

## Automatic Vehicle Interior Ventilation using ARM

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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. 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 signal.

**Keywords:** Microcontroller, Temperature, Automatic Ventilation of Vehicle Interior, Sensors, Controlling Position of Vehicle Windows.

### 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.

- **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.
- **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.
- **Cannot able to establish the remote communication:** The following system cannot able to provide the information regarding temperature condition to the user remotely.
- **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.
- **Environmental conditions:** It cannot accurately analyze the environmental conditions like temperature, detection of rains for closing or opening the windows itself.
- **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.

Microcontroller managed module for automatic Ventilation of vehicle interior system is equipped with the advanced RISC micro controller to enable the all the features, and to make the system very efficient. This system is equipped with the temperature sensor, rain drop sensor, and having the motor assembly for closing or opening the windows automatically.

### II. BLOCK DIAGRAM OF PROPOSED SYSTEM

Fig1 Block diagram of the microcontroller managed automatic ventilation system for vehicle interiors. The above Block diagrams Consisting of the Arm7 Micro Controller and

the Temperature Sensor to Monitor the Temperature inside the Vehicle. Rain Drop Sensor Is Used To Detect The Rain Fall Around The Vehicle And If Rain Occurred When Window Is In Open Position, The Window Will Close Automatically. To Monitor The Status Of The System LCD Display Is Provided. Motor Driver Circuit Is Used To Drive The Motors; Hence The Micro Controller Can Not Drive The Motor Directly. Two 60 Rpm Motors Are Used To Close or To Open the Window (Both Left Side Window and Right Side Window).GSM Module Is Here To Send Information Regarding Temperature Inside The Vehicle and Rain Occurrence To The Remote User.Max232 Is Used As Translator In Between The Micro Controller and GSM Modem because Communication Logic Levels Are Different From The IC (As CMOS or TTL) Logic Levels.

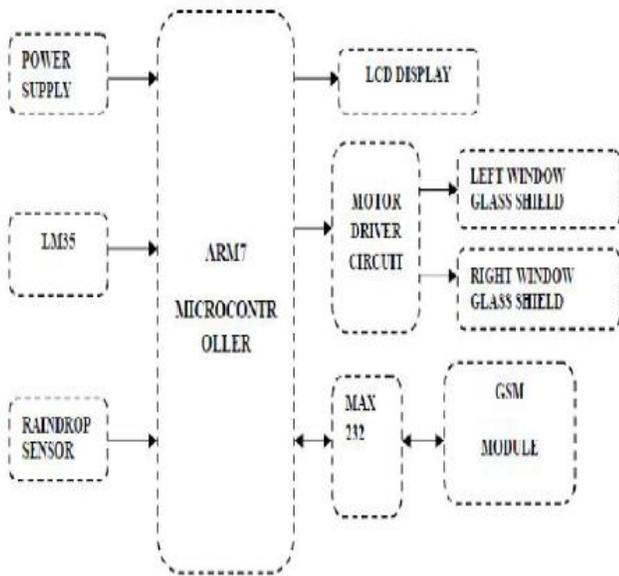


Fig.1. Block Diagram of Proposed System.

This device needs the power requirements as given as follows 5V, 750mA power supply.. So battery of the vehicle provides the voltage of 12V, 20A, so we are using 7805 three terminal voltage regulator is used for voltage regulation.Arm7 microcontroller having the 64 pins & low power consumption model, it is having the64 pins totally, It is having 48 I/O pins, on chip ADC, UART, RTC 512kb of flash memory and utilizes low power, it requires +3.3v volts for its operation. A simpler design facilitates more efficient multi-core CPUs and higher core counts at lower cost, providing higher processing power and improved energy efficiency for servers and super computers LCD display.

### III. PRAPOSED SYSTEM

The proposed system has the following specifications.

- **Fully digital system:** This system is implemented by using advanced controller, which enables all the sensors to interface them digitally to the micro controller so that the results given by the system are very accurate.
- **Status monitoring:** Whatever the works performed by the controller system, which enables the LCD display

to monitor the status of the system so that the user use this or operate this system more and more comfortably.

- **Time dependent operation:** This system allows the time dependent operations. Which means that how much of time is required fully opens the window the window or fully closes. Time taking to open a window or to close the window is fixed by the programmer.
- **Intelligent:** This system behavior is very intelligent, why because it is designed over the micro controller platform, it works depending on the situation occurred.
- **Temperature & rain monitoring in digital:** This monitors the temperature and rain occurrence in digital way; it means it will compare the received data from sensors with the predefined data, if input data is matched with the predefined data it will perform the desired operation as it is necessary.
- **Accurate and high speed operation:** Data provide by the system is very accurate in terms of data collecting and process execution. Operation Speed of the system is very high, due presence of the high performance controller and reliable sensors operation.
- **Support remote communication:** The following system has ability to communicate with vehicle user; it will send the information regarding temperature condition inside the vehicle to the user by SMS.

### A. Working

First the system should be connected to the battery of the vehicle directly; the system should remain in on condition even though vehicle in OFF position. When the temperature inside the vehicle exceeds the predefined level, the microcontroller automatically switch on the motors for opening the window simultaneously it will send a message to the user by using the GSM modem. When the temperature inside the vehicle reaches the lower level, it will automatically close the window and status of the operation is displaying on the LCD display. Same operation is performed during raining also. If the windows are in open position if it rains the micro controller automatically activates the windows to close, again status is send to user through SMS. Important notice is that the same operation can performed even the driver presented inside the vehicle.

### Advantages:

- **It provides the advantage of safety.** The major advancement in this system, it provides the safety to the vehicle users. And keeps the vehicle interior clean and reduces the health problems to the user of that particular vehicle.
- **Saving of time.** The users of the vehicle are no need to waiting until vehicle becoming cool. So this system keeps ready vehicle any time to travel.
- **Increases the life span of the vehicle interiors:** This system helps the vehicle interior to continue the long time. So it prevents damage of vehicle interiors from the excess heat and rain water in rainy season.
- **Saving the fuel.** If vehicle kept in sun shine it may get overheat, to diminish that overheating the user may switch on the AC of the vehicle. By utilizing this

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system the user may not required them to switch on the AC, so it automatically reduces usage of AC, it reflects the fuel saving.

- **Saving money.** Microcontroller managed automatic ventilation system, it reduces the fuel usage, increases the life span of the system, provides the safety for the vehicle interiors so that ultimately reflects that money saving.
- **Easy maintenance.** By using the, high end technological device for vehicle safety, this device works without human involvement because it is intelligent one and that too it does not require any maintenance.

### B. Applications

- **Cabs:** This systems is very useful in cabs, because the customers of the cab may accept the luxury of resources, this system meet their requirements.
- **Transport business.** The stated in the above, this system is not only used in cabs, but also in every transportation bodies, why because that the Passengers may expect the comfortable journey.
- **Home and own vehicles:** We can comfortably arrange this type of microcontroller based automatic ventilation for houses, own vehicles for comfortable living, comfortable journeys respectively.

### IV. TEST RESULTS AND DISCUSSION

Module has been tested under real operating conditions in few vehicles on outside temperatures in range of 21 °C to 27 °C. Mid position sensors were set on few different levels. Also, temperatures inside vehicles while fully opened/closed windows were measured for better comparison. Measured temperatures are presented by Fig.2. The samples were collected during longer period of time. Comparing measured inside temperatures it is concluded that slightly opened windows (up to 5 cm) do not get satisfying results. To achieve quality ventilation it was necessary to lower windows at least 10 to 15 centimeters. Of course, more opened windows, and finally completely opened windows gives the best results, but 15 to 25 centimeters is optimal regarding inside temperature drop, energy consumption and safety concerns. Presented results should be taken into consideration as informative since measurements were not taken in exactly the same weather conditions for each individual vehicle so there are visible disrupting effects.

It can be remarked that many different factors, besides obvious direct sunlight, outside temperature and windows position directly affect ventilation process; weather conditions have significant influence on the ventilation process – e. g., wind noticeably accelerates and enhances ventilation. Further, size of the vehicle, even vehicle body color and vehicle orientation relative to the sun makes noticeable difference. Except module proved to be safe, reliable and efficient, satisfactory results of the ventilation function were achieved. Without the module and with closed windows (or slightly lowered windows),

temperature inside of the vehicle parked in the sun on light spring temperatures of 25 °C can reach over 50 °C. In summer, inside temperature rises even more drastically. While lowering windows for at least 10 to 15 centimeters to enable quality ventilation process, inside temperature becomes much bearable. Considering the fact that this ventilation process is a passive method of cooling overheated interior, it accomplishes very good results.

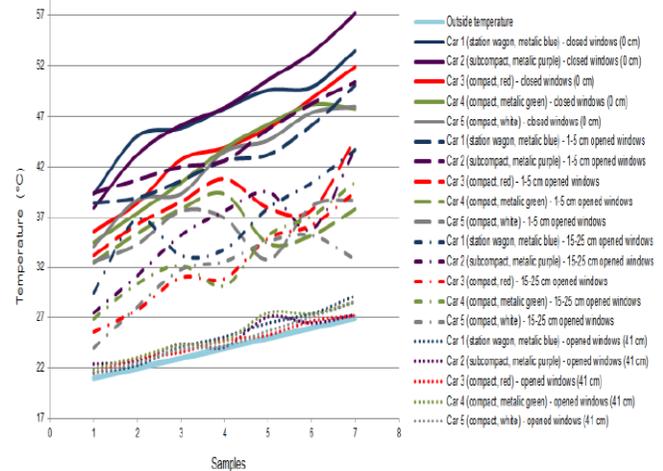


Fig.2. Measured Temperatures.

### V. CONCLUSION

Microcontroller managed automatic ventilation system is very useful to maintain or to reduce the overheating inside the vehicles .the functioning and data provided the sensors are very accurate. Operation of the Microcontroller managed automatic ventilation system is very reliable this system is designed with multi sensors: temperature, raindrop for detecting the high temperature and raining respectively. As per our requirements we increasing speed of operation of the main advantage is extendibility. As per our requirement we can extend the Microcontroller managed automatic ventilation system features .By adding additional sensors, communicating equipment in order to increase coverage area. In next five years, utility for Microcontroller managed automatic ventilation system in cabs, houses and all other transporting business my grow more and more. Microcontroller managed automatic ventilation system a main advantage is extendibility. As per our requirement we can extend the Microcontroller managed automatic ventilation system features .By adding additional sensors, communicating equipment in order to increase coverage area. In next five years, utility for Microcontroller managed automatic ventilation system in cabs ,houses and all other transporting business my grow more and more.

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