



Intelligent Vehicle Security and SOS Messaging System with Embedded GSM Module

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ABSTRACT: This paper describes GSM and RF technology based safety, security and convenience features that can be installed in a car. The safety feature addresses deadly situations of children getting locked in the car, security feature addresses car theft and the convenience feature provides better user experience while parking and getting the car out from the garage. A prototype with all these three features was developed and tested.

Once this module is installed in the car, it gets activated through central locking system when the car ignition is OFF. In unfortunate situations of children getting locked in the car or someone attempts to break into the car, SMS would be sent to owner's mobile using GSM technology. RF modules are installed in the car and on the garage walls/doors which would assist driver while parking the car and also automatically raise the garage door when requested.

KEYWORDS: GSM module, RF module, vehicle security, safety of children in hot air cars, detection of co2 levels.

I. INTRODUCTION

Recently some of the leading newspapers (Times of India, 20th April 2015, The Hindu etc...) have reported four children (aged 2 and 4 years) accidentally locked in a parked car became unconscious due to suffocation. About 500 children died in USA between 1998 and 2010 as they were left alone inside the parked cars [1], [2]. Similar unfortunate incidents is happening frequently in various parts of the world.

Once a car is turned off and parked keeping its window glasses closed, the temperature inside the car rises rapidly even on a day with atmospheric temperature of about 21 degree Celsius [3,5]. As the thermoregulatory system of the child is not well developed, this condition may lead to hyperthermia or heatstroke in a child left locked in a parked car, this can be fatal. Such incidents can be prevented by sensing the presence of a child soon after a car is turned-off and the generating/sending a suitable warning signal to the driver or parents who can take timely action to save the child.

Vehicle security is a major concern now-a-days. As the demand for luxury features in the vehicle are increasing day by day, cost of the vehicle parts are also increasing. So, vehicle theft cases are becoming higher than ever. Vehicle security remains a prominent automotive issue for engineers, consumers and government regulators.

Vehicle CLS (anti-theft device) ensures the best guarantee to protect vehicle from different kinds of theft cases [4]. Integration of central locking system, mobile communications into an embedded system was presented in [5] and position and status of the vehicle can be found from the message sent by the vehicle.

Bluetooth has been used to design and develop a consumer system for a garage door opening. Bluetooth based garage door opening system helps to overcome the inconvenience to move out of the car for unlocking the door has been reported in [6].

This paper proposes a simple, low cost technique to address above mentioned issues. First it addresses the child deaths in a hot air vehicle (cars) due to suffocation and presents a messaging system to alert the parent/driver in case the child is left unattended in the car. Secondly, this paper proposes few solutions to detect breaking into a car and send a message to the owner's number and third is on automatic opening of the garage door with RF Technology

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II. OBJECTIVE

The project mainly aims to provide security to the vehicle including automatic door opening of the garage for easy parking and safety of the children, who left unattended in hot air vehicles. Security module will detect the attack on vehicle and inform the owner about status of vehicle in his absence. Security module is divided into three sub modules based on the type of attack on the vehicle. Each sub module (detection of door opening, detection of glass window breaking, detection of towing) detects and alerts the owner about the status of the vehicle via SMS. Safety system is to provide safety to the children who get locked inside the car unknowingly or children who kept inside the car unattended for long time. Due to improper provision of air the children are dying in the locked cars. This module measures the level of carbon dioxide inside the closed car and alerts the owner when the carbon dioxide level crosses the threshold level. RF module provides the automatic opening of the garage door for easy parking of the vehicle inside the garage.

MODULE 1

Safety system

This module uses MQ-2 gas sensor for detection of carbon dioxide, a microcontroller and a GSM module. Hardware implementation of safety system was depicted in Figure.1.

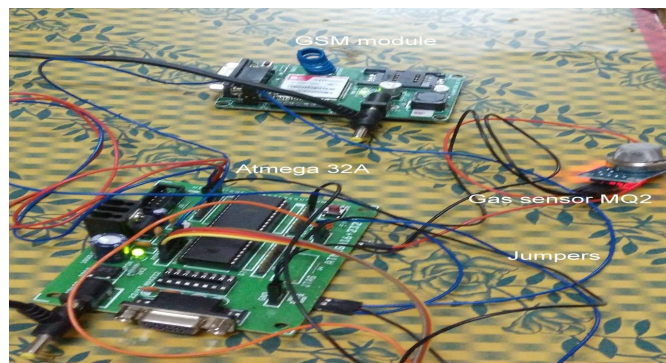


Figure.1: Safety system hardware implementation

Gas sensor interfaces with microcontroller and GSM module to continuously measure the levels of carbon dioxide in the vehicle. The MQ-2 sensor reports gas by the voltage value that it outputs. The more gas there is, the greater the voltage that it outputs. When the gas levels increases and crosses the threshold value (500ppm), then the sensor through the microcontroller and GSM module sends message to the owner mobile number saying that “**CO2 levels are high in the car**”. The MQ-2 has built in potentiometer to adjust the sensitivity to the gas. By adjusting the potentiometer, you can change how sensitive it is to gas.

MODULE 2

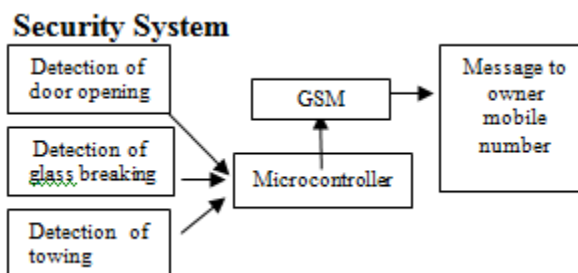


Figure.2: Block diagram of the security system

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Security system is used to detect the various types of theft conditions common in real life such as detection of door opening, detection of glass breaking, detection of towing. Security module consists of one Atmega 32A microcontroller, GSM module of SIM 900, push buttons, Light dependent resistor (LDR) and two voltage supply adaptors of 12volts. The security system gets activated only when the vehicle is in off condition. The activation of security system is implemented in two ways - one is through a remote controller (CLS), second is activating through a manual push button.

Detection of door opening

The main aim of this sub module is, when improper way of door opening takes place a message will be sent to owner's mobile number. The methodology used to solve above mentioned problem is depicted in Fig.3. To achieve this task, wire connection is given in such way that, one wire is connected at the door locking system and the other wire is connected to the microcontroller pin. Initially the wire is in open condition, when the improper opening of the door takes place then the wire gets in contact with the microcontroller pin wire just like the normal switch. Then the microcontroller will receives a high pulse and it will send the message to owner mobile number through GSM module saying that **"Your car door is opened"**. The message to be sent will be given in the program of microcontroller.

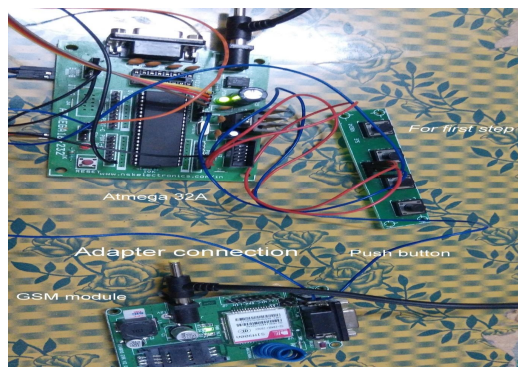


Figure.3: Security system hardware implementation

Detection of Glass window breaking

The detection of glass breaking can be achieved using photo diode or Light dependent resistor (LDR) for detection of sunlight, microcontroller and GSM module. The methodology used to solve above mentioned problem is depicted in Fig.2. LDR's are light dependent devices whose resistance decreases when light falls on them and increases in the dark. When a light dependent resistor is kept in dark, its resistance is very high. This resistance is called as dark resistance. It can be as high as 1012 Ω . And if the device is allowed to absorb light its resistance will decrease drastically. If a constant voltage is applied to it and intensity of light is increased the current starts increasing. Fig.4 shows resistance vs. illumination curve for a particular LDR.

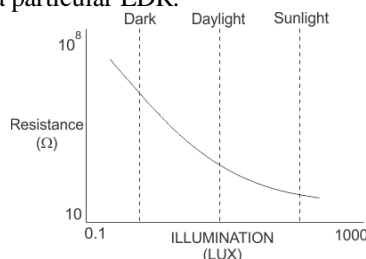
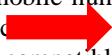


Figure 4: Resistance vs. Illumination curve for LDR

When glass window is broken under off condition of the vehicle, then immediate in rush of sun light takes place. When the sun light falling on the LDR reaches the threshold value then the message will be sent to owner mobile number saying that **"Your vehicle glass door was broken"**. The output of the sensor is current signal but micro  will detects only voltage. A pull up resistor is used to convert the current signal to voltage signal which is compatible to microcontroller. Based on the sensitivity, the value of the resistor can be used ranging from 1k Ω to 10k Ω .

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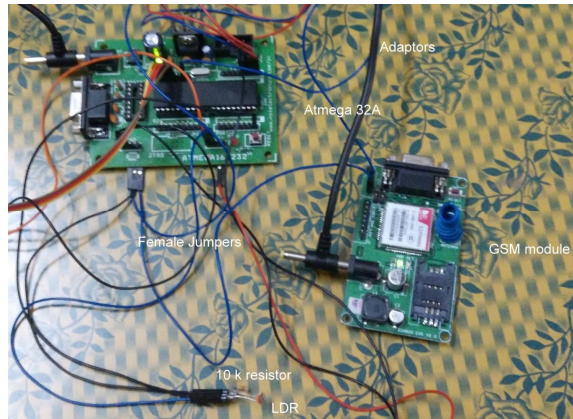


Figure.5: Detection of glass window breaking - hardware implementation

Detection of towing

For detection of towing we can use mercury sensor or for simplification we can use wire connections as depicted in Figure.6. Whenever towing takes place the mercury sensor will get disturbed. Normally in mercury sensor two wires will be there such that they will get contacted when the disturbance happens. When towing takes place then wires in the mercury sensor gets disturbed and a message will be sent to the owner’s mobile number saying “**Your vehicle is being towed**”. Here to achieve this task hardware implementation is done through a push button, when the push button is activated a message will be sent to the owner’s mobile number.

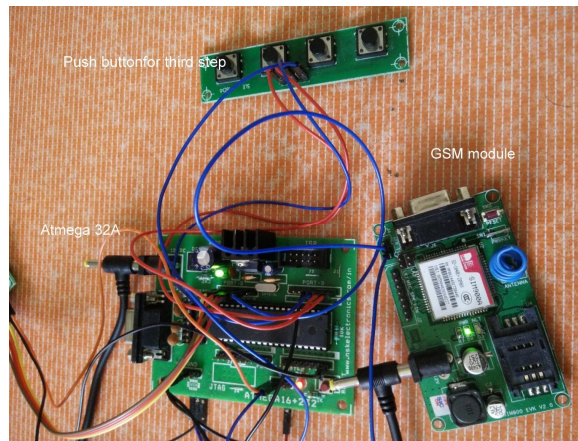


Figure.6: Detection of towing - hardware implementation

MODULE 3

RF Parking Assist System

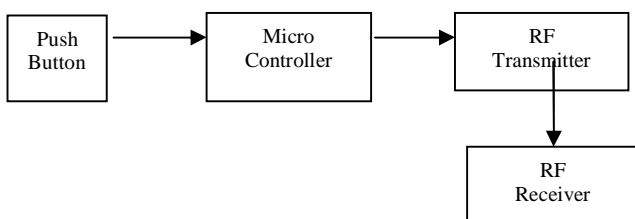


Figure.7: Block diagram RF parking assist system

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The main aim of this module is automatic opening of the garage door for easy parking of the vehicle inside the garage. The hardware implementation used to solve above mentioned problem is depicted in Fig.7 and 8. This RF module consists of RF transmitter, RF receiver, microcontroller and a led board. RF transmitter is located inside the vehicle and the RF receiver is fixed at the garage door. This module is efficient up to a range of 20 meters.

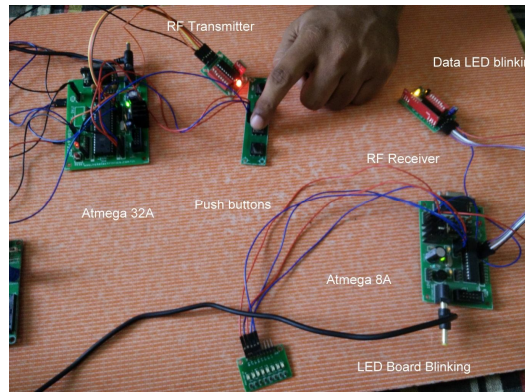


Figure.8: RF Parking assist system – hardware implementation

When the vehicle has arrived near the garage door then the driver inside the vehicle needs to press a push button to open the door. When the push button is pressed, the data transfers from transmitter in the car to the receiver on the garage door. This data is decoded and the garage door is opened with the help of a motor. When vehicle is parked inside the garage then door has to be closed, this is also done in the same manner by pressing the push button again to run the motor which closes the door. Here we used LED board to show the reception of data.

III. CONCLUSION

This paper presents the work done on vehicle safety, security and convenience system using GSM and RF technology. Safety module detects children locked in hot air vehicles using CO₂ sensor, microcontroller and a GSM module. Security module has three sub-modules which detects various theft scenarios and alert the owner through a microcontroller and GSM module. RF technology was used to develop a convenience feature which assists owner while parking and also opens garage door automatically when requested.

The cost of this module is also presented and it proves to be cheaper compared to existing products in the market which predominantly use analog circuits.

Future Scope

Following test cases can be considered for further improvement in In case of security module of the vehicle we can develop disconnection of battery to the start and blocking of engine. Where in case of safety module of the vehicle we can implement opening of glass/window door for some extent, providing thermoelectric cooler for certain period of time and switching on a fan arranged separately in the vehicle for some period of time.

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