Michigan Tech

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Department of Electrical and
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Intelligent Railroad Crossing Maintenance Jumper

Presented April 17th, 2014
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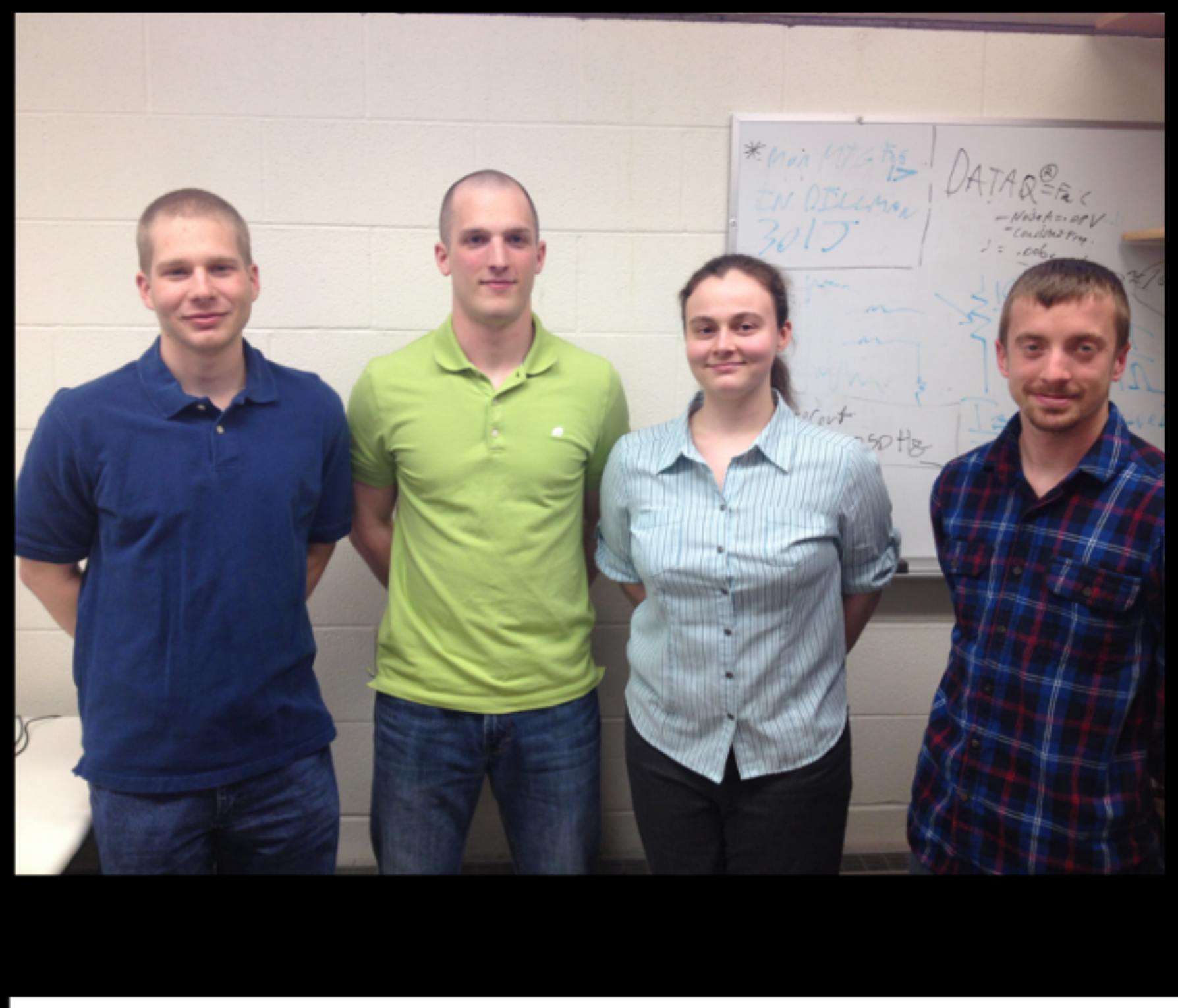
Figure 1: Group Photo



Original Problem:

During track maintenance, jumper cables are used to disable crossing signals. On rare occasions, the jumper cables may be forgotten due to human error, and the disabled crossing signals pose a risk to human life.

Project Goal:

Design a device to use with jumper cables or signal crossing devices to lessen the impact of human error during and after maintenance.

Our Prototype:

Our device monitors a voltage on a GCP-3000, HXP-3, or PMD-3, which measures changing impedance on the track as a vehicle approaches. It then uses signal processing to decide if a train or train-like vehicle is coming down the track.

If a train is detected, our intellgent jumper cable turns itself off, returning the crossing to normal operation.

After a predetermined time period, an optional timer in our device will turn the jumper off, regardless of the presence or absence of a train.

Figure 2: Filter Effects on Voltage Seen

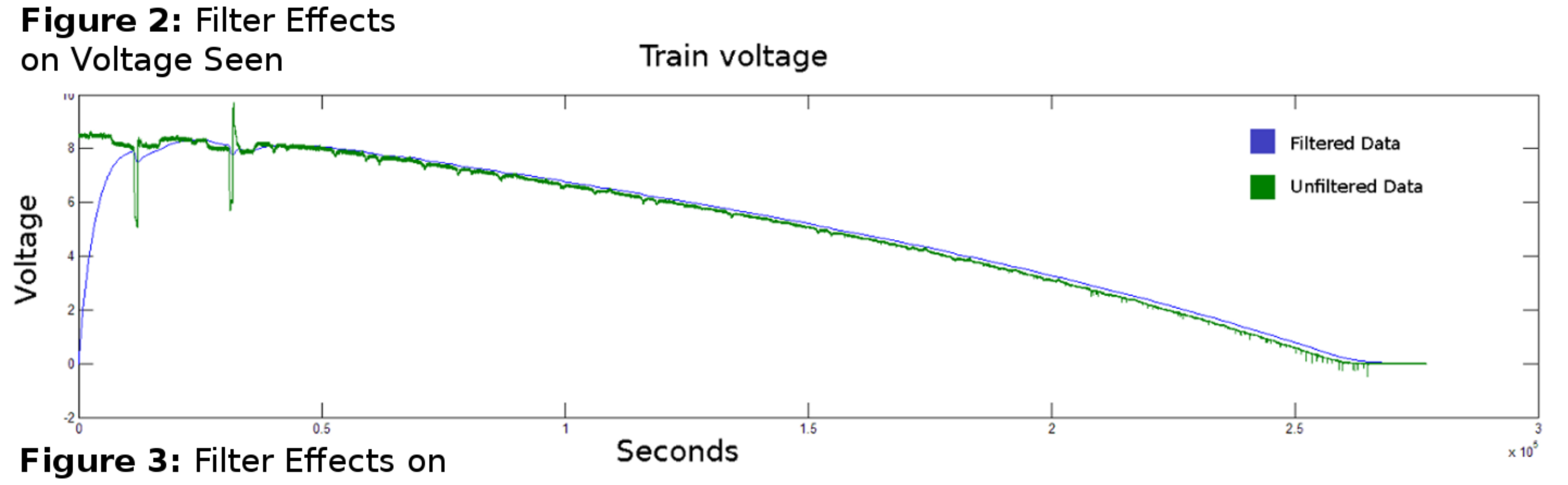
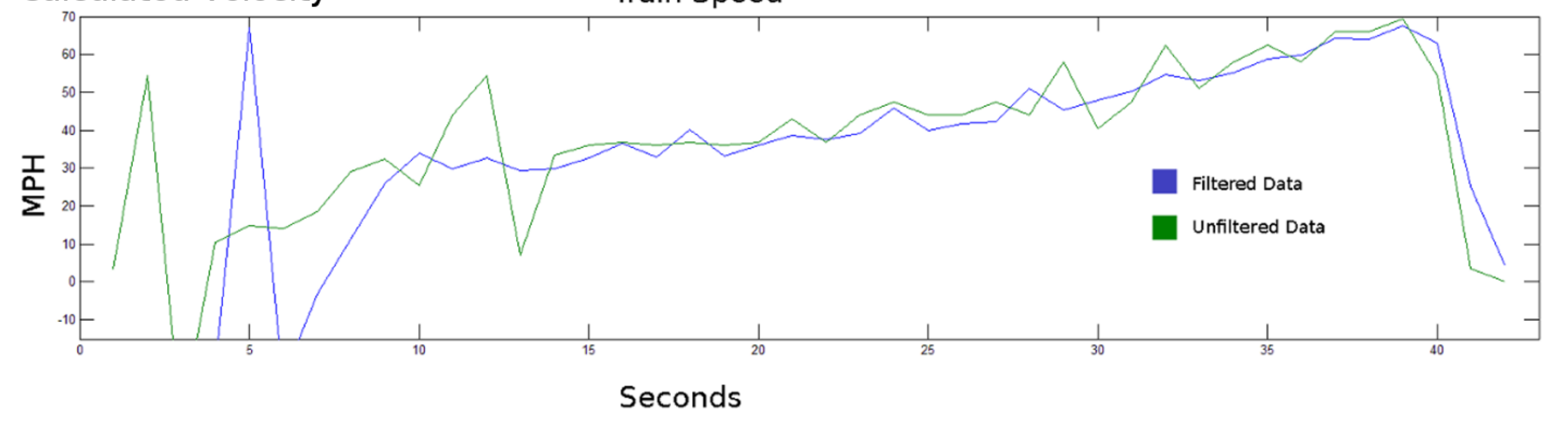


Figure 3: Filter Effects on Calculated Velocity



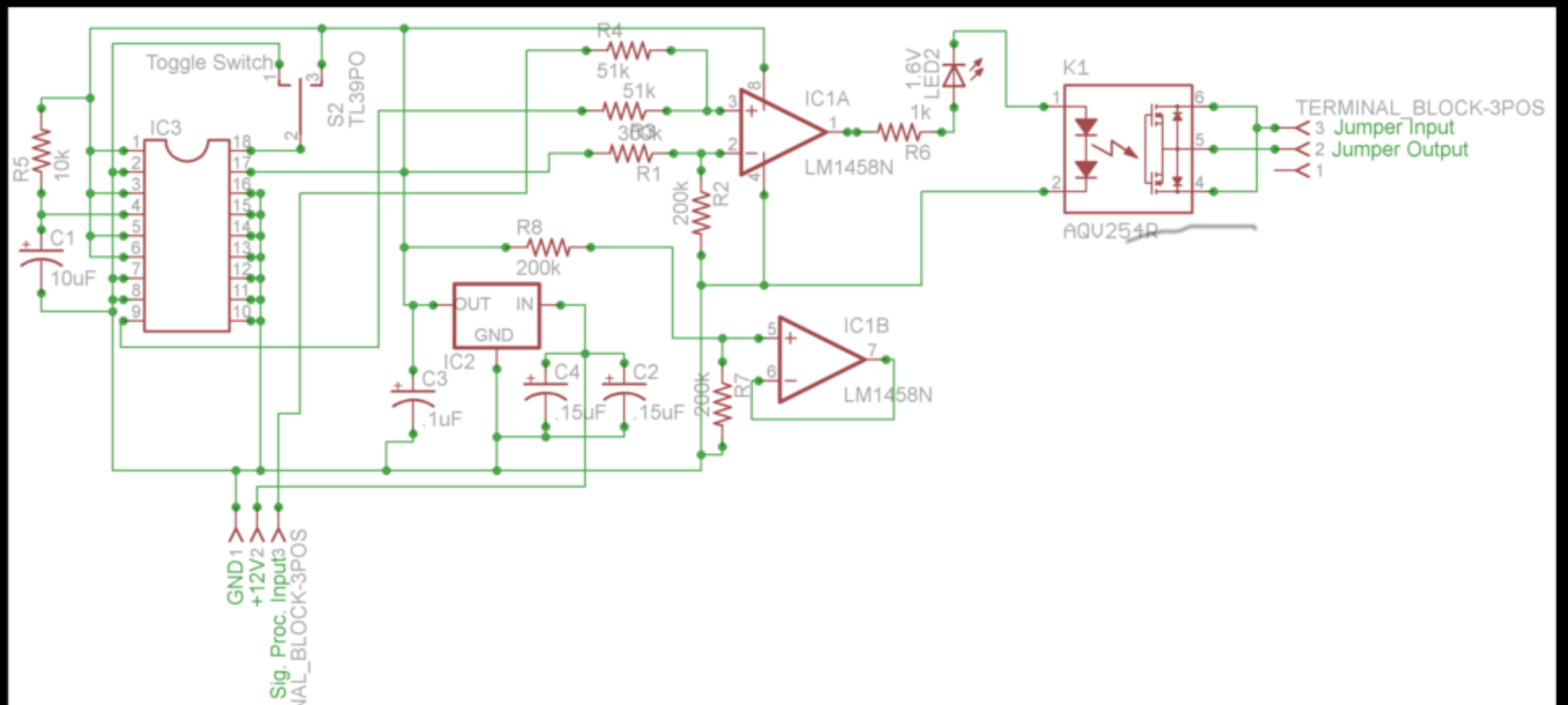


Figure 4: Circuit Diagram

Results:

In simulations, using prerecorded data taken from a crossing, we achieved warning times of approximately 20 seconds or greater. This is not only sufficient for a car to stop, but is also above the Federal Railroad Administration's required minimum warning times.

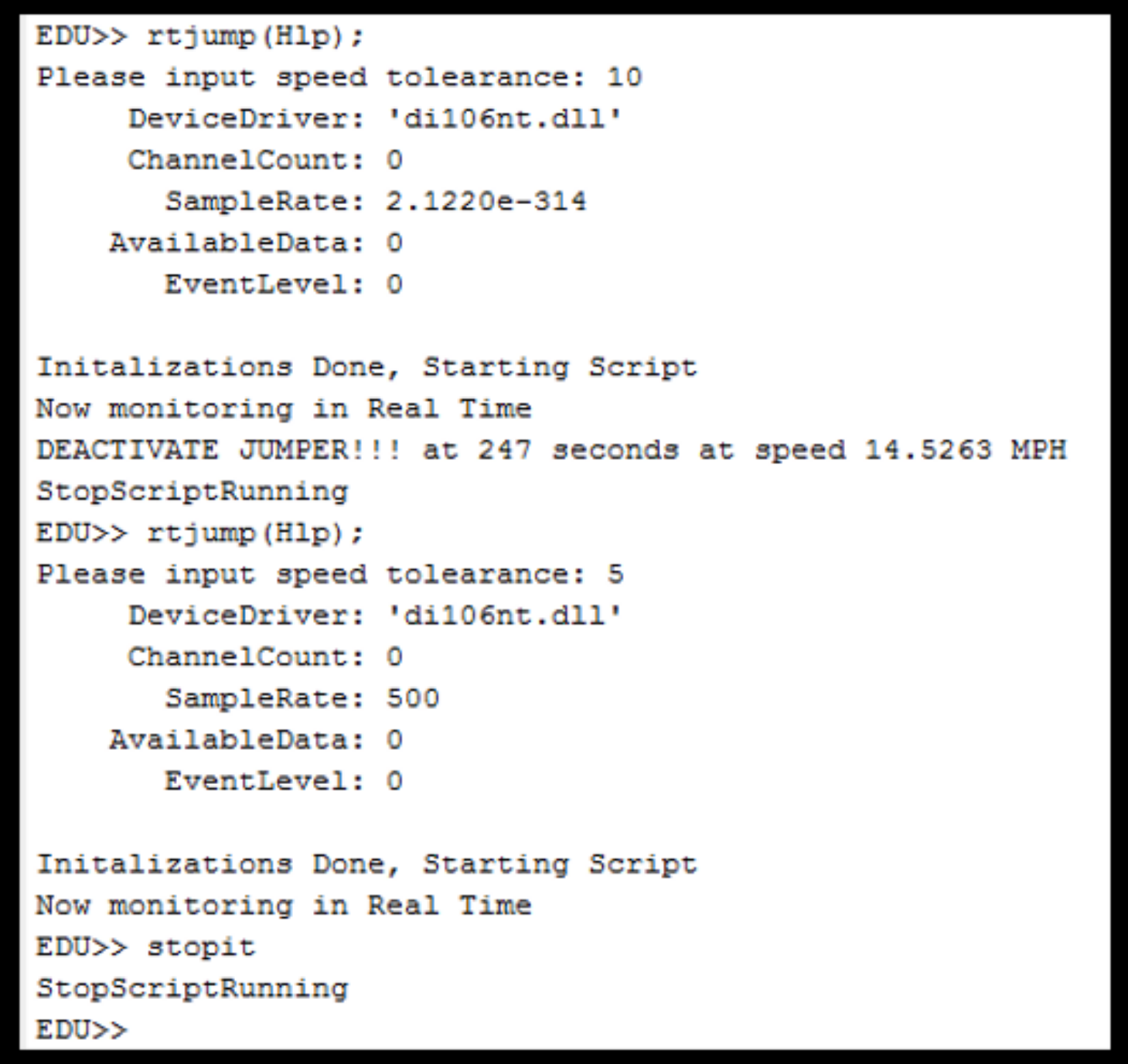
A live test was conducted in which our prototype successfully deactivated itself, albeit with less warning than expected based off of simulations. Further testing and calibration will achieve the desired design goals.

Future Potential:

Our device is intended to be a low-cost, effective, and robust component in a signal-maintainer's toolkit. It is our belief that its functionality could be easily integrated into modern crossing predictors, eliminating the need for a separate device.

FIgure 5: Ron jumpering a GCP.

Figure 6: Michael setting up real-time monitoring.



```
EDU>> rtjump(Hlp);
Please input speed tolearance: 10
     DeviceDriver: 'di106nt.dll'
     ChannelCount: 0
       SampleRate: 2.1220e-314
    AvailableData: 0
       EventLevel: 0

Initalizations Done, Starting Script
Now monitoring in Real Time
DEACTIVATE JUMPER!!! at 247 seconds at speed 14.5263 MPH
StopScriptRunning
EDU>> rtjump(Hlp);
Please input speed tolearance: 5
     DeviceDriver: 'di106nt.dll'
     ChannelCount: 0
       SampleRate: 500
    AvailableData: 0
       EventLevel: 0

Initalizations Done, Starting Script
Now monitoring in Real Time
EDU>> stopit
StopScriptRunning
EDU>>
```

Figure 7: Real-time Matlab interface.

Figure 8: Testing device with Matlab.

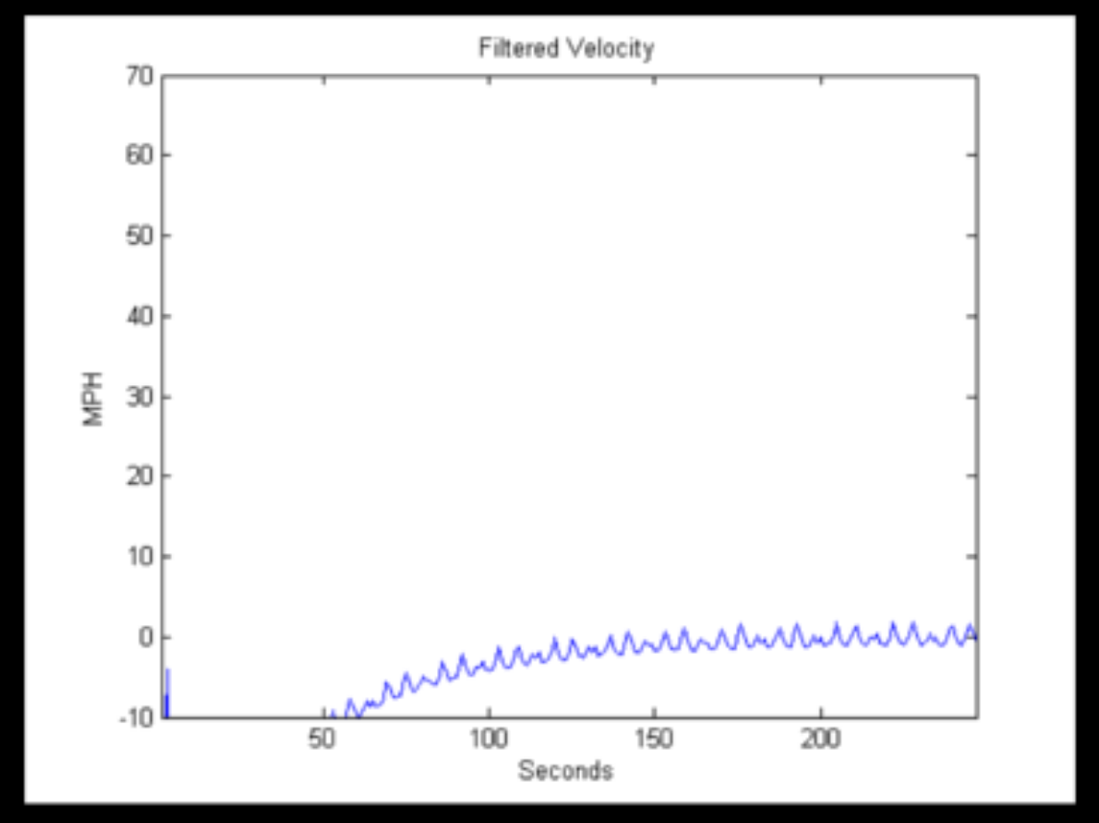


Figure 9: Real-time Matlab interface, velocity graph.

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