

AUTOMATED AC AND SHUTTER CONTROLLER SYSTEM FOR VEHICLES

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ABSTRACT

Air Conditioning (AC) Controller System is a very important part in automobile industry. Modern vehicles come with complex AC Controller Systems but most of old vehicles have manual AC controller where the use needs to turn on and off the AC. Unnecessarily running the AC affects the poor fuel consumption of the vehicle. Further, keeping the AC on while the shutters are open, wastes energy. This paper proposes a low-cost automated AC Controller System integrated with window shutters to minimize energy wastage. The new system contains a microcontroller, which keeps in track whether the doors and shutters are open or not to turn on the AC. Further, it monitors the temperature inside the vehicle. Considering all these information, the AC controller turns on the AC and helps to minimize fuel wastage due to Air Conditioner of the vehicle.

Keywords: *Automobile air-condition controller, Minimizing energy waste, Microcontrollers*

1.0 INTRODUCTION

Automobile sector is one of the demanding and fast growing sectors. So with the development of the technology the automobile engineers and the technician try to make changes and advanced systems of vehicles. As it is in the technology there are some old vehicles which include Air Conditioning systems controlled manually by the passengers. These systems have switches to control the Air Conditioning system. And also the shutters are controlled by using a liver or a separated switch in the middle age of development of automobile sector.

Nowadays the engineers designed the Air Conditioning system to be controlled automatically. And the shutters are controlled using a switch in a more efficient way. While the Air Conditioning can be set to a desired value and when the passenger turns OFF

the Air Conditioner and again turn it ON the Air Conditioner keeps the pass value in its memory and gives it as the output when the Air Conditioner turns ON.

With this study of the automation and the controlling of the vehicle systems, and since there are no systems developed at the moment connecting the Air Conditioner and the Window shutters we decided to combine these two factors together in order to make a solution to the power usage and the fuel usage. Here in this project we designed a prototype to show the working conditions of the above factors using a Microcontroller and some other components.

2.0 THEORY AND EXPERIMENT

For the designing of the AC and Shutter controller System, a microcontroller was used. This microcontroller is connected to the ULN2803 which is a motor driver IC, a LCD display, LM35 temperature sensor and to a L293D IC. These two ICs control the motor and the fan of the system which is used as an AC fan unit. The details of the components are as follows.

PIC16F877A Microcontroller

This is a common 8 bit microcontroller with a variety of useful peripherals, including 33 I/O lines, eight 10-bit ADCs, two PWM Channels, in-circuit programming, UART, and runs at 20MHz, 5MIPS. This is mostly used in many applications^{1,2}.

LM35 Temperature Sensor IC

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of $\pm 1/4^{\circ}\text{C}$ at room temperature and $\pm 3/4^{\circ}\text{C}$ over a full -55 to $+150^{\circ}\text{C}$ temperature range. Low cost is assured by trimming and calibration at the wafer level³.

ULN 2803 IC

The ULN2803APG / AFWG Series are high-voltage, high-current Darlington drivers comprised of eight NPN Darlington pairs. All units feature integral clamp diodes for switching inductive loads. Applications include relay, hammer, lamp and display (LED) drivers. This contains of 500mA max current and 50V min voltage⁴.

L293D - IC

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors. L293D contains two inbuilt H-bridge driver circuits⁵.

Designs of the Circuit

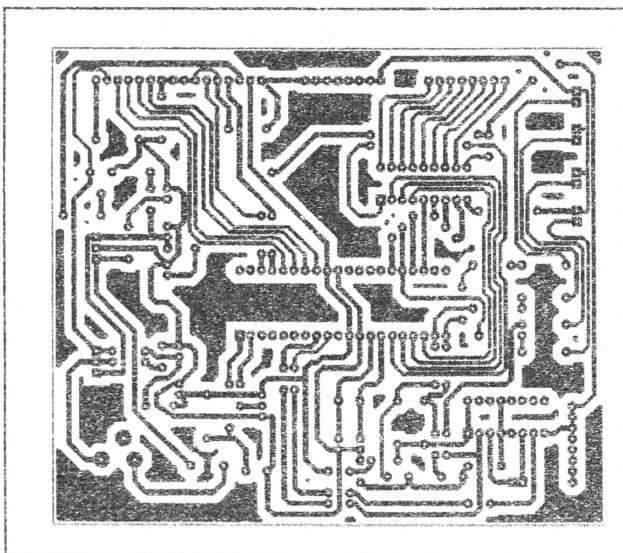


Figure 1:PCB Design of the Circuit

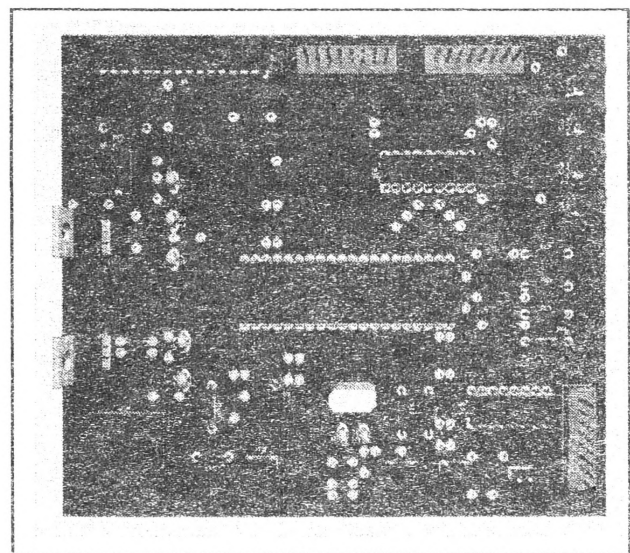


Figure 2: 3D View of the Circuit after Completion

At the beginning of this the program was implemented and the circuit was designed using the Proteus software and the PCB design was taken from the ARES. Finally the circuit board was designed and the components were soldered to the circuit board. The PCB and the 3D view of the circuit are shown above in the last paper gives the idea of the prototype. And shown below is the block diagram of the system and next is the complete circuit diagram of it which was designed using Proteus.

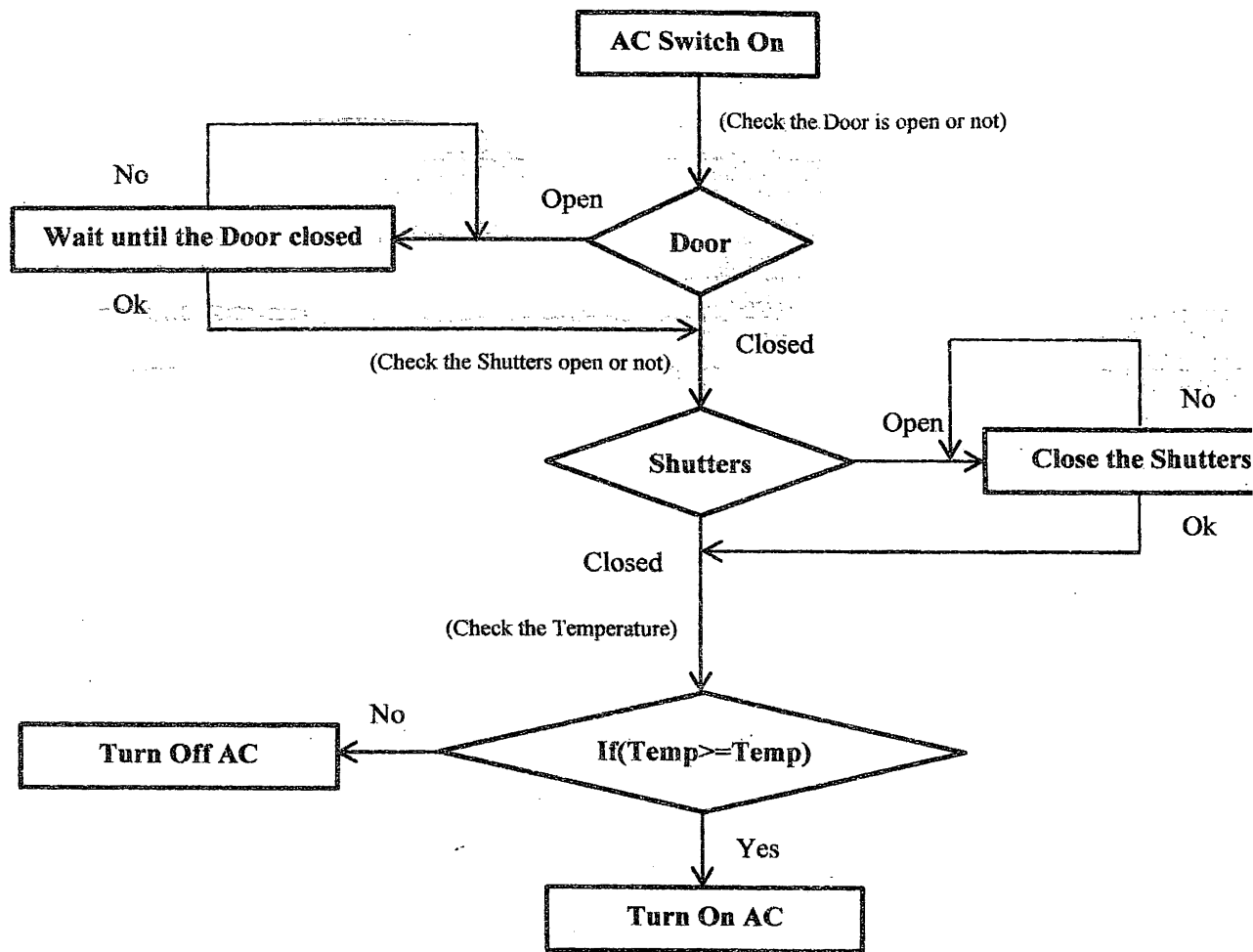


Figure 3: Control Diagram of the System

As it is shown in the block diagram it shows that there are some conditions to check by the system before it turns on the Air Condition of the vehicle. They are as follows.

- First when the switch of the AC turned ON it checks the door.
- If the door is open the AC won't turn ON and waits until the door is closed.
- In the next step the system checks whether the shutters of the doors are closed.
- And if the shutters are open it closes the shutters using the given condition to close the shutters. But, if the shutters are closed at the moment when the door is closed it goes to the next step.
- The next step, it checks the temperature of the vehicle and if the temperature inside is higher than a defined value (eg: 25 C) it turns ON the AC. If the temperature is lower than the defined value the system does not turn ON the AC.

- When the AC is turned on it automatically sets to a defined value if the temperature is changed by the controller or the passenger.
- This system let a manual controlling system to be working for some of the important conditions of the passenger and for his/her ease of access.

The complete circuit diagram of the system is shown in Figure 4.

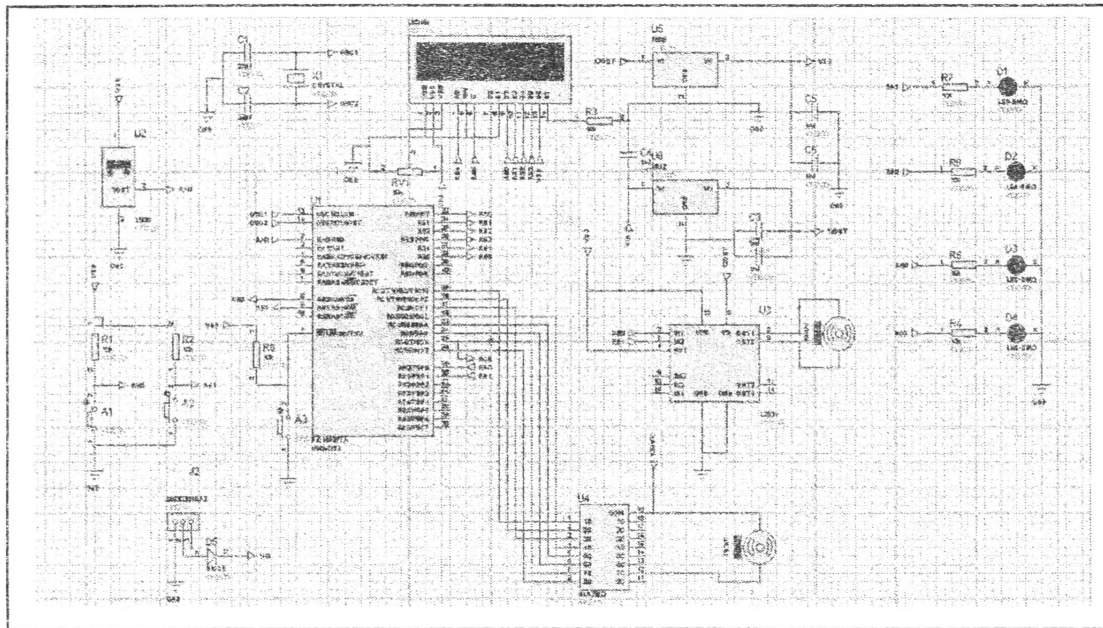


Figure 4: Complete Circuit Diagram of the System

And in this circuit board there are two switches indicating the Door and the Shutter, and when these switches are pressed the system starts to work considering the necessary conditions.

3.0 DISCUSSION

Since this is a cost effective system it won't take a lot of money to implement this system to the vehicles. And because of that the industry will have that chance of implementing this system easily to the existing system of the vehicles.

When considering from the customers they will be able to have an efficient system for their vehicle since this is specially implemented for the vehicles which are in use now. And this system controls automatically the air conditioner and the shutters and because of that it saves your power and fuel since it turns off the AC and controls it when necessary.

4.0 CONCLUSION

A proper AC Controller System of a vehicle increases the fuel efficiency. Considering the weakness in AC Controller systems in old and new vehicles, we attempted design an automated AC Controller System that integrates window shutters and doors of the vehicle. The system consists of a microcontroller that monitors the internal temperature of the vehicle. In addition, it monitors whether the doors and shutters are open or not. Since the system turns on the AC only after ideal conditions are satisfied, fuel wastage is minimized.

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