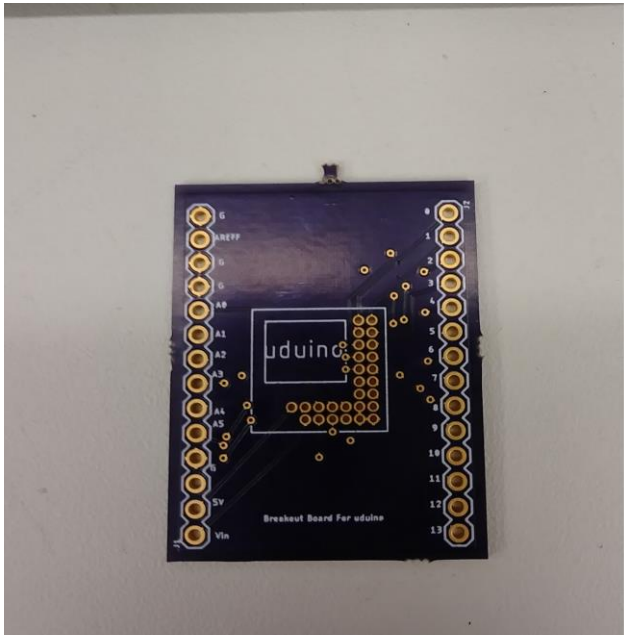
Method / Approach Mini-Rover

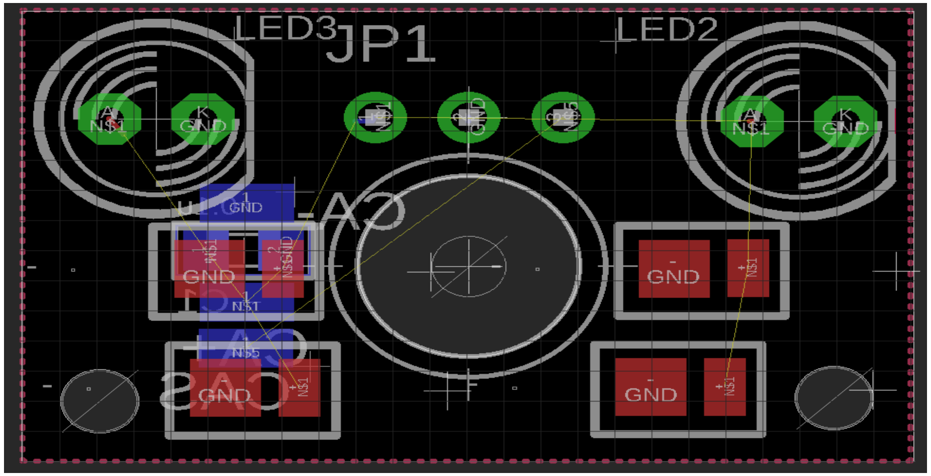
- **Mini Rover:**
  - we have acquired a more efficient, and compact light source for the mini rover, and have modified the front PCB to fit them
  - we are currently testing the new microcontroller (uDuino) with the motors used on the mini-rover





Preliminary Results/Discussion

- **Ultron Sensors:**
  - currently measuring inconsistent phase shift with our oscilloscope
- **Mini-Rover:**
  - waiting for proper headers to test the new microcontrollers with the breakout board
  - created optimal PCB for camera lighting LED PCB design



Conclusions and Future Work

- **Ultron Sensors:**
  - we have concluded that the best way to measure the phase shift for the signals is to multiply signals using a simulation software
  - collect data from the oscilloscope, process it in a computer and store it in a database
- **Mini-Rover:**
  - successfully developed more efficient LED board
  - waiting on correct female headers to test the uDuino
  - test motors with new microcontroller, relocate all of the electronics for movement onto the mini rover itself

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