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Obstacle avoidance with anti theft mechanism system and cabin safety system for automobiles

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ABSTRACT

Safety, along with security, plays a vital role in today's society. The goal of this project is to design an embedded safety and security system for vehicle by integrating and modifying existing modules. This system endures mainly with three modules namely Gas sensing module, Obstacle detection module and Anti Theft Alert system, these are interfaced with atmel AT89S52 microcontroller. Ultrasonic sensors transmit ultrasonic waves from its sensor head and again receives the ultrasonic waves reflected from an obstacle and instructs the microcontroller which alerts the driver with an alarm and controls the vehicle by stopping it. The gas sensor here is mounted inside the vehicle such that it senses the presence of the gases inside the vehicle cabin if there is any increase in the level of the toxic gases it informs to the microcontroller which alerts the persons inside the vehicle with an alarm and also sends a SMS to the authorized user through GSM. When an unauthorized person opens the car door, the car anti theft system becomes active and gives indication by raising an alarm that the car is being under theft.

Introduction

Vehicle is the first place where safety starts. Hence we must try to equip it with the latest technologies and measures to make it a safe machine and also to keep our self and our loved ones safe. Always remember that safety starts and ends with the person who drives the vehicle. The cars and trucks found today have high range of inbuilt safety accessories to protect their passengers. Before it used to be just seatbelts, but now more features have been included which are more advanced and efficient than seatbelts. Warning alerts and alarms are other security systems incorporated in the cars and trucks to alert us about various factors like exceeding speed limit or smoke alarms. These are designed to make the passengers aware of crossing the limitations which is important in most of the time and in most cases. In the same way here an embedded system has been designed to make the journey of the passengers inside a vehicle safe and secure with various recently found safety and security measures.

Hardware description:

In our proposed system an obstacle sensor i.e. the Ultrasonic module is mounted in front the car, Ultrasonic sensors transmit ultrasonic waves from its sensor head and again receives the ultrasonic waves reflected from an obstacle. By measuring the length of time from the transmission to reception of the sonic wave, it detects the position of the obstacle and instructs the microcontroller about the obstacles ahead. The microcontroller then alerts the driver with an alarm and controls the vehicle by stopping it. In the same way a gas sensor is mounted inside the vehicle such that it senses the presence of the gases inside the vehicle cabin and informs the microcontroller if there is any increase in the level of the toxic gases. The microcontroller then alerts the passengers and the driver inside the vehicle with an alarm and also sends a SMS to the authorised user through GSM. The block diagram of the proposed system is shown in the fig. 1. developed using Atmel AT89S52 microcontroller. The system has three modules namely the Gas sensing module, Anti theft mechanism system and the Obstacle detection module and they are interfaced with the microcontroller. An ADC is provided in these two modules for converting the analog acquired data in to the digital data for processing by the microcontroller. with the microcontroller through RS232 and the alarm is interfaced with the microcontroller to raise an alarm during the critical situations.

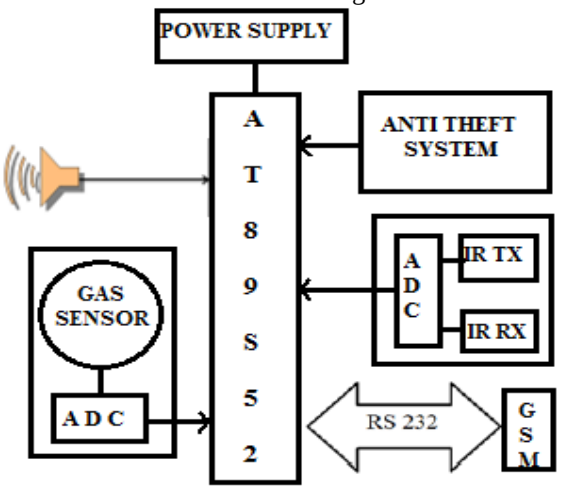

Fig.1. Block diagram of the proposed system

Gas Sensing Module:

The gas sensing module is used to sense the presence of toxic gases such as CO, LPG, Alochol and other toxic gases inside the vehicle. If critical levels of gases were found ,that is if the CO exceeds 20ppm and the level of LPG exceeds 10,000 ppm and the presence of alcohol is detected then the digital data

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from the gas sensing module is sent to the microcontroller which displays the information about the gas leakage inside the vehicle and produces an alaram to alert the persons inside the vehicle .It also sends a text message to the authirised person through the GSM modem connected to the microcontroller such that remedy measures could be taken by the authorized person and to give proper medical treatment to them if required.

MQ-7- Gas Sensor

A MQ-7 gas sensor is used in this system which is a device that detects the presence of the carbon monoxide (CO) and LPG and various other gases in the environment. CO is a colourless and odourless compound produced by incomplete combustion. It is often referred to as the "silent killer" because it is virtually undetectable without using detection technology. Elevated levels of CO can be dangerous to humans depending on the amount present and length of exposure. Smaller concentrations can be harmful over longer periods of time while increasing concentrations required diminishing exposure times to be harmful.MQ-7 sensors are designed to measure CO levels over a time and sounds an alaram before dangerous levels of CO accumulate in an environment, and therefore giving the people adequate warning to safely ventilate the area or evacuate. Some system-connected detectors also alert a monitoring service that can dispatch emergency services if necessary. The interfacing of the sensor with the microcontroller and the developed gas sensor module is shown in the fig 2 and fig 3.

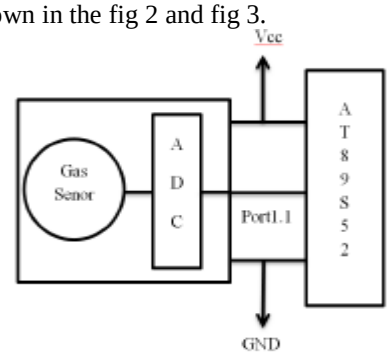

Fig.2.Interfacing Gas Sensor With Microcontroller

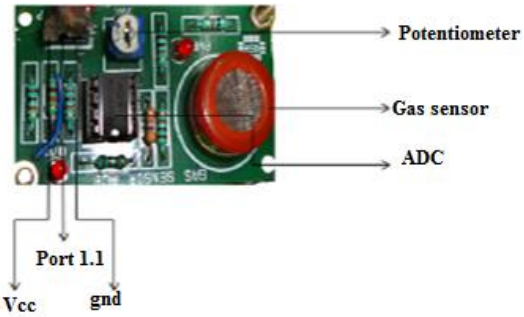

Fig.3.Developed Gas Sensor Module

The MQ-7 sensor also detect the presence of a dangerous LPG leak in our home or in a service station, storage tank environment and even in vehicle which uses LPG gas as its fuel This unit can be easily incorporated into an alarm unit, to sound an alarm or provide a visual indication of the LPG concentration. The sensor has excellent sensitivity combined with a quick response time. When the target combustible gas exist, the sensor's conductivity is higher along with the gas concentration rising. A simple electronic circuit is used to convert the change in conductivity to its corresponding output signal of gas concentration. This module may be used in various application areas such as in Home, Industry and in car .The features of this sensor are,

• High sensitivity to carbon monoxide, LPG, propane etc.,
• Stable and long life

Obstacle Sensing Module

The obstacle sensing module is used to sense the static obstacles in front of the vehicle such that, accidents due to unwanted parking of the vehicles and collision with trees and other objects especially during the night time could be avoided. These obstacles could be detected using various methods such as ultrasonic sensors etc. The working principle of the obstacle sensor is shown in the fig.5.

Fig 4.Ultrasonic module

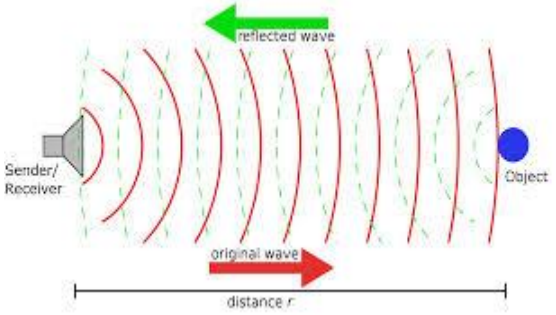

Fig 5.Working of ultrasonic sensor

Ultrasonic sensors work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors have an acoustic transducer which is vibrating at ultrasonic frequencies. The pulses are emitted in a cone-shaped beam and aimed at a target object. Pulses reflected by the target to the sensor are detected as echoes. The device measures the time delay between each emitted and echo pulse to accurately determine the sensor-to-target distance.

Car Anti Theft System:

The circuit, shown in Fig.6, is simple and easy to understand. When key-operated switch S2 of the car is turned on, 12V DC supply from the car battery is extended to the entire circuit through polarity-guard diode D5. Blinking LED1 flashes to indicate that the guard circuit is enabled. It works off 12V power supply along with current-limiting resistor R4 in series.

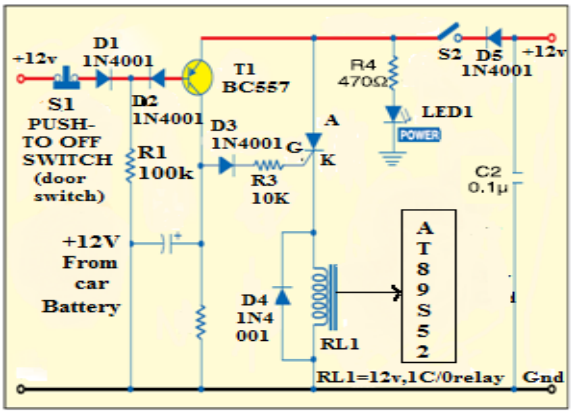

Fig 6.Circuit diagram for Car Anti Theft System

When the car door is closed, door switch S1 is in 'on' position and 12V power supply is available across resistor R1, which prevents transistor T1 from conducting. In this position, antitheft guard circuit is in sleep mode. When someone opens the car door, switch S1 becomes 'off' . As a result, transistor T1 conducts to fire relay driver SCR1 (BT169) after a short delay introduced by capacitor C1. Electromagnetic relay RL1 indicates the microcontroller which energises the alarm sounding to indicate that someone is trying to steal your car. To reset the circuit, turn off switch S2 using car key.

Microcontroller

The microcontroller forms the heart of an embedded system. The AT89S52 is the microcontroller used here which is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density non-volatile memory technology and is compatible with the industry-standard 80C51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highlyflexible and cost-effective solution to many embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The microcontroller is always in the active mode, if the gas sensor senses a gas and founds a critical situation then the information is sent to the microcontroller. The microcontroller first provokes an alarm to alert the passengers inside the vehicle and also an alert message to the authorised user is sent in the form of SMS through GSM. The microcontroller uses AT+CMGS command to send the SMS where the GSM is connected to the microcontroller through RS232 cable.

GSM Module

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone. A GSM modem exposes an interface that allows applications such as SMS to send and receive messages over the modem interface. The mobile operator charges for this message sending and receiving as if it was performed directly on a mobile phone. To perform these tasks, a GSM modem must support an "extended AT command set" for sending/receiving SMS messages, as defined in the ETSI GSM 07.05 and 3GPP TS 27.005 specifications. Due to some compatibility issues that can exist with mobile phones, using a dedicated GSM modem is usually preferable to a GSM mobile phone. It should also be noted that not all phones support the modem interface for sending and receiving SMS messages. In particular, most smart phones, including Blackberries, iPhone, and Windows Mobile devices, do not support this GSM modem interface for sending and receiving SMS messages at all. Additionally, Nokia phones that use the S60 (Series 60) interface, which is Symbian based, only support sending SMS messages via the modem interface, and do not support receiving SMS via the modem interface. The interfacing between the GSM and the Microcontroller and the developed module is shown in the fig. 7(a) and fig.7(b).

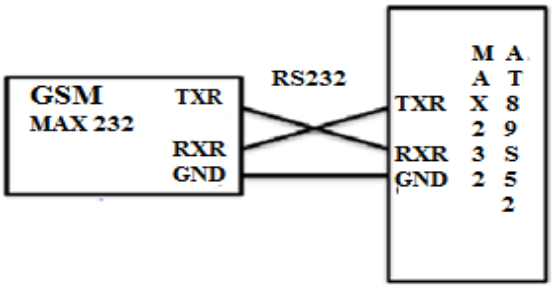

Fig.7(a).Interfacing GSM with AT89S52

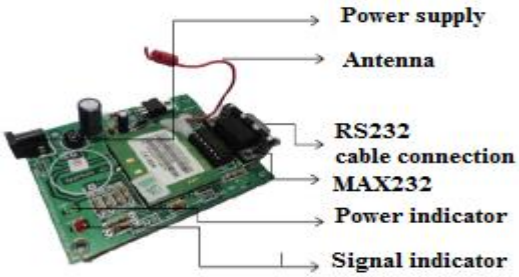

Fig.7(b).The developed GSM module

Implementation

An embedded controller is implemented by using three set of modules, i.e. the obstacle sensing module , the gas detection module and anti theft system. The obstacle detection module is mounted in front of the vehicle such that it searches for the static obstacles. The IR transmitter transmits the IR signals continuously to the maximum level of 3 ft. when the IR signals are reflected back by an object then the signal is received by the IR receiver, thus the module senses the obstacle. It then sends the corresponding signals to the microcontroller such that an alarm is provoked by the microcontroller as the first measure and stops the vehicle. The data flow diagram of the obstacle sensing module is shown in the fig.9.

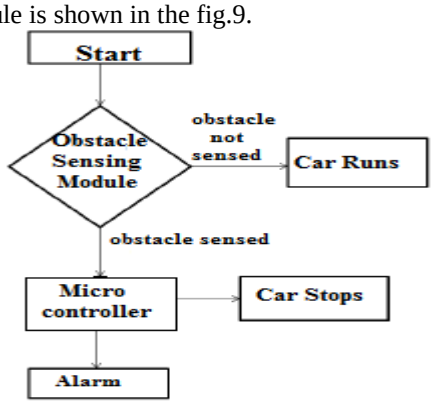

Fig.8.Flow chart for working of obstacle sensing module

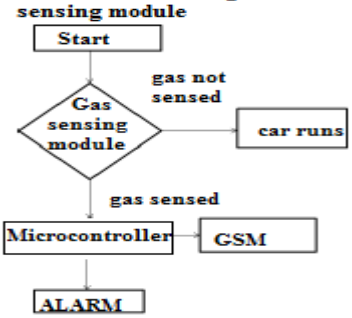

Fig.9.Flow chart for working of gas sensing module

In the same way the gas detection module which is placed inside the vehicle continuously senses the presence of gas in the vehicle cabin. When excess levels of toxic gases such as CO greater than 20ppm, LPG higher than 10,000ppm and the presence of alcohol are found, then the corresponding signals are sent to the microcontroller which in turn provokes an alarm to alert the passengers in the vehicle. And in turn commands the GSM module to send an SMS to the authorised user about the alarming situation inside the vehicle using the AT+CMGS command. The flow diagram of the gas sensing module is shown in the fig.11. The GSM module is connected to the microcontroller by the means of RS232 cable as the communication between the GSM and the microcontroller is synchronised through the MAX232. The car anti theft system which placed inside the car gets enabled when car opened by any unauthorized persons so that the process continues and relay indicates the microcontroller which enables the alarm so that everyone nearby get to know that car is being under theft. The flow diagram for car anti theft system is shown in the fig.10.

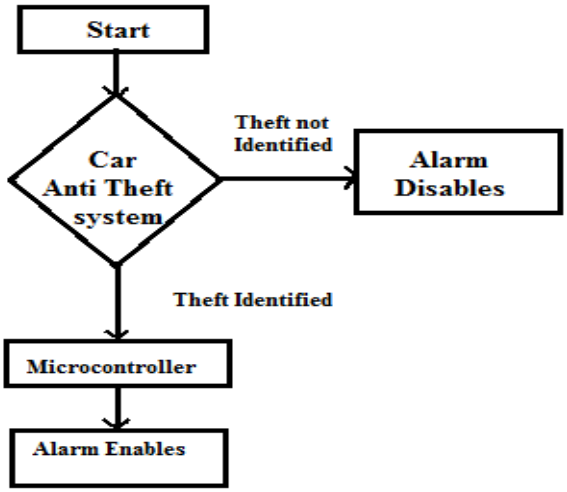

Fig.10.Flow chart for working of anti theft system

Conclusion

An embedded system has been developed which senses the toxic gases inside the vehicle and alerts the person inside the vehicle, the system also send an alert message to the authorised user through GSM such that remedy measures could be easily taken for the passengers inside a vehicle. The developed system also senses the obstacles in front of the vehicle and so that the accidents due to static obstacles could be avoided. The proposed system has been developed in a special motive that should protect not only the passengers inside the vehicle but also the persons around it such as pedestrians, and to prevent collision of vehicles with any other vehicle or obstacles such as trees. The developed system is greatly helpful to avoid accidents which happen during the night time. The distance between the vehicle and the static obstacle supported by the IR sensor is three feet, and in future the distance could be increased by replacing the IR sensor with the ultrasonic sensor. The proposed system provides the vehicle safety from being theft. This system could be further enhanced with future technologies to provide further more safety and security to the vehicle systems.

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