Maestría en Ingeniería en Automatización de Procesos Industriales

Title

Training panel for sequence analysis injection and ignition in the MFI system (Multiport Fuel Injection), controlled by an embedded system and CAN BUS protocol

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1. Introduction

The automotive sector offers great diversity in opportunities associated with maintenance, manufacturing and development of new technologies for automobile production. Therefore personnel involved in such activities must have the knowledge and skills that will benefit you in a productive and competitive performance.

To achieve comprehensive human resource training required technological means for analyzing and understanding the different systems that make up an automotive system, so the activities associated with production, innovation and maintenance are developed with high quality and effectiveness.

This research proposes the design and manufacture of a training panel display logic sequences used in the ignition system of an internal combustion engine by MFI (Multiport Fuel Injection) technology also aims to train staff in communication elements or subsystems a car through CAN BUS protocol.

2. Objectives

2.1. General objective

Building a training panel for analysis and troubleshooting of electronic injection and ignition based on the MFI system of an automobile.

2.2. Specific objectives

- To generate a methodology for conditioning control loops of MFI system for training purposes.
- To select an embedded system capable of inducing flaws in the control loops of training panel, so they will be diagnosed as staff training.
- To communicate the training panel components through CAN BUS protocol.

3. Method

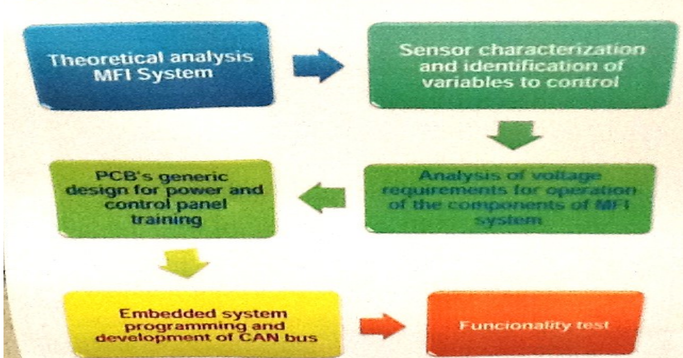

Figure 1. Methodology used in the development of this research.

4. Implement MFI system: components and sequences.

The MFI system operates under 3 modes of timing for fuel injection, considering an interaction between the mechanical part of the engine and the logical sequence of ignition and fuel injection for each case, Figure 2.

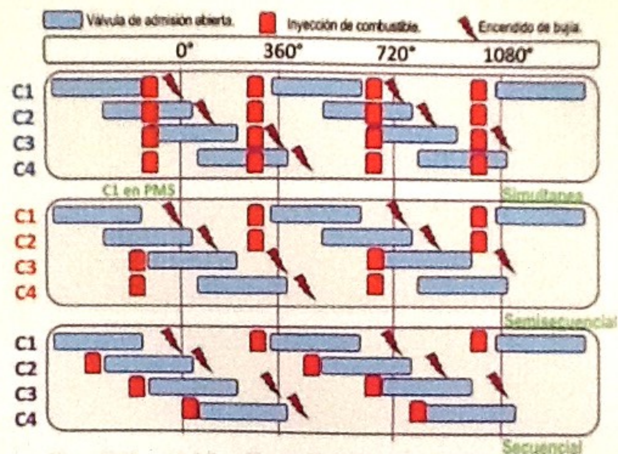

Figure 2. Characteristics of types of injection system featuring MFI

The crankshaft position sensor (CKP) is responsible for the timing for injecting fuel into the combustion chambers of the engine. This sensor mechanically interacts with the engine through a pulley as indicated in Figure 3.

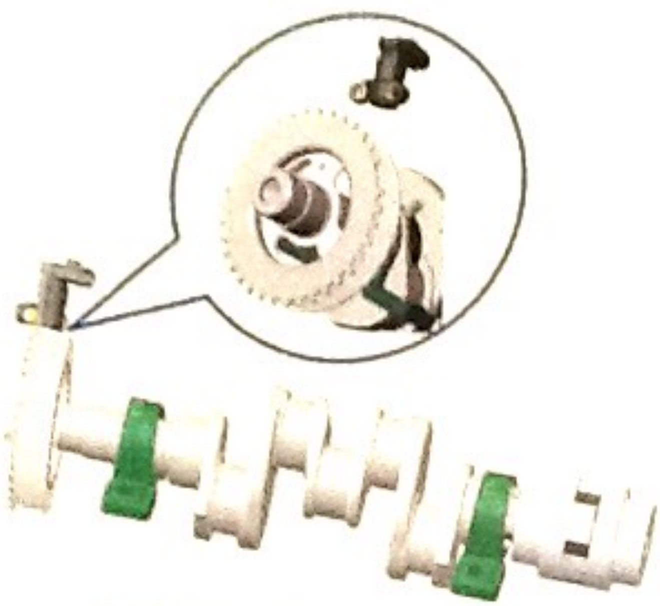

Figure 3. Location of the crankshaft position sensor

5. Results.

Table 1 presents a series of microcontrollers with characteristics of speed, handling analog and digital signals, besides profitability considered appropriate to interact with the panel proposed training.

Model	Programming platform	I/O	Speed	Programming language	Cost	Observations
FRDM-K64F	mbed	15 D & 6 A IN	50 MHz	C/C++	$33.00 USD	It allows connection I2C, CAN and PWM.
LPCXpresso1549	mbed	15 D & 6 A IN	72 MHz	C/C++	$15.00 USD	It allows connection I2C, CAN and PWM.
NUCLEO-F302R8	mbed	13 D IN, 6 A IN & 1 A OUT.	72 MHz	C/C++	$15.00 USD	It allows connection I2C, CAN and has only analog output.
NUCLEO-F303RE	mbed	15 D IN, 6 A IN & 2 A OUT.	72 MHz	C/C++	$18.00 USD	It allows connection I2C, CAN and has analog outputs.
NUCLEO-F334R8	mbed	21 D IN, 6 A IN & 3 A OUT.	72 MHz	C/C++	$20.00 USD	It allows connection I2C, CAN and has analog outputs.
Basys 2	XILINX_ISE-VIVADO	24 D/A	450 MHz	VHDL-Verilog-Schematic Language.	$143.00 USD	12 analog outputs possibility.
Basys 3	XILINX_ISE-VIVADO	12 D/A	500 MHz	VHDL-Verilog-Schematic Language.	$149.00 USD	6 analog outputs possibility.

Table 1 Embedded systems selected

The crankshaft position sensor inductive type has characterized considering a voltage range of 0.5 to 1 V for generating pulses, Figure 4, to be received by the microcontroller and in turn trigger the simulation for fuel injection or ignition.

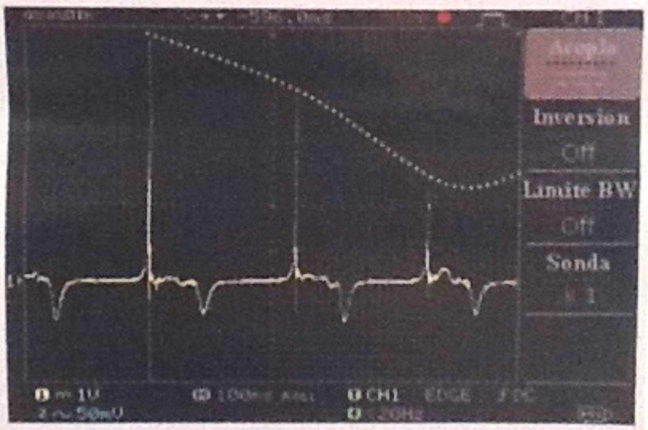

Figure 4. Response signal of the inductive sensor.

Figure 5 shows the training panel design, it may be noted that the mechanical elements are adjusted to the characteristics of the prototype.

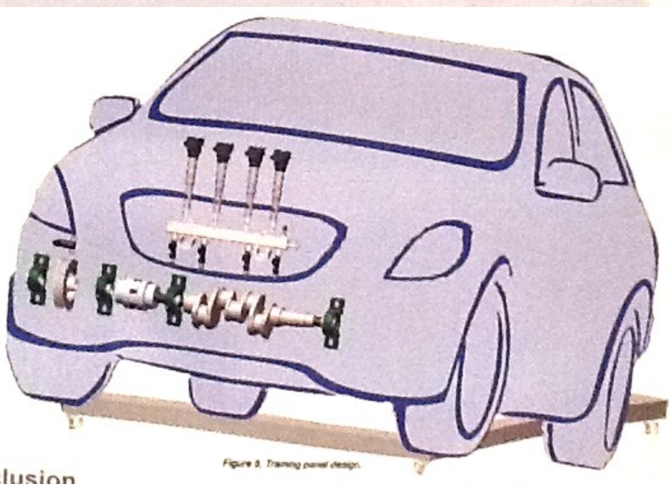

Figure 5. Training panel design.

clusion

Figure 5. Training

5. Conclusion

This research provides ample flexibility to interact with other subsystems of a car. Also it offers the possibility of adding added other devices. However, it is recommended to include the methodology proposed to develop a characterization and appropriate electronic interface.

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