MONITORING AND DETECTION OF HEALTH SAFETY IN THE LOCKED CAR USING SMART ARDUINO SYSTEM

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Abstract: In recent years, there is increase in the number of heatstroke deaths of children in vehicles. For detecting rear seat children, and sending a prompt and accurate alert to their parents effectively, a better solution is needed to avoid these preventable tragedies. This paper promotes an innovative complete control system for car against children abandonment in vehicles. Existing car seat detection system will either compromise privacy of people (based on camera), or fails to identify children sitting in the back seats from heavy stuff and keep sending false alerts based on pressure sensor. The proposed system implements with a force sensing resistor, infrared sensors, a carbon dioxide sensor, a temperature/humidity sensor. These sensor devices are connected to a microcontroller device which is able to combine all acquired information, and prompts alert messages to users with the help of a GSM module. The data can be monitored in cloud at any time with the help of IoT. The DC motor of Car's glass window starts working if no action performed by owner. Thus, the proposed system offers health safety to children, pets and adults by implementing warning procedures about the situation.

1. Introduction

In each year, there are some children who have been forgotten in the locked car and lost their life due to heatstroke. The amount of heatstroke deaths of youngsters in vehicles remain increasing. How to remind these careless parents is an urgent problem to unravel. A better solution to those tragedies is to effectively detect rear seat children, and send a prompt and accurate aware of their parents.

People's day to day life style is pervaded by a galaxy of artificial systems that autonomously acquire information from the environment surrounded, process them, and real actions were performed based on the outcome of their analysis. All these systems interact with us, using graphical interfaces, communication platforms, sound or light feedbacks and physical actions [1].

As shown in Fig 1, In the United States, 54 children died in 2018, 42 children died in 2017 and 39 children died in 2016 because of heatstroke in vehicle, and the most of these in-car heatstroke deaths are accidents that are preventable.
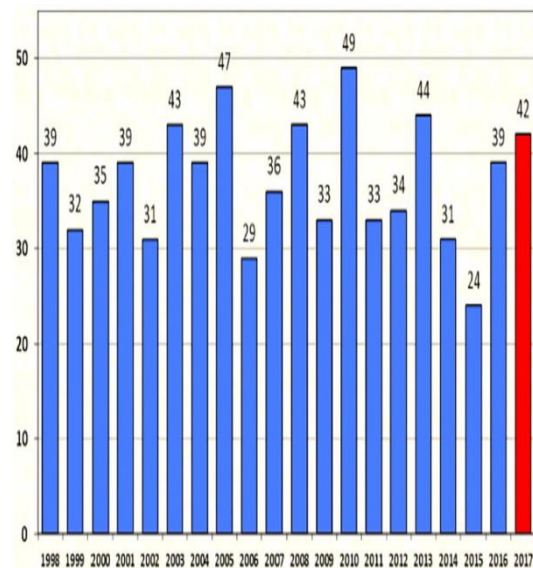

Fig. 1 Child deaths in USA for heat stroke in cars from 1998 to 2017 (www.noheatstroke.org)

These situations have increased the need to develop and install innovative system which can able to detect the presence of a child into an unattended vehicle through proper usage of sensors and to alert the driver or other possible contacts with various types of alarm. In the USA, about 37 children on an average die each year for heat stroke or hyperthermia in the car, and about 87% of them are aged between 1 and 3 years.

Fig. 2 Rear Door Alert system interface [2]

(a)Activation message at vehicle's turning-on, after rear door opening and shutting , (b) Warning message for rear seats control, at vehicle's shutdown, (c) System settings interface, (d) Access interface to system settings. (Images provided by Nissan)

The number of control systems that assist the driving force in managing the vehicle, increases with car's complexity level. For instance, competition cars need a high control level for all functional parameters, thus they instantly send wireless information to the control station, which enables to tune the cars in real time for optimizing their functions. Scientific research is very active in this field [3], since, in the future, most of the cars will be more and more network-oriented and the use of telemetry will be applied to them.

2. Detection Systems currently available on the market

Even though airbag may be a vehicle guard, it kills children below 12 years by the exertion of force[4]. This paper explains about detecting the amount of passengers sitting within the car then classifying everyone whether he/she may be a child or an adult by processing the image taken from the camera. So that the deployment of airbags are often avoided near children.

Two similar systems have been patented in the USA. The first one employs a weight sensor to detect the driver's presence and a sensor on the safety belt of a baby's chair to detect child's presence [5]. The other uses the frequency identification (RFID) technology, exploiting an RFID tag installed on the baby's chair and an RFID reader placed into the car, in order to detect the child presence on the safety seat [6].

Therefore, in this paper, we propose the rear seat children detection via the WiFi signals using machine learning techniques [7], [8]. There are two steps in our detection system. The first one is to identify if there is a pet, a child or some other sundries in the rear seat of the car by using the static Channel State Information (CSI) of WiFi signals. Next, we try to distinguish between the pets and children according to the CSI signals over time. In Table 1 shows the summary of technical features and main functionalities of the described system.

However, as vehicles become more autonomous, car accidents will slowly begin to decrease [9]. The system described in this paper uses sensors to measure features such as height and weight in order to distinguish between adult and small child. With modern sensor and connectivity technology[10], it should be possible to detect these scenarios by uploading raw data to the cloud. In this paper, we explore cloud technology to process updates from a sensor system and the way it might be wont to send notifications to stop these tragic occurrences.

In [11], an identical system uses a PIR sensor, a PIC16F877A microcontroller and a GSM module for detecting the presence of a toddler during a parked vehicle and to alert the driver with an SMS transmission. These systems typology, based only on presence sensors, can lack of detectability in conditions during which the child/ infant is asleep or is roofed with a blanket; for these reasons, the proposed system integrates, not only presence sensors, but also a sensible camera and a voice detection device to beat these shortcomings.

NAME	DETECTION METHOD	ALARM CONDITION	ALARM TYPES
Rear occupant alert	Ultra sound movement sensor	Vehicle off, doors locked	Flashing lights, hom sound
Car passenger detector	PIR movement sensor	Vehicle off	Accoustic and bright sound
Rear door alert	Rear doors opening before vehicle start	Vehicle off, doors locked	Message on panel, accoustic sound
Rear seat remainder	Rear doors opening before vehicle start	Vehicle off	Message on panel, accoustic sound
Baby care	Weight sensor in baby seat	Phone senor bluetooth connection	Phone message

Table 1 Characteristics [12]

The system reported in [13] uses a weight sensor for detecting the child's presence on the baby's seat, eventually sending a notification to driver's smartphone and enabling an acoustic alarm on the electronic keychain device. If the driver exits from transmission range of RF signal, the keychain device loses communication with the transceiver in the mat and so enables its acoustic alarm. The system referred in [14] can detect the presence and movements of a child forgotten in a vehicle.

The 'Hot Car Baby Detector' system reported in [15] allows detecting the presence of a child in a car through its movement, its voice and its breath, also in conditions of high cockpit temperature. A temperature sensor, an ultrasound movement sensor, a vocal detector and a CO2 sensor, wont to detect child's breathing. If a movement, a sound or a growth of carbon dioxide levels are detected, the system enables an acoustic alarm.

To detect if there is a child sitting in the rear seat of the car, we set a pair of WiFi transmitter and receiver near the rear door of the car[16]. In most of cases, people always put children, pets, i.e., dogs and other stuff in the rear seat. The basic idea is to capture the changes in the wireless channel when different objects are placed. Different materials and different sizes for the different objects lead to the differences between the responded CSI.

3. Proposed system

The proposed system uses force sensing resistor sensor, temperature sensor, IR sensor and gas sensor to detect the conditions of patients. These acquisition devices are connected to a microcontroller board that is able to combine all acquired data for triggering the alarm scenario. Consequently implementing some warning procedures, and sends alert messages to users with GSM module. By using IoT we can monitor the data in cloud. DC motor of car's glass window starts working if no action performed by owner.

Temperature Sensor measure the quantity of warmth energy or maybe coldness that's generated by an object or system. The working of temperature meter depends upon the voltage across the diode. The temperature change is directly proportional to diode's resistance. The resistance across diode is measured and converted into readable units of temperature. Force Sensing Resistors (FSRs), also referred to as printed force sensors or force-sensitive resistors, are a kind of piezoresistive sensing technology that consists of a semi-conductive material or ink which is sandwiched between two substrates that are separated by a spacer. The resistance drops inversely proportional to the applied force.

Fig. 3 block diagram of proposed system
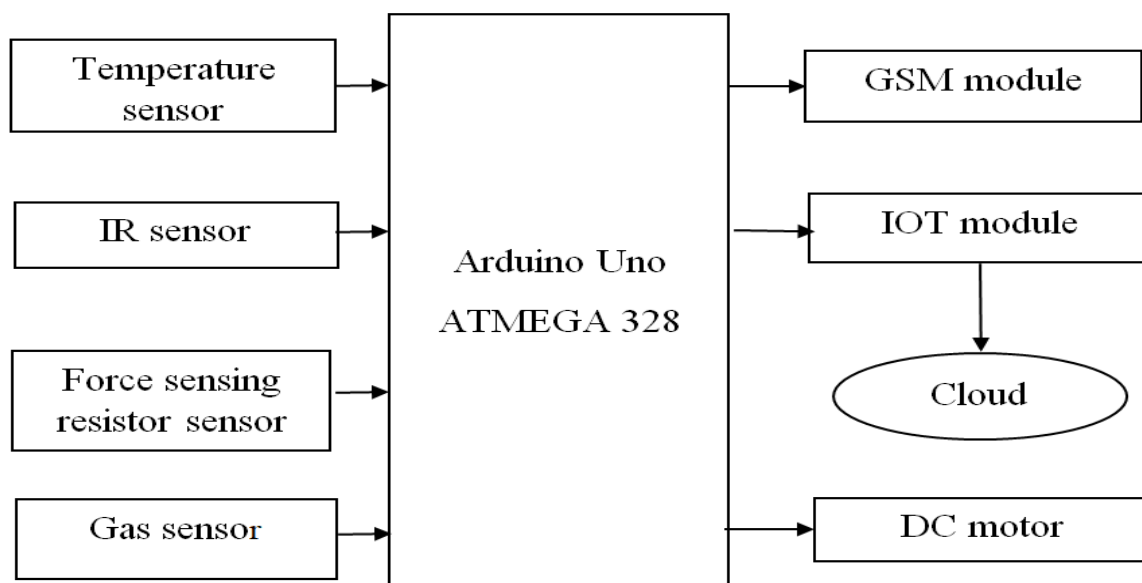
An IR sensor can measure the heat of an object as well as detects the motion. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of an equivalent wavelength as that emitted by the IR LED. A gas detector may be a device that detects the presence of gases in a neighborhood, often as a part of a security system. This type of kit is employed to detect a gas leak or other emissions. Gas detectors are often wont to detect combustible, flammable and toxic gases, and oxygen depletion.
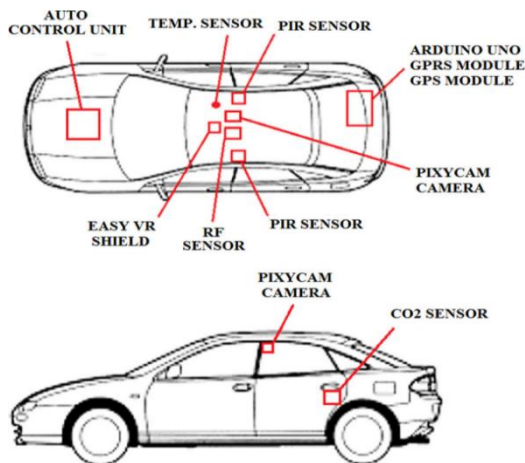

Fig. 4 System device positioning from[7]

A DC motor is any of a category of rotary electrical motors that converts DC electricity into energy. Nearly all kinds of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current partially of the motor. A DC motor's speed are often controlled over a good range, using either a variable supply voltage or by changing the strength of current in its field windings.

4. CONCLUSION

We have developed a new sensor-based system with IoT and GSM alert. In this system we implemented a force sensing resistor, infrared sensors, a carbon dioxide sensor, a temperature/ humidity sensor. These acquisition devices are connected to a microcontroller board that's ready to combine all acquired data for detecting the alarm scenario and consequently acting some warning procedures, and sends alert messages to users with GSM module. The Dc motor of car's glass window starts functioning in order to open the window. Thus, the proposed detection system is implemented to offer warning and safety procedures for children forgotten in cars.

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