

A PIC-BASED WIPER BLADE MAINTENANCE SYSTEM

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Abstract—This paper presents the maintenance system of a wiper blade using Peripheral Interface Controller (PIC). The system consist of three main parts; Sensor, Microcontroller (PIC16F84A) and a Motor. When temperature is detected it will converted to a digital signal and sends it to the microcontroller (PIC16F84A). MPLAB is the software use to download or programmed data into the controller by using PICkit to PIC16F84A. It will receive the converted outputs from the sensor and recognized the digital signals from the input pins. This PIC16F84A has been programmed according to certain instruction. Furthermore the PIC16F84A will send the digital output to the motor based on the desired inputs detected. The motor will be installed to the wiper and lift it up to avoid the blade from touching the windscreen that can make it defect.

Keywords—Peripheral Interface Controller (PIC), MPLAB, PICkit, wiper.

1.0. INTRODUCTION

A wiper blade is made from rubber therefore it will begin to deteriorate from the start it was installed to the vehicle. When not in used the rubber is in contact to the windshield where it is exposed to the wind, rain and sun 24 hours every day. There are many reasons for the deterioration such as ultraviolet, ozone, oil, sand, mud, dust, snow, ice, acid and salinity of the air and water. The major reason of damaging the rubber is ultraviolet light and ozone where it produces heat. There are three symptoms of damaged rubber visible damage; splitting cracking, corrosion, deformation audible damage; causes noise with blade vibration and chattering and damage that can be felt; hardening of the rubber. A damaged wiper blade cannot be expected to give good services because it will limit the field of vision of a driver on the windshield glass. Basically the signs where the wiper blades deteriorate are the windshield glass is streaking, jumping, and spotting and uneven wiper blade pressure [2].

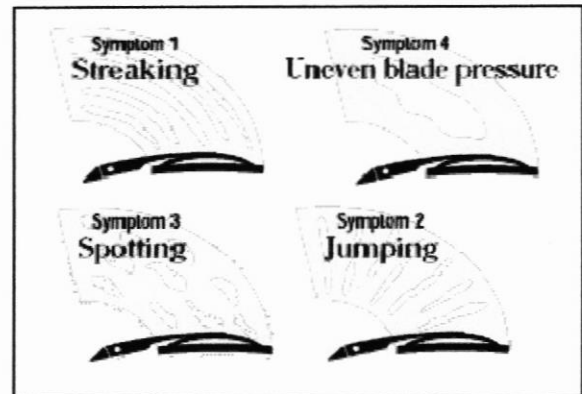


Figure. 1. Symptoms of wiper deterioration on front windshield glass

Usually when user parked their car in the middle of the sun they will lift up their wiper manually to prevent the wiper blade from damaged. It is because during this period the heat on the windshield glass will transfer to the blade and will damage the blade. To solve this problem, a specific hardware is developed to take the task to lift up the wiper. In this case the users do not have to worry if they forgot to lift it up since the hardware will activate it automatically.

The objective of the project is to implement Peripheral Interface Controller (PIC) to run the circuit that consist PIC16F84A as the controller. This project is the combination of hardware and software system. The operation will start once the car engine is off and automatically on the system. The heat sensor will send the data that have been converted to digital signal to the PIC. The PIC will recognize the desire inputs hence will operate the motor. As a result the wiper will lifted up and avoid contact between the rubber and the windshield to prevent from the heat of the windscreen.

2.0. METHODOLOGY

The main concept of this project is to lift up the wiper automatically to avoid contact between the rubber and the windshield during hot sunny day that can damage the rubber rapidly. The whole process begins when the car engine is switch off and the

microcontroller will automatically function to start the whole system. The whole system divided in three main systems which are sensor, microcontroller and motor. The output of the sensor will indicate the heat in the form of binary or digital signals. The signal then will transfer to the microcontroller to be analyzed based on the programmed loaded into the microcontroller. When a heat is detected the microcontroller will send a signal to the motor which then will lift the wiper up. Figure 2 shows the block of overall system.

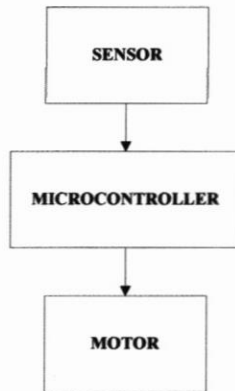


Figure 2: Block of Overall System

2.1. Hardware Development

There are 4 primary components in this project. Each component has its own circuits and functions. The primary components are:

- a) Voltage regulator supply
- b) Analog to Digital Converter
- c) Microcontroller
- d) Motor

This project required a 5v DC power supply and DC Motor required an additional 12v DC power supply to operate the circuits. The sensor used is platinum temperature sensor since it has the characteristic fast response to temperature changes and can measure on the surface. Therefore it is suitable to use since the measurement of heat is on the windscreen and the surrounding heat is changing. Heat detected is an analog signal, so it must be converting to digital signal by ADC0804 which is an analog to digital signal device [4]. The converted signal is in 8 bit binary. The four least significant will be connect to the microcontroller which is PIC16F84A where it has 13 I/O [3]. The inputs from ADC will be connected to Port B since it has been initialize as input port while Port A as output port. There is also provided

switches to control the lifting of wiper manually that connected at Port B. The output of the PIC will be the motor driver that purpose to drive the motor either clock wise or counter clock wise. The process will be based on the program loaded into the PIC. Figure 3 shows the combine circuit of this project.

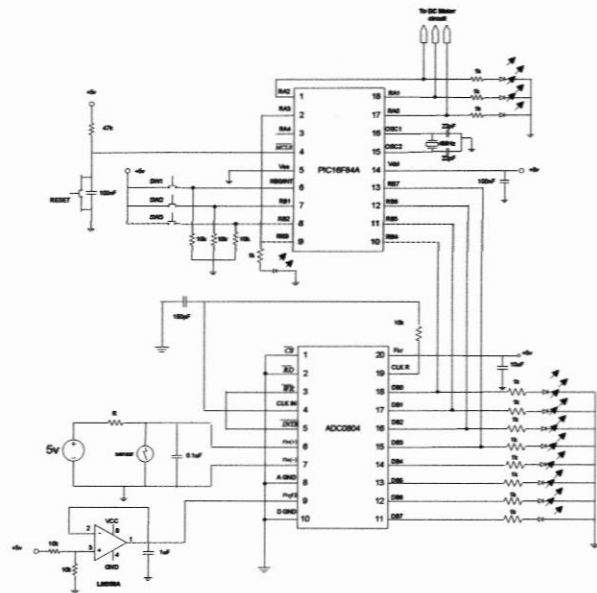


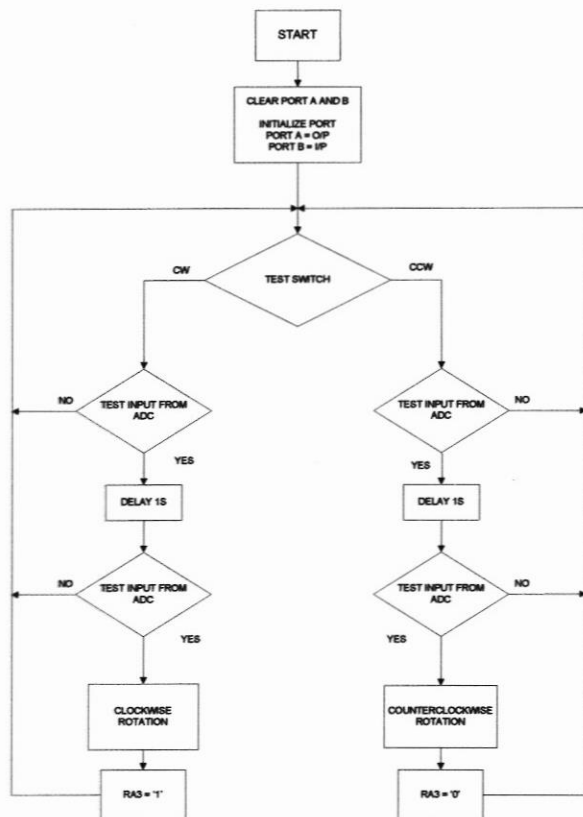
Figure 3: The Combine Circuit

2.2. Software Development

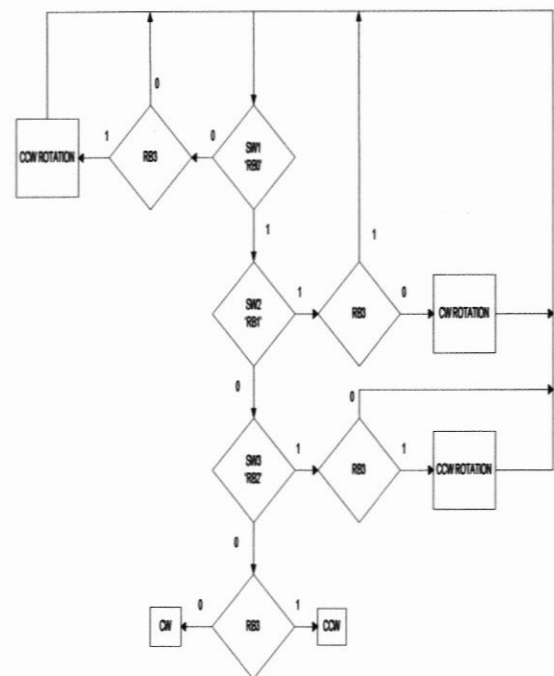
The hardware is impossible to operate the system without programmed because the hardware is just a passive device. In order to ensure its functionality, the program by using the appropriate software has been developed into the PIC. Software for work out the program has been developed in MPLAB IDE v7.41.

The program is divided into two conditions which is clock wise and counter clock wise where clock wise is condition to lift up the wiper while counter clock wise vice versa. Before that it will test the switch to see if there is any been pressed to lift up or down the wiper manually. If there is no any switch pressed it will go to test RB3 which test the position of the wiper which is in up mode or down mode. If the wiper is in down mode it will go to clock wise condition where at this condition it will only detect the input from ADC that will lift up the wiper and vice versa to the other mode.

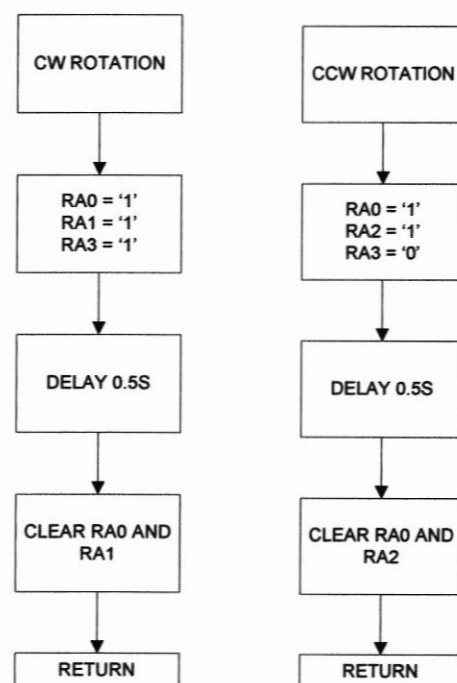
2.2.1. Flowchart of program



2.2.2. Flowchart of Test Switch



2.2.3. Flowchart of CW and CCW rotation



3.0. RESULTS AND DISCUSSION

To ensure the exact function and make it easier to trouble shooting the circuit, LEDs are placed at all the output of all circuits. All the LEDs are not connected directly to the output of the pins since the output of the IC is large and unbalanced. It will burn the LEDs since the voltage supply to it is larger than required. Therefore these LEDs are connected through series with $1k\Omega$ resistor. After connecting this resistor the voltage supply to LEDs are 1.96V. This small voltage will make the LEDs life time longer.

3.1. Testing Voltage regulator supply

First is testing the voltage regulator circuit.

	Theory	Actual
5v voltage regulator	5v	5.02v
12 v voltage regulator	12v	11.83v

Table 1: Testing results

The results obtained are similar to the theory only the 12v voltage regulator is not quite approximate. It because the maximum adapter supply voltage used is 12v. Figure 4 below shows the output waveform from the voltage regulator where the Channel 1 and Channel 2 probe is attached to the output of 5v and 12v voltage regulator respectively.

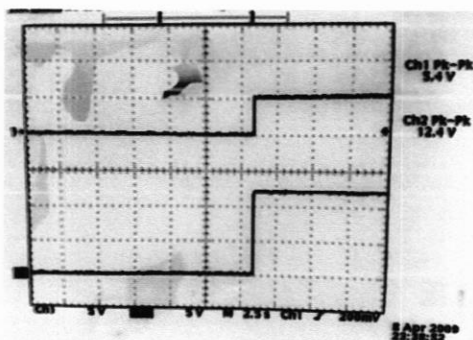


Figure 4: Output Waveform from voltage regulator.

3.2. Testing Analog to Digital Converter

First test by replace the sensor with variable resistor to see if there any change at the output. By adjusting

the variable resistor the LEDs connect to the output of the ADC is on and changing. Therefore it's mean that the circuit is functional. Then the variable resistor is replaced with sensor and some data is collected. Only the four least significant bits is collected since it connected to the microcontroller. Table 2 shows the tabulate data.

	DB3	DB2	DB1	DB0
31°C	1	0	0	1
33°C	1	0	1	0
36°C	1	0	1	1
40°C	1	1	0	0
43°C	1	1	0	1
45°C	1	1	1	0
48°C	1	1	1	1
52°C	0	0	0	0

Table 2: Data from ADC

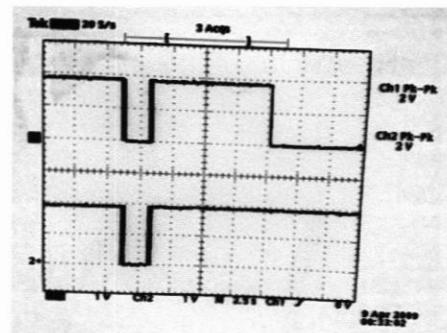


Figure 5: Output Waveform from ADC

Figure 5 above shows the output waveform from the ADC where Channel 1 probe is attached to DB2 while Channel 2 probe is attached to DB3.

3.3. Testing Microcontroller

In able to check whether the connection, arrangement and appropriate components of microcontroller circuit are correct or not, a testing program had burned into the PIC. Basically a program to test the switch where when it is pressed it will turn on the LEDs that connected to the output.

For the first test is failed it is because when the switch is open the output still on cause it thinks that the switch is closed when in fact it jus floating high. An adjustment is made by place a pull-down resistor to overcome this problem. The pull-down resistor purpose to prevent the input from floating by prevents too much current from floating through the pull-down circuit [1]. Figure 6 below shows the output waveform from the microcontroller where Channel 1 is attached to RA1 while Channel 2 is attached to RA0.

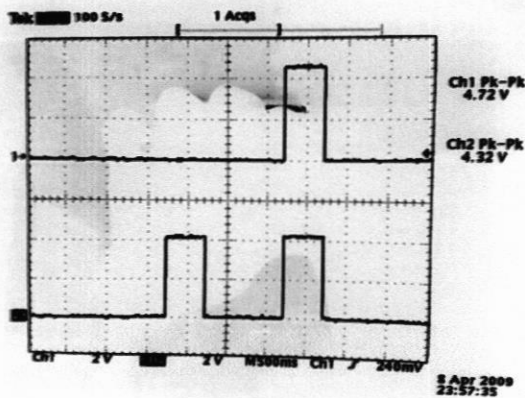


Figure 6: Output Waveform from Microcontroller

3.4. Testing the Motor

The output device in this system is motor. It will rotate to lift up the wiper. There are three wires connected to the PIC. Three colors which are yellow (PWM), pink (CW) and red (CCW). Table 3 shows the truth table to drive the DC motor.

	PWM	CW	CCW
Clock wise	1	1	0
Counter clockwise	1	0	1
STOP	0	0	0

Table 3: Truth Table to Drive the DC Motor

4.0. CONCLUSION

As the conclusion, the objective of the project are achieved which is to implement Peripheral Interface Controller (PIC) to run the circuit that consists

PIC16F84A as the controller. This application is creating maintenance to the wiper blade from damaged.

In the future this project can be improved to become a commercial product. It also can be integrated in car embedded system. The same concept of this application also can be implement to cool the car if its park in middle of sun.

5.0. ACKNOWLEDEGERMENT

First of all, praise is only to Allah s.w.t for his bounty and blessing upon us who have give me strength and ability to complete this project. I would like to express my sincere appreciation to my supervisor, Encik Abdul Hadi bin Abdul Razak for his suggestion, guidance and invaluable advice upon completing this project. Explicit thankfulness was given to my parents who gives their support for me directly and indirectly and to my entire friend for their time and support, giving ideas, comment and encouragement. This project wouldn't be possible without the helps from all of them.

6.0. REFERENCES

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