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A Non-Contact Rotary Position Sensor Using Embedded Technology Programming and Testing

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Abstract

Tuthill Controls Group, headquartered in New Haven, Indiana, specializes in the manufacture and sales of motion control related products. Their product line includes control cables, rod ends, spherical bearings, ball joints, linkage assemblies, and other motion control components such as throttle pedals and joystick hand controls. These products are used in a wide range of mechanical motion control applications in aircraft, agricultural equipment, lawn tractors, racing cars, industrial equipment, printing presses, trucks, and tanks.

The company currently markets an electronic foot pedal that features a non-contact rotary position sensor. This pedal is used for acceleration control in materials handling and construction equipment, as well as actuator control in augers and lift mechanisms. Tuthill currently purchases from an outside source and would like to eliminate their dependency on this supplier and create their own pedal product line. Tuthill is collaborating with Indiana University-Purdue University Fort Wayne (IPFW) to develop their initial electronic foot pedal assembly. [1]

IPFW's involvement consists of developing the initial sensor circuit, programming and testing the prototype circuit, creating a data acquisition software program that tests the output of the prototype pedals, and creating a test foot pedal assembly. Because of the amount of work involved, IPFW split the project into two parts, each part making up the components of a Senior Design project. The first part saw the creation of the initial rotary position sensor circuit, the test pedal assembly, and the development of a demonstration software test program. This report documents the work completed during the second portion of the project. It will include information and documentation from the first part in order to provide relevant background information and continuity.

The majority of the work in part two involves testing and programming. The Hall effect sensors used in the prototype assemblies, created by Excellon Technologies of Fort Wayne, IN, were programmed with the HAL Application Board Version 5.1 and PC8x5 software from Micronas of Freiburg, Germany [2]. Changes to the embedded C language firmware for the circuit microcontroller were made by using Microchip's MPLAB PM3 Universal Device Programmer [3] and a PIC C compiler from Custom Computer Services [4]. The software test program and the accompanying user interface were developed using National Instrument's LabVIEW graphical programming software, version 8.5 [5].

Initial testing of the prototype Hall effect sensors was accomplished by integrating the sensor with the pedal assembly and using an oscilloscope to display output from manual pedal movements. After the LabVIEW test software was developed, a Schaevitz Sensors R120LC rotary position sensor [6] was installed on the pedal assembly. Outputs from the Hall effect and rotary position sensors were then feed into a National Instruments NI USB-6008 multifunction data acquisition module (DAQ) [7], which was programmed with the LabVIEW software. The software provided the user interface that analyzed, tested and recorded the data.

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