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Self-Regulated Automatic Ventilation of Vehicle Interior

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Abstract: In order to mitigate overheated interior of a vehicle parked in the hot summer sun and thereby to make the entering into the vehicle more comfortable, microcontroller managed module for automatic ventilation of vehicle interior is made. The module is implemented using a microcontroller as a central logical unit and a series of sensors which provide sufficient data to ensure functional, but also efficient, reliable and safe ventilation. The ventilation process is performed by opening vehicle windows slightly, which enables air to circulate. Microcontroller controls the position of the windows autonomously and independently of the driver's presence, following predefined algorithm that uses sensors data obtained from the vehicle's surroundings. Besides temperature, the most important factors to ensure quality implementation of ventilation are detected movements around the vehicle, the presence of precipitation and other. This paper shows the components, their purpose and capabilities, advantages and disadvantages, as well as potential implementations and upgrades. The test results give insight into utilization options of this module and its usefulness. This project uses regulated 5V, 500mA power supply. 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac output of secondary of 230/12V step down transformer.

Keywords: Self-Regulated Automatic Ventilation, Vehicle Interior, Microcontroller, three terminal voltage regulator.

I. INTRODUCTION

The ventilation is very important to the humans in anywhere. Especially for vehicle, in vehicles there is a lot of heat my generate inside the vehicle, if it is parked in the sun shine results more and more heat. So we cannot enter in to the vehicle immediately, it takes more time to cool inside the vehicle results uncomfortable to the vehicle owner. So that a micro controller managed automatic ventilation systems will help to make the vehicle comfortable to the owners while it is parked in the sun shine of the vehicles. Micro controller managed automatic ventilation system is implemented using a microcontroller as a central logical unit and a series of sensors which provide sufficient data to ensure functional, but also efficient, reliable and safe ventilation. The ventilation process is performed by opening vehicle windows slightly, which enables air to circulate.

II. DEMERITS OF EXSISTING SYSTEM

[A] Pure analogy:
Previously existing systems are pure analogy systems. Which needs the manual operation, it does not having quality sensors for detection of the high temperature. This system does not support the predefined input data.

[B] Time independent operation:
We cannot give the time to system for its operation set the time the existing systems are programmed to search only in a predefined path. There is no chance to dynamically alter the search path.

[C] Cannot able to establish the remote communication:
The following system cannot able to provide the information regarding temperature condition to the user remotely.

[D] Unintelligent:
Existing systems are unintelligent, it means it does not having micro controller. It simply collects the data analogy mode; based on that collecting voltage from the sensors, it performs the operation. It opens window when it receives the maximum voltage and close the door when cools.

[E] Environmental conditions:
It cannot accurately analyze the environmental conditions like temperature, detection of rains for closing or opening the windows itself.

[F] Low trough put:
It was built over the analog system, so that analogy systems performances are time taking process, so these cannot provide the high speed operations.

III. DIFFERENT DEVELOPED SYSTEM FOR AUTOMATIC VENTILATION

Automatic ventilation is required for the vehicles. So different researchers have developed various systems to meet the objective. Here is brief discussion over the developed system. A system was implemented using at mega microcontroller and series of different sensors to

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provide sufficient data so as to perform the process of ventilation. It is performed by opening window of vehicle slightly which enables the air to circulate. Temperature as well as some other important parameters like movement near the vehicle is also used as the input to controller. Only prototype of the system was developed which actual practice was the remaining objective of the system.
The above system was replicated with the help of new microcontroller. MC is favorite when it comes to industry application. Rajesh Reddy et. Al. had developed a automatic system which will sense the environmental condition and operate windows for proper ventilation.
System uses microcontroller for more effective and reliable operation. Again the drawback associated with the system is that it is also a prototype.
More feature were added to system like humidity measurement and ultra sonic sensor. These sensors were used for the advancement of vehicles. As soon as higher temperature is detected using temperature sensor then system with ARM processor will turn on the air conditioner. Also temperature sensor is well supported by the humidity sensor. Ultrasonic sensors are used to avoid the theft of vehicle. These sensors will respond when an intruder comes near the vehicle. The proposed system could reduce the theft. To save electricity and make use of air conditioner less, a system called Intelligent Ventilation System (IVS) was developed. An IVS is an electronic instrument that records data from the environmental conditions and take decision how the room temperature should be controlled. This research work deals with the design and construction of a ventilation system using the PIC16F877A which includes 10 bit Analog to Digital Converter (ADC) for data conditioning and a 256 byte EEPROM for data storing. Here we use a 4X20 line Liquid Cristal Display (LCD) for display section as well. This system is really nice to have an idea about ventilations in the vehicles [8].

The objective of developed system is to control four chambers simultaneously on different temperatures which were taken directly from sensors and showed on screen while providing sufficient cooling/heating. All four chambers contained smoke sensors to detect and monitor smoke effect. The cooling/heating in a chamber was circulated by a fan. Comfort application for different structure building types is relatively dissimilar and is designed according to the need of process applications and the need of the buildings and with the aim to provide a suitable environment for the people and things conceded out, despite of inner temperature and humidity loads and external climate situation [9].

With discussing various systems for automatic ventilation for vehicles and homes, it is observed that there is a central controller which would direct the motion of window based on the inputs from different sensors. Many proto types were prepared but the actual implementation was lagging. So we want to develop a new system will help people to automate their ventilation process. Next section will give the idea of the system.

IV. BLOCK DIAGRAM OF PROPOSED SYSTEM

The ventilation process is performed by opening vehicle windows slightly, which enables air to circulate. Microcontroller controls the position of the windows autonomously and independently of the driver‟s presence, following predefined algorithm that uses sensors data obtained from the vehicle‟s surroundings. Besides temperature, the most important factors to ensure quality implementation of ventilation are detected movements around the vehicle, the presence of precipitation and other. This paper shows the components, their purpose and capabilities, advantages and disadvantages, as well as potential implementations and upgrades. The test results give insight into utilization options of this module and its usefulness. The module's task is to control the ventilation process autonomously in order to facilitate vehicle utilization, i.e. providing conditions to make the entering into the vehicle parked in the sun more comfortable.

In order to meet all the criteria of quality ventilation, the module has to collect enough data from the vehicle's immediate environment and, based on that data, it has to decide whether it is necessary to lower the windows and thus start the ventilation process. Accordingly, the module can be divided to three logical units: peripheral unit – collects data, control unit – manages module operations, and switching unit – adjusts signals. This project uses regulated. 5V, 750mA power supply. 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac output of secondary of 230/18V step down transformer. Closed area without air circulation and directly exposed to sunlight heats up much faster and reaches significantly higher temperatures than the open space where air circulates freely – so-called "greenhouse effect". That is exactly what happens in a vehicle parked in the hot summer sun, which later represents a problem when entering such overheated vehicle. Fig.1 shows block diagram of module.
The basic idea of this project is to prevent or at least mitigate overheating of the vehicle interior in order to facilitate entering into the vehicle. The problem can be solved by leaving the vehicle windows partially opened so air can circulate, which reduces the heating of the vehicle interior. However, as the ventilation process takes place in a parked vehicle, without human presence, and the vehicle is exposed to external influences, such as precipitation or potential burglary, it is unreliable and unsafe. Consequently, it is necessary to automate the ventilation process.

Fig.2 shows logic diagram of power supply. The complete automatic ventilation process is managed by microcontroller default algorithm, considering input signals read using various sensors. The temperature sensor measures the temperature inside the vehicle. If it exceeds predefined level of "comfortable temperature", microcontroller automatically lowers the power windows to enable air circulation which alleviates aforementioned "greenhouse effect".

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The automatic ventilation process must be reliable and not affect the safety of the vehicle. For this reason, additional sensors are used, whose task is to annul dangers appeared with this ventilation method. Before all, these are precipitation sensor that makes the ventilation process reliable, and motion sensors that make it safe. There are also other sensors whose implementation gives additional quality, but these are the most important of them. Together with temperature sensor, they meet the minimum requirements to perform automatic function of ventilation, without endangering the vehicle. Following chapters show components and technologies used, operation modes, advantages and disadvantages, capabilities and potential upgrades of the module, as well as ability of integration with existing automatic systems within the vehicle. Results of testing the module in real conditions are presented and analyzed.

Temperature Sensor

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 ±1⁄4°Cat room temperature and ±3⁄4°C over a full −55 to +150°Ctemperature range.

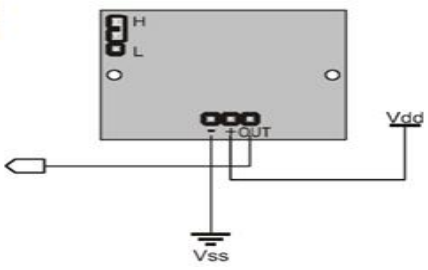
It can be used with single power supplies, or with plus and minus supplies. As it draws only 60µA from its supply, it has very low self-heating, less than 0.1°C in still air. The LM35 is rated to operate over a −55° to +150°C temperature range, while the LM35C is rated for a −40° to +110°C range (−10°with improved accuracy).The LM35 series is available packaged in hermetic TO-46 transistor packages, while theLM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package. The LM35D is also available in an 8-lead surface mount small outline package and a plastic TO-220 package.

FIG: TEMPERATURE SENSOR

1. Can be calibrated directly to the Celsius scale.
2. Linear scale factor + 10mV / ° C
3. The accuracy of 0.5 ° C. at room temperature (25 ° C).
4. Range of temperature between -55 ° C to 150 ° C.
5. Work on the voltage 4 volts to 30 volts.
6. Operating current less than 60µA.

LIQUID CRYSTAL DISPLAY: LCD stands for Liquid Crystal Display. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons: 1.The declining prices of LCDs. 2.The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters. 3.Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data. 4.Ease of programming for characters and graphics. These components are "specialized" for being used with the microcontrollers, which means that they cannot be activated by standard IC circuits. They are used for writing different messages on a miniature LCD.

PIR SENSOR: A PIR sensor, or Passive Infrared sensor, is a type of de-tector that is capable of detecting infrared light emitting from objects within its field of view. PIR sensors differ from other infrared sensors because they are only able to receive infrared waves rather than being able to emit and receive them. Because all objects emit infrared (electro-magnetic waves that travel with heat), PIR sensors are able to detect objects that are in front of them. In fact, PIR sensors can see many things that humans cannot. PIR sen-sors are used for a number of applications, such as night vision, motion detection, and laser range finding



V. SOFTWARE DETAILS

A. Keil compiler:

Keil compiler is software used where the machine language code is written and compiled. After compilation, the machine source code is converted into hex code which is to be dumped into the microcontroller for further processing. Keil compiler also supports C language code.

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B. Proload:

Proload is software which accepts only hex files. Once the machine code is converted into hex code, that hex code has to be dumped into the microcontroller placed in the programmer kit and this is done by the Proload. Programmer kit contains a microcontroller on it other than the one which is to be programmed. This microcontroller has a program in it written in such a way that it accepts the hex file from the keil compiler and dumps this hex file into the microcontroller which is to be programmed.

VI. ADVANTAGESAND APPLICATIONS

- Highly sensitive
- Fit and Forget system
- Low cost and reliable circuit
- Complete elimination of manpower

Applications:

- In vehicles
- Public Transportation
- Military Applications

VII. WORKING PROCEDURE

- Kit should be placed inside a car to provide better ventilation.
- The controller is interfaced with few sensors to identify the condition inside a car.
- A LDR is interfaced to the controller to sense the sun light.
- If it is too hot inside then that will be sensed by temperature sensor and the windows will get opened.
- In case if there is sudden rainfall then that will also be sensed and the windows will get closed.
- PIR sensor is also interfaced to identify the presence of a person near it and also reacts with buzzer alert.

VIII. CONCLUSION

Hence “Microcontroller Managed Module For Automatic Ventilation Of Vehicle Interior” Is Implemented Successfully Using Lpc2148 In The Stream Of Embedded Systems.

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