

ADVANCED CHILD-LEFT-BEHIND WARNING SYSTEM BASED ON SENSORS AND GSM

GALI SURESH

M.Tech

Nalanda Institute Of Technology

Guntur,A.P, India

PSVVN CHANUKAYA

Assistant Professor

Nalanda Institute Of Technology

Guntur,A.P, India

ABSTRACT: *This paper presents a simple and efficient capacitive sensing system suitable for detecting presence of a child in an infant car seat. It also details a warning system that alarms the parents once a child is found to be left alone in a car. Infant seat with child is, usually, kept (safely) in the rear seat. Driver and passengers, in some situations, may leave the car without taking (forgetting) the child. When a car is turned-off (windows closed) temperature inside it will increase rapidly and can be life threatening as the thermoregulatory system of child is weak. Such incidents have been reported worldwide. The proposed capacitive sensor system detects child occupancy. The system also has a warning unit. Once the car is turned-off and a child is found to be left alone in the car (in an infant seat) the unit first generates an audio alarm. After a preset time, if no one takes the child, it will automatically dial (using a GSM module) to parents or driver to help the child. A prototype of the proposed capacitive sensor and warning system have been built and tested. The developed sensor accurately detected presence of a child (in various postures) in an infant seat. It also distinguished a child from other objects such as milk/water bottles, toys, bags, etc. Results showed that the developed system is very efficient and reliable.*

Keywords: ARM7, PIR, GSM.

INTRODUCTION

This has been reported by a non-profit organization called Kidsn-cars. Similar, unfortunate, incidents also happens in various parts of the world. Once a car is turned-off and parked, keeping its window glasses closed, the temperature inside the car increases rapidly even on a day with atmospheric temperature of about 21oX. As the thermoregulatory system of the child is not well developed, this condition may lead to hyperthermia or heatstroke which can be fatal. As we know, the child entirely depends on elders but, unknowingly, in a busy schedule, the driver or passengers may forget to take the child (who may be sleeping) in the infant seat, usually kept in the back seat of the car. Such incidents can be prevented by sensing the presence of a child soon after a car is turned-off and then generating/sending a suitable warning signal to the driver or parents who can take timely action to save the child. A child presence detection system based on a combination of optical detector, mechanical switch and temperature sensor has been reported in. Optical or thermal sensors are not well suited for this as it may not detect when a child is wrapped in a blanket or clothes. An electric field sensor to detect infants sitting in rearward position in an infant seat in a car has been reported

in. A capacitive seat occupancy detection system (for adult passengers) that provides occupancy information to an airbag control unit has been reported in. In these schemes, sensing electrodes are placed in the car seat as it is to detect adult occupancy. Thickness of infant seat available in the market is not fixed. Thus, distance between child and electrodes in car seat can be between 5 to 12 cm (depending on manufacturer). Thus, it is difficult to sense presence of a child using these sensors reliably. Also, such capacitive/electric field systems are not available in all the cars and usually, if available, it is not installed in back seats of cars where probability of forgetting a child is high. A weighing based child detector has been developed by NASA's Langley Research Center. Such weight based sensors may detect water or milk bottles, filled thermo-flask or bag, toy, etc. (or any combination of such items) as a child and may activate an (unwanted) alarm. In this paper, we propose a simple and compact capacitive sensor that can be placed in an infant seat to detect presence of a child. The proposed system also has a vehicle ignition monitor to confirm presence of driver inside a car. It also has a temperature sensor to keep track on current temperature inside the car. A GSM modem is used to alert driver or parents/guardians as soon as a child left in the car in an infant seat is detected and the car is found to be turned-off. Principle of operation of the capacitive sensor, measurement scheme employed, details of prototype sensor and warning system developed and test results are discussed in the following sections of the paper.

LITERATURE SURVEY

Once a car is turned-off and parked, keeping its window glass closed, the temperature inside the car increases rapidly even on a day with atmospheric

temperature of about 21degree centigrade. As the thermoregulatory system of the child's not well developed, this condition may lead to heatstroke which can be fatal. As we know, the child entire depends on elders but, unknowingly, in a busy schedule, the driver or passengers may forget to take the child in the front seat, usually kept in a back seat of the car. Such incidents can be prevented by sensing the presence of a child soon after a car is turned-off & the generating/sending a suitable warning signal to the driver or parents. Here we proposed a simple and compact capacitive sensor that can be placed in front seat to detect presence of a child. The proposed system also has a vehicle ignition monitor to confirm presence of driver inside a car. It also has a temperature inside the car. A GSM modem is used to alert driver/parents/guardians as soon as a child left in the car in front seat is detected and the car is found to be turned-off. Principle of operation of the capacitive sensor, measurement scheme employed details of the prototype sensor and warning system (through SMS or Voice announcement) developed and tested.

PROPOSED SCHEME

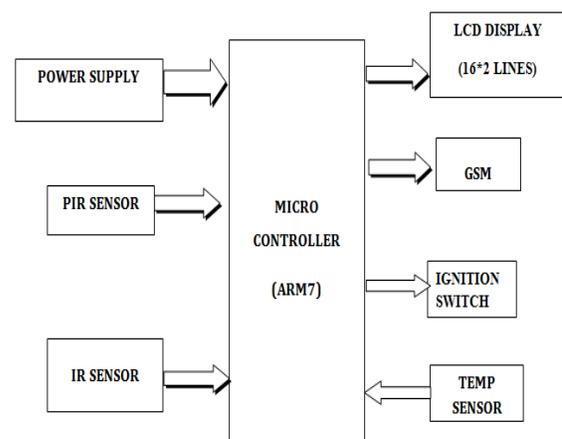


Fig.1:Block diagram

METHODOLOGY

Micro controller:

This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

ARM7TDMI:

ARM is the abbreviation of Advanced RISC Machines, it is the name of a class of processors, and is the name of a kind technology too. The RISC instruction set, and related decode mechanism are much simpler than those of Complex Instruction Set Computer (CISC) designs.

Liquid-crystal display (LCD)

It is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock.

Temperature sensor:

A thermistor is a type of resistor whose resistance is dependent on temperature. Thermistors are widely used as inrush current limiter, temperature sensors (NTC type typically), self-resetting overcurrent protectors, and self-regulating heating elements. The TMP103 is a digital output temperature sensor in a four-ball wafer chip-scale package (WCSP). The TMP103 is capable of reading temperatures to a resolution of 1°C.



Fig.2: Temperature sensor

PIR sensor:

A Passive InfraRed sensor (PIR sensor) is an electronic device that measures infrared (IR) light radiating from objects in its field of view. PIR sensors are often used in the construction of PIR-based motion detectors (see below). Apparent motion is detected when an infrared source with one temperature, such as a human, passes in front of an infrared source with another temperature, such as a wall. All objects emit what is known as black body radiation. It is usually infrared radiation that is invisible to the human eye but can be detected by electronic devices designed for such a purpose. The term passive in this instance means that the PIR device does not emit an infrared beam but merely passively accepts incoming infrared radiation. “Infra” meaning below our ability to detect it visually, and “Red” because this color represents the lowest energy level that our eyes can sense before it becomes invisible. Thus, infrared means below the energy level of the color red, and applies to many sources of invisible energy.



Fig.3: PIR Sensor

IR Tx and Rx:

Transmitter and receiver are incorporated in a single housing. The modulated infrared light of the transmitter strikes the object to be detected and is reflected in a diffuse way. Part of the reflected light strikes the receiver and starts the switching operation. The two states – i.e. reflection received or no reflection – are used to determine the presence or absence of an object in the sensing range. This system safely detects all objects that have sufficient reflection. For objects with a very bad degree of reflection (matt black rough surfaces) the use of diffuse reflection sensors for short ranges or with background suppression is recommended.

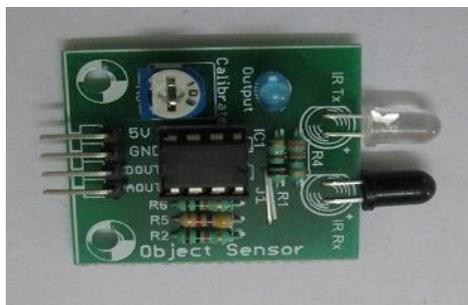


Fig.4: IR sensor

GSM:

Global System for Mobile Communication (GSM) is a set of ETSI standards specifying the infrastructure for a digital cellular service.

The network is structured into a number of discrete sections:

- Base Station Subsystem – the base stations and their controllers explained
- Network and Switching Subsystem – the part of the network most similar to a fixed

network, sometimes just called the "core network"

- GPRS Core Network – the optional part which allows packet-based Internet connections

SM was intended to be a secure wireless system. It has considered the user authentication using a pre-shared key and challenge-response, and over-the-air encryption. However, GSM is vulnerable to different class of attacks, each of them aiming a different part of the network.

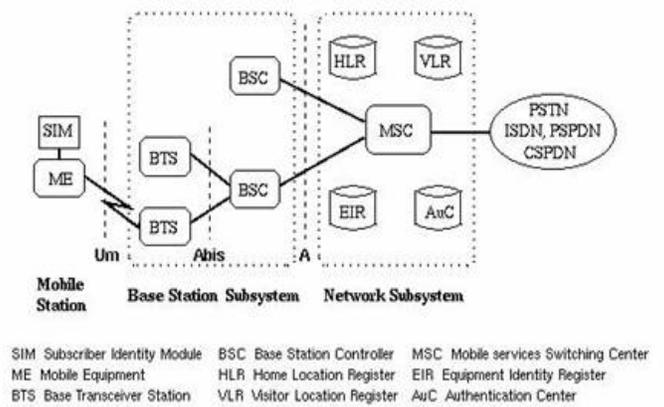


Fig.5: GSM architecture

CONCLUSION

This paper is an attempt to ensure child’s complete safety when it is left unattended by parents in car. The conditions considered above are necessary and sufficient for the same and the system is designed considering different cars structure in general. However there is still scope for improvement as technology is changing every day .

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