

ECET 491/CPET 491 Senior Design
Project Title:
A Non-contact Rotary Position Sensor Using
Embedded Technology

Department of Computer, Electrical, and Information Technology
Indiana University-Purdue University Fort Wayne
Date: Month date, Year

Student: xxxx
Faculty Advisor: xxxx
Class Instructor: Professor Paul I-Hai Lin

TO: Professor Paul I-Hai Lin
FROM: xx
DATE: xx
SUBJECT: ECET 491 Final Testing Report #1

Purpose

The purpose of this report is to provide feedback on the overall progress of the Non-contact Rotary Position Sensor Using Embedded Technology project.

Problem Review/Discussion

As you may recall from my last progress report, the PWM output signal being produced from the microcontroller was not the correct shape. This problem has been traced to an incorrectly configured assembly language program. Because my C program was developed using this assembly language program as a model, work on this portion of the project was also unsuccessful. Last week, Professor Broberg was able to redesign his assembly language program to provide a correct output. I have made corresponding changes to my C code and have tested to verify the correct output signals. With the firmware of the microcontroller operational, complete testing of the subsystems can be accomplished.

The other major aspect of my project is the LabVIEW program to evaluate the output signals of the prototype pedal assembly. Development has progressed nicely. I have been working closely with Ed Dewitt from Navistar and he has suggested some nice features that I have incorporate into the design. Some minor debugging still needs to be done and I hope to accomplish this within the next week.

Completed Tasks and Estimation, Project Completion, Remaining Tasks

1. Testing and verification of the C Program
2. Testing and verification of desired output signals
3. Testing and verification of a LabView interface program
4. The project is about 50% completed
5. The remaining tasks are

The following report provides information on the testing and verification of the C program, output signals, and the LabVIEW interface program.

C Program Testing and Evaluation

Testing of the C program involved measuring the appropriate output signals present at the microcontroller. As shown in the system block diagram of Figure 1, the microcontroller receives an analog input voltage from the Hall-effect sensor that is proportional to the strength of the magnetic field present. The C program configures the microcontroller's analog-to-digital converter to provide a corresponding duty cycle to a 500 Hz pulse width modulated output signal.

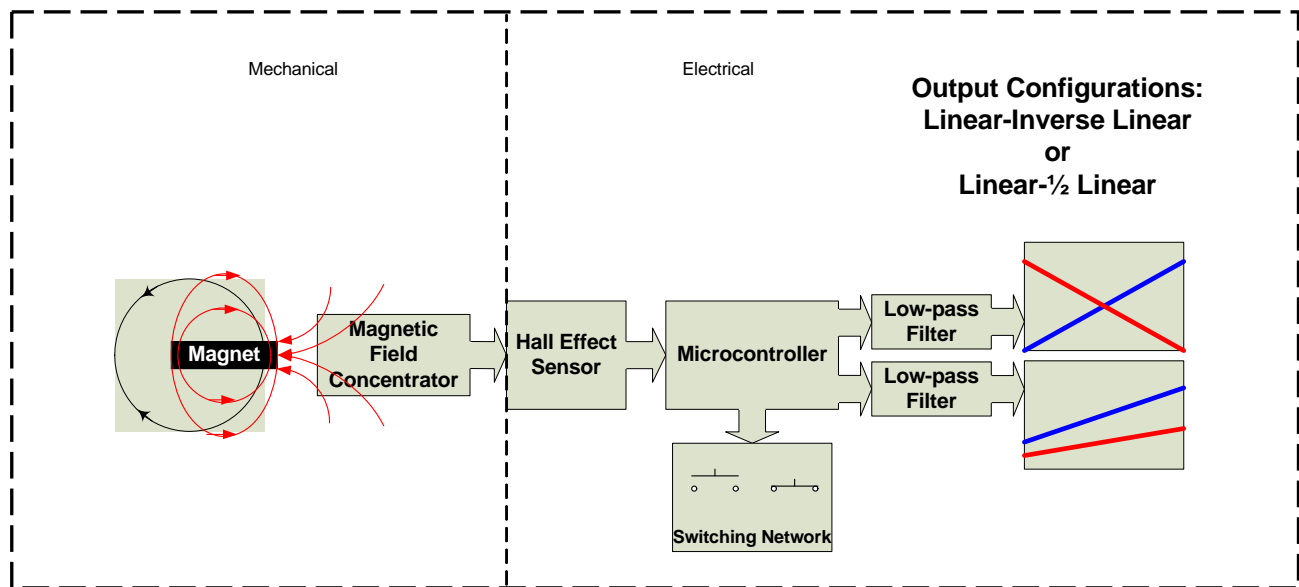


Figure 1: Block Diagram of Sensor System

Figure 2 shows the 500 Hz pulse width modulation signal being produced by the microcontroller with no magnetic field present at the Hall-effect sensor.

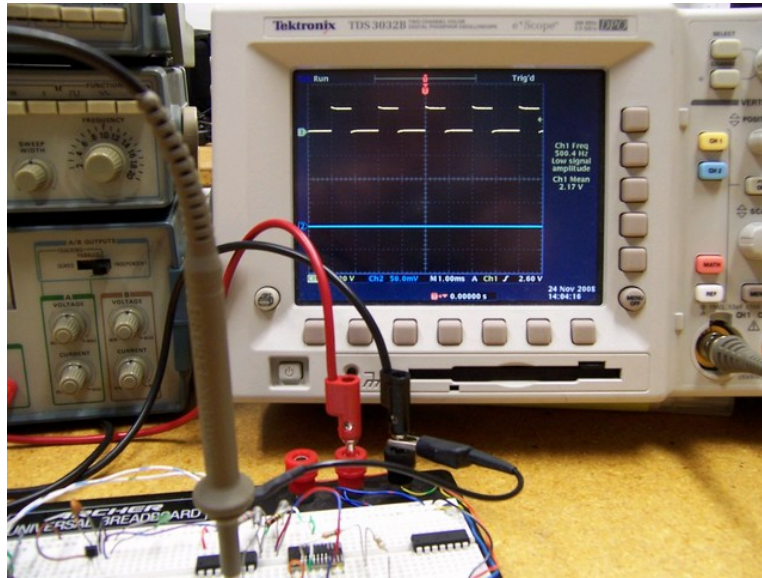


Figure 2: 500 Hz Pulse Width Modulated Signal Verification

Functionality was added to the C program to allow customization of the linear output signals. The program under test is configured to produce an ascending linear output signal that ranges from .45 to 3.65 volts dc. Figure 3 shows the output voltage produced with the Hall-effect sensor fully saturated to produce the minimum voltage. As can be seen, the accuracy is within 20 millivolts of the intended output.

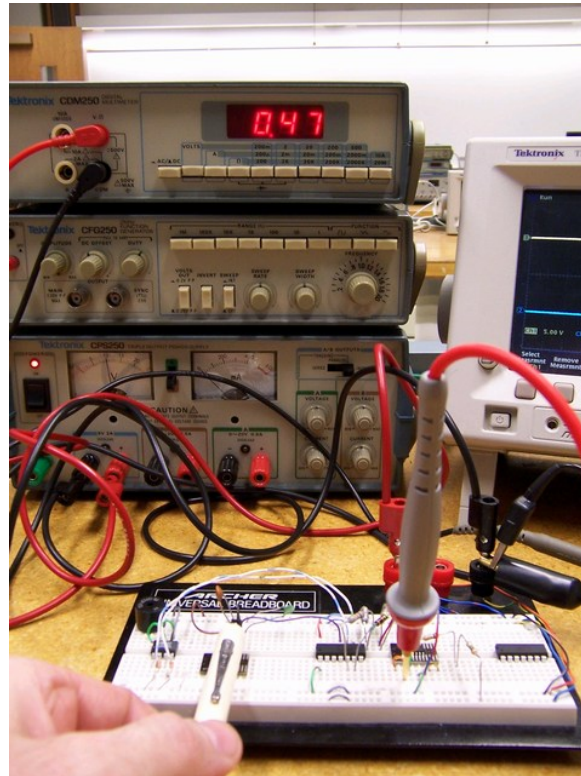


Figure 3: Minimum dc Output Voltage with Fully Saturated Hall-effect

Figure 4 shows the output voltage produced with the Hall-effect sensor fully saturated to produce the maximum voltage. The accuracy is within 10 millivolts of the intended output.

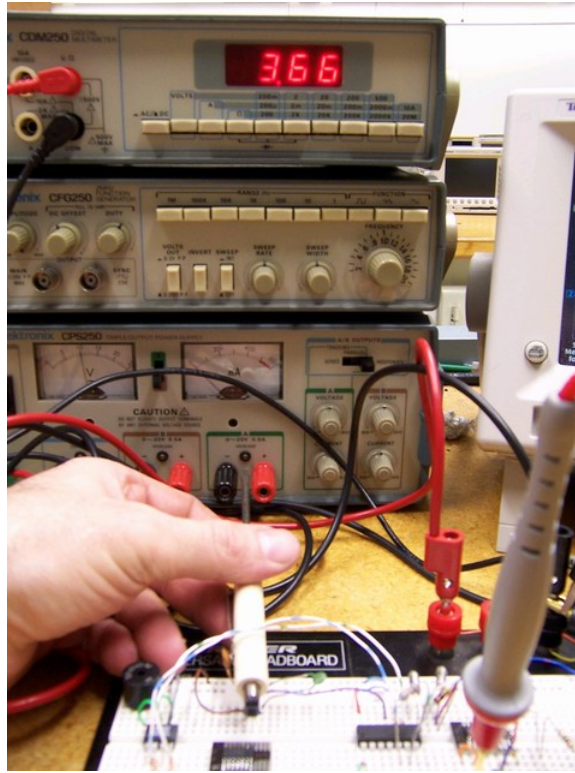


Figure 4: Maximum dc Output Voltage with Fully Saturated Hall-effect

The circuit was set up to test the functionality of the low-pass filter subsystems used to produce the linear output signals. Figure 5 shows the oscilloscope output of the ascending linear output signal and the $\frac{1}{2}$ ascending linear output signal with no magnetic field present at the Hall-effect. The dc levels measured 2.11 volts and 1.02 volts verifying functionality of the filters.

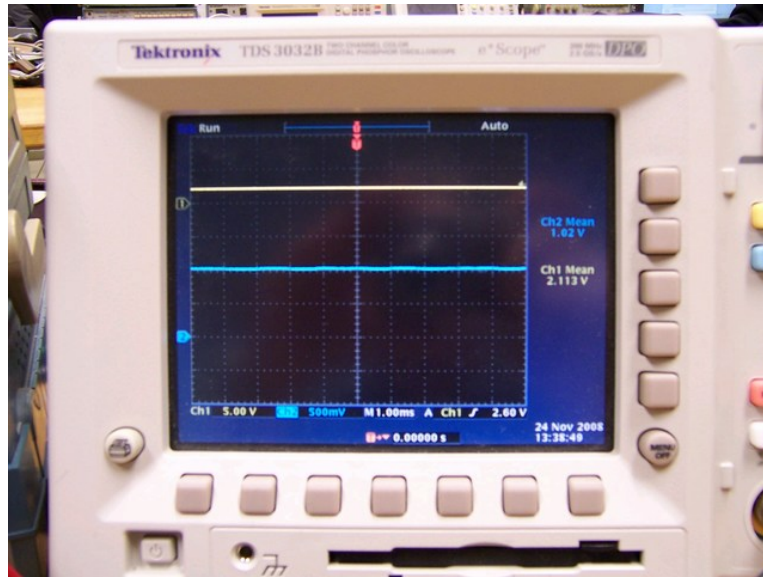


Figure 5: Ascending Linear and $\frac{1}{2}$ Ascending Linear Output Signals

LabVIEW Interface Testing

To facilitate output signal testing of a completed prototype accelerator pedal assembly, a test fixture will be used in conjunction with a LabVIEW interface. A block diagram of the testing system is shown in Figure 6 followed by a description of the subsystems.

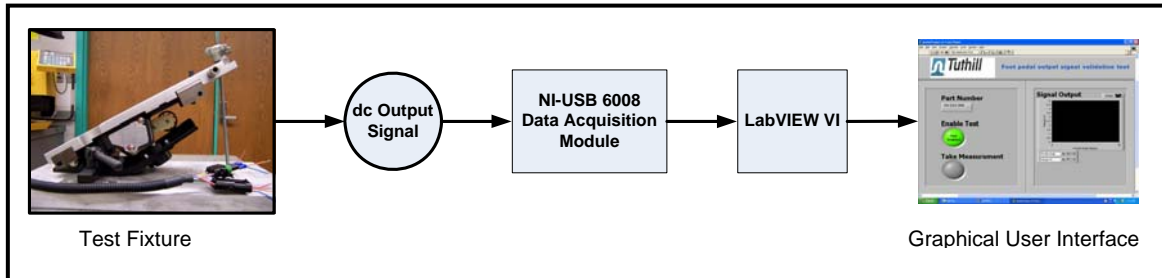


Figure 6: Block Diagram of Pedal Testing System

- Test fixture: Locating device for accelerator pedal assembly
- dc Output Signal: dc signals produced from accelerator pedal during actuation
- Data Acquisition Module: Provides analog to digital conversion of dc signal and interfaces with LabVIEW VI
- LabVIEW VI: Graphical programming language to process data from data acquisition module
- Graphical User Interface: Allows user interaction with accelerator pedal test fixture and provides graphical display of pedal output signal

The LabVIEW graphical user interface shown in Figure 7 consists of the following features:

- **Part Number:** Allows operator to choose a specific pedal assembly to be tested.
- **Enable Test:** Allows data acquisition to begin when pressed
- **Take Measurement:** Acquires a single data sample when pressed
- **Signal Output:** Provides a graphical indication of pedal output signal level

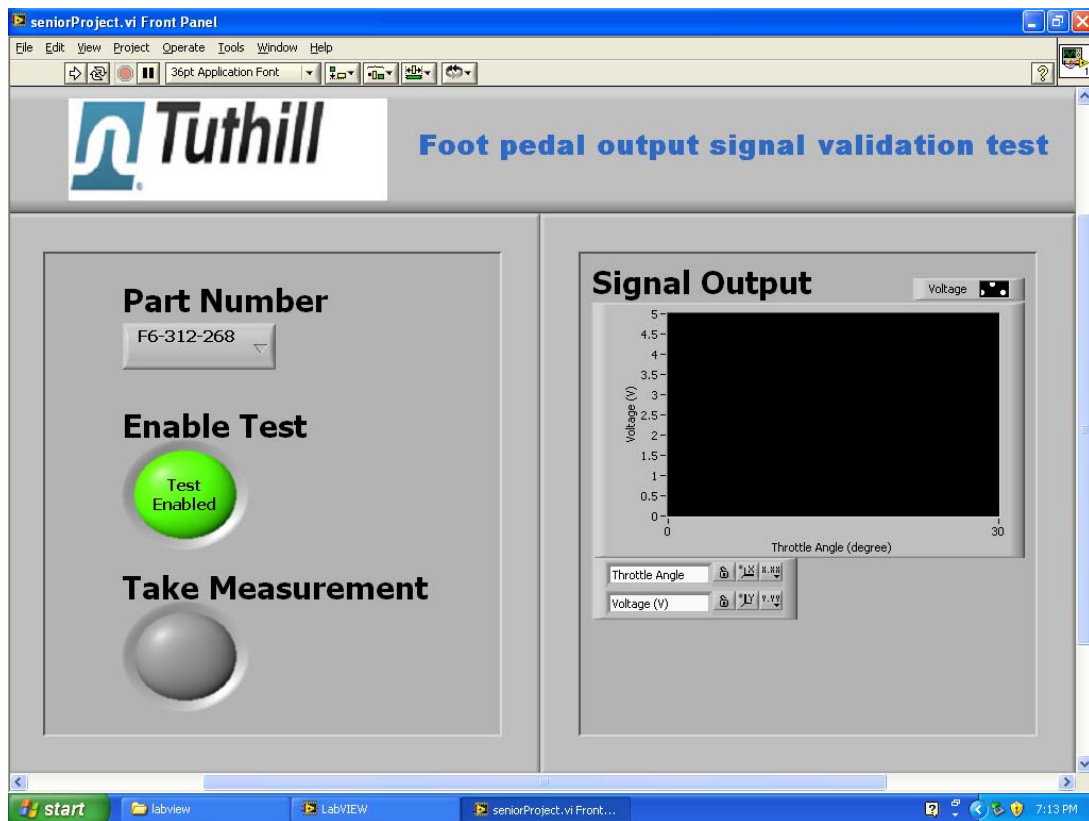


Figure 7: LabVIEW Graphical User Interface

Current work on the LabVIEW testing system consists of developing a feature allowing the user to choose a configuration file containing information on each unique pedal assembly. This feature will allow the user to add additional pedal assemblies for testing, or modify existing pedal assembly test parameters. Providing access to a configuration file will eliminate the need to modify LabVIEW code when a new type of pedal assembly requires testing.