MOTOR SPEED CONTROLLER SYSTEM USING MICROCONTROLLER

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ABSTRACT

This project is to design the dc motor speed controller using a microcontroller. A sensor will be used as distance measuring element. The design system will automatically operate as sensor detecting certain distance the car is speeding. As a controlling center of the system, microcontroller will be used. The ultrasonic sensor is an option to the measurement of the distance between the vehicle and retrain object (another vehicle). In this project, dc motor is used to represent the speed of vehicles that is liable to change followed by the distance that is affected by the sensor.

Keywords:
DC motor, sensor ultrasonic, PIC16F84A and MPLAB IDE programming.

1.0 INTRODUCTION

If we look at the statistic of an accident which is increasing, there are so many efforts produced by automobile manufacturers to enhance a few of safety characteristic to their product. One of the suggestions is to complete the vehicles with anti-accident system to decrease the number of accidents.

In this project, a system will be designed using microcontroller to reduce the speed of a vehicle when ultrasonic sensors detect another vehicle in front of it. The ultrasonic sensor will be used to measure the distance between the vehicle and the object (another vehicle). Once, the sensor detects the range of the distance of the barrier and the vehicles are not safe; the sensor will send the signal to the transducer [1] .Then, the signal will be converted to the pulses wave and send it to the design system to alarm the design system that the speed of the vehicle must be reduced automatically.

DC motor will be implemented to the design system to show the reduction of speed if there are any barriers in front of the vehicle. If nothing is blocking, the speed of the motor will not change. However, if the sensor detects that the distance between the barriers is a few meters in distance the motor will automatically stop. This distance will be set in microcontroller to ensure that the vehicle is in safe distance between the barriers as a limitation to the dc motor speed.

1.1 Objectives

The objectives of this project are:

- To design a system that can sense a distance from a vehicle and an object those block using microcontroller.
- To analyze the system to ensuring that the driving distance always in a safe distance by using ultrasonic sensor.
- To study the characteristic of ultrasonic sensor and microcontroller system.

2.0 SCOPE OF WORK

This project is divided into two parts: hardware and software. Hardware implementation requires some studies to be done to ensure its suitability in the design system. It is include the microcontroller, PIC16F84A to perform the action as guidelines for this system. In addition, the usage of ultrasonic sensor is important and must be suitable for detection as an output of project. The software development is another task for the microcontroller programming. The controller is designed based on PIC microcontroller programming capabilities. Both hardware and software will be integrated to guarantee the project is successful.

3.0 METHODOLOGY

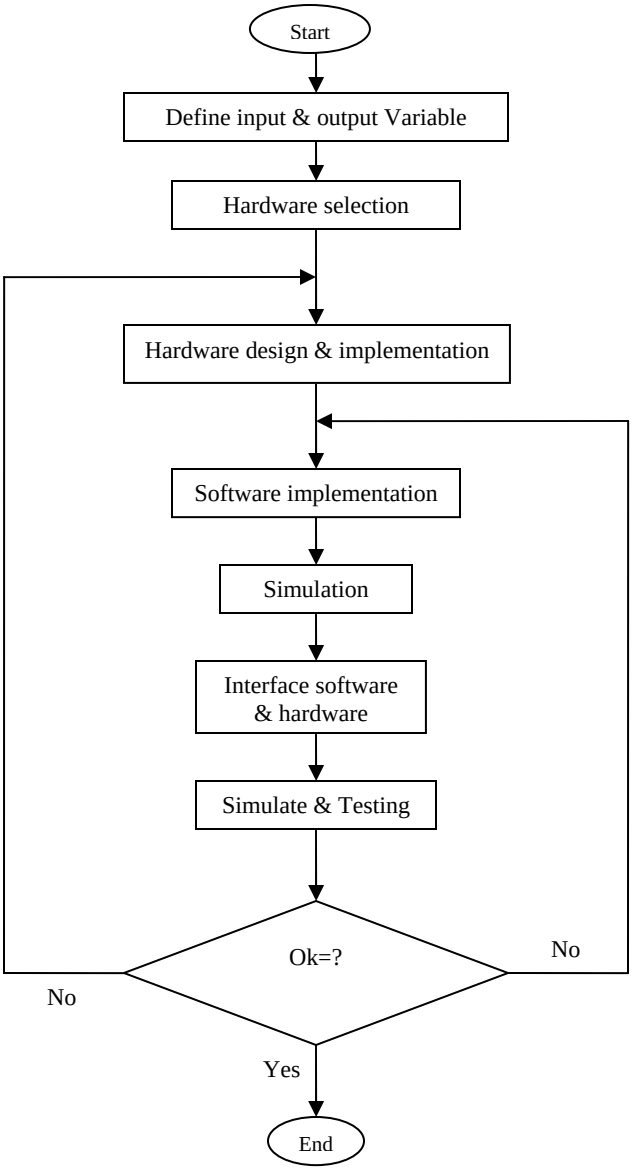

Figure 3.0: Flow Chart for Motor Speed Control System

The project is design based on the flow chart shown in Figure 3.0. The design is divided into two parts: hardware and software. The hardware selection is based on the motor speed controller system which is the main task in the design specification.

3.1 MOTOR SPEED CONTROL SYSTEM

Motor Speed Control system is designed based on the block diagram shown in Figure 3.1. This motor speed control system consists of one input and one output as shown in the flow chart of Figure 3.0. These inputs consist of distance between the barriers. Speed DC motor will be the output of this system to slow down the speed when the vehicle approaches a barrier.

This motor speed control system will detect the barrier in front of the vehicle. If there is any barrier in front of the vehicle, the PIC program will generate the speed dc motor to slow down [1]. This barrier will be measured by the ultrasonic sensor circuit.

Figure 3.1: Block Diagram of Motor Speed Control System

In this design, the ultrasonic sensor circuit can detects the barrier in 220cm range in front of the vehicle [4].

3.1.1 Design Specification

The design specification is developed on the system to alarm the driver. Some considerations have been made as shown in Table 1 in order to design the motor speed controller system.

Component	Function
PIC16F84A	- Control all operation - Control outputs and inputs
Power supply	- Supply the required voltage
Transmitter	- transmit the signal
Receiver	- receives the signal
DC Motor	- Run the motor
LED	- Display output at pin 13

Table 1: Function of each component

The PIC16F84A is used to control all the operations of the circuitry especially to control the outputs and inputs signal from the transmitter and receiver. The 5V and 12V power supplies are used for ultrasonic circuit and the dc motor respectively [3]. Light emitting diode (LED) is used to display reaction from the ultrasonic sensor that act as transmitter and receiver of the car.

3.1.2 Motor Speed Control System

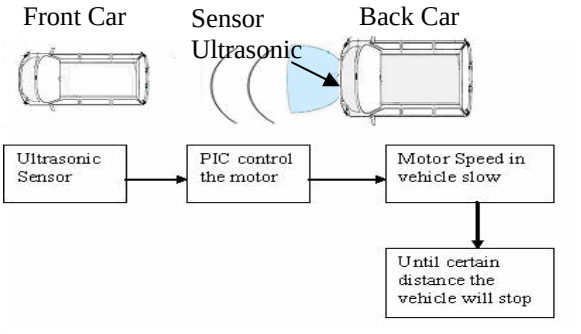

Figure 3.2: Block Diagram of Proposed Design for Actual Motor Speed Control System

Figure 3.2 shows the block diagram how the system is functioning. When the back car is speeding at certain speed, the sensor ultrasonic will turn ON. Hence, transmitter on the 'back car' will transmit signal to the barrier (front car). The signal will be reflected to the receiver. The signal will be amplified and compared to control the motor speed. Until certain distance the design system will stop the 'back car'.

The ultrasonic sensor will be attached in front of the car as shown as in Figure 3.3 to ensure the sensor can easily detect any barrier in range of 220cm. Ultrasonic sensor has been chosen because the ultrasonic sensor range is better than the infrared sensor [8]. The ultrasonic sensor will be connected to the PIC circuit which controls the speed of the motor.

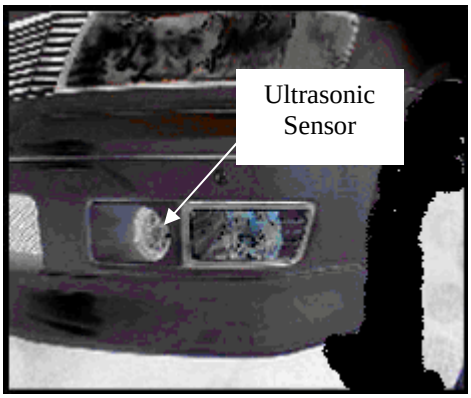

Figure 3.3: Placement of ultrasonic sensor

4.0 RESULTS

4.0.1 Hardware Development

Hardware development is realized on the PCB by using the proposed schematic diagram. Figure 4.0 and 4.1 shows the PCB layout and schematic diagrams of the overall system respectively. It has been tested that the circuit is functioning.

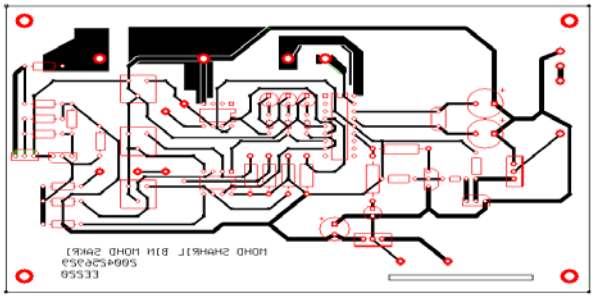

Figure 4.0: PCB layout for the proposed circuit

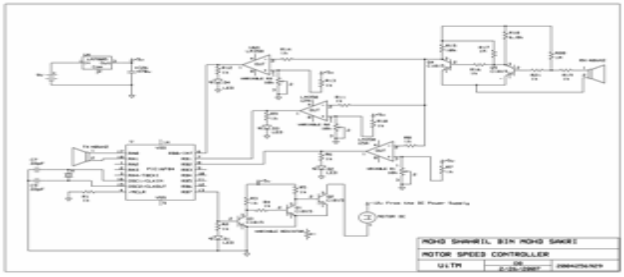

Figure 4.1: Schematic diagram of the proposed design

The measurement of the distance is made and tabulated as shown in Table 2. The voltages in Table 2 shows the voltages in speed motor as the distance is varied.

Distance (cm)	Voltage (V)
5	0
57	1.6
108	2.2
164	2.6
220	3.2

Table 2: Distance versus voltage in speed motor

An oscilloscope is used to indicate the output waveform if there is any obstacles in front of ultrasonic sensor. Figure 4.2 shows there is no obstacles in front of the ultrasonic sensor. If there is an obstacle, the waveform indicates step output to show the motor is slowing down as shown in Figure 4.3. The motor will eventually stop as the obstacle is in front of the ultrasonic sensor and it shows in the output waveform of Figure 4.4.

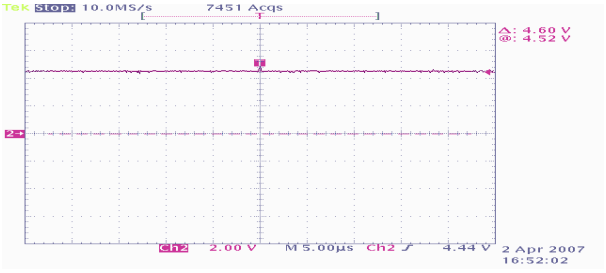

Figure 4.2: Output waveform when no obstacle is detected at range 220cm

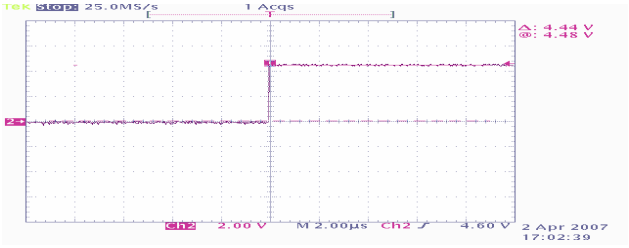

Figure 4.3: Output waveform when obstacle has been detect at range 57cm

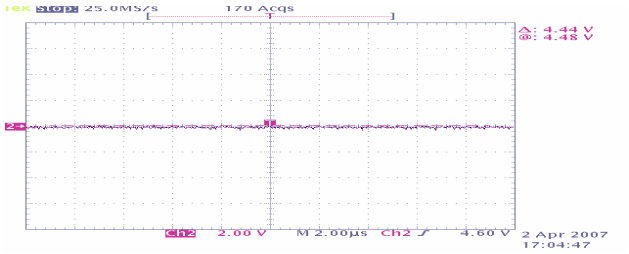

Figure 4.4: Output waveform when the obstacle in front of the ultrasonic sensor

4.0.2 Software Development

MPLAB 7.41 language is used to develop the programming of the PIC16F84A. The compilation of the programming is successful as shown in Figure 4.5. It shows no error and than the code is burned to the chip PIC. The code of for PIC is based on the set up from the PIC rule base as shown in Table 3.

Figure 4.5: Compile to check for errors before burn-in the PIC16F84A

INPUT	PORT RB0	PORT RB1	PORT RB2	DC Motor Speed
111	High	High	High	Fast
110	High	High	Low	Medium
100	High	Low	Low	Slow
000	Low	Low	Low	Stop

Table 3: Rule base of PIC

When the outputs receive at port RB0, RB1, RB2 are High, High, Low the motor will shift in the medium speed. When the outputs receive at port RB0, RB1, RB2 are High, Low, Low the motor will progress in the slow speed and finally, when the outputs receive at port RB0, RB1, RB2 are Low, Low, Low the motor will stop [5].

5.0 DISCUSSION

The implementation of hardware and software has been successfully done. The software development shows the programming and the code written is successfully compiled. Then, the code is used to be interfaced for the hardware and it works. Table 2 and Figure 4.4 show the variation of the distance and the changes in voltage of the dc motor and the output waveform respectively. The results show when the range is near 5cm the motor speed eventually stops. In addition, the ultrasonic sensor used in the project is functioning as expected in the system design and the overall circuit is working although not fully the output can be reach.

6.0 CONCLUSION

The proposed design system is an alternative to the anti-accident system for safety purposes. Hence, it is design with an intention to reduce the number of accidents. The system will automatically reduce the speed of a vehicle once the sensor detecting that the range of the distance between the car and the barrier are not safe. Gradually, the dc motor will stop the car as the distance is not safe. PIC16F84A is chosen as the microcontroller in this design because of its effectiveness and the cost is cheaper base on its function as microcomputer for special purposes [1]. The project has been completed both in hardware and software.

7.0 FUTURE DEVELOPMENT

For the future development this motor speed control system base on vehicle must have some modifications in ultrasonic sensor. There are limitations in the system. The maximum distance detection can be change so that it not has the limit only for certain distance. The modification also can be made to the circuit to minimize the size of the circuit. It is important as an initiative to reduce space. The display should be made that is convenient to the user where it can be placed on the car dashboard. Besides that, this system should be combined with the breaking system. The study on developing a motor speed control system can be continued to produce a quality product that can be commercialized.

8.0 REFERENCES

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