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Implementation of Child Safety Alert System in Automobiles

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Abstract

Every year lot of children are passing away due to hyperthermia and coronary heart strokes. This is happening because the children are left inside the car unknowingly. Many incidents of such cases are increasing rapidly in the past few decades. These incidents are recognized as the automobile injuries and for this, a research has been done to know more about the fat situations of the surroundings of such instances. By the research it is known that there are two elements which made the kids more liable to hyperthermia when compared to adults. A systematic rationalization about how this can be appeared that the children are left unknowingly by their parents in the vehicle can be identified with working memory, it builds up the pressure obstruction and impends to a particular interest. In past two years, 16 children of these cases in Italy and 53 children of these cases in US of infant hyperthermia because of abandonment in vehicles were perceived. These discoveries propose that instructive bundles and writing for guardians concerning auto insurance should incorporate such data about these threats of the heart stress, in fact such actions are unknowingly happened and not intentionally done. In triumph over these issues a prototype has been proposed by means of the child safety alert system.

Introduction

A child safety alert system in automobiles is designed to prevent instances of children being left unattended or trapped inside a vehicle. The system works by detecting the presence of a child in the car seat and alerting the driver through an audible and visual warning system. The alert system can be triggered when the driver turns off the engine or opens the door, reminding the driver to check the backseat for any occupants. The system can also send notifications to a mobile device if the driver forgets to check the backseat after leaving the vehicle. The child safety alert system in automobiles can help prevent tragic incidents of heatstroke or suffocation in young children left alone in vehicles.

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Child safety is a crucial aspect of automobile design, and one of the most pressing concerns is the risk of children being left unattended or trapped inside a vehicle. Heatstroke is a leading cause of death among children left alone in cars, and the incidence of such incidents has been on the rise in recent years. To address this problem, manufacturers have been developing child safety alert systems that can remind drivers to check the backseat for children before leaving the vehicle.

The child safety alert system in automobiles typically uses a combination of sensors and alarms to detect the presence of a child in the car seat and alert the driver if the child is still in the vehicle. The system can be activated when the driver turns off the engine or opens the door, triggering a warning signal if the child is still in the car seat. The alert system may use a combination of audible and visual cues, such as a flashing light or a beeping sound, to ensure that the driver is aware of the situation.

Moreover, the child safety alert system can also include a smartphone app that sends notifications to the driver's mobile device if they forget to check the backseat after leaving the vehicle. The app can use GPS and motion sensors to determine the car's location and detect whether a child is still in the car seat. The notifications can include reminders to check the backseat, or alerts that a child is still in the car. With the help of a child safety alert system, drivers can avoid the tragedy of accidentally leaving a child in a car, ensuring that children remain safe and secure during every ride.

Literature Review

Development of Child Safety Car Alert System using Arduino and GSM Module

The Child Safety Car Alert System by Arduino is an integrated device that sends alerts to the driver if a child is left unintendedly in the car. The system is developed using the Arduino board which incorporates the integration between sensors and GSM module. This system uses pressure and motion sensors to detect the presence of a child located at the back seat of the vehicles. Meanwhile, the GSM or Global System for Mobile Communication allows the system to send an alert to the driver within a short period. The GSM is chosen due to its ability to lower the energy consumption per bit while providing higher data rates. Two sensors are used; Force Sensitive Resistor (FSR) Sensor and Pressure Infrared (PIR) Sensor. The alert system is triggered when both sensors detect the presence of a child at the back of the car seat which will then notify the parents or a driver immediately through a message sent via a mobile phone. Every few days in the world, there are reports of young children dying from heatstroke after being left in parked cars [1-5]. With cases of clear neglect, the justified intervention and local solution must be addressed accordingly. Figure 1 shows the percentages of the child being left in vehicles. 54% is due to the “forgotten in vehicle” element. Even though an emphasis on education and awareness focused at parents or drivers and to the public, in general, have been given, this could not stop the number of a child end up in this kind of tragedy. This shows that it’s very important to develop a device or system that can notify the driver or alert them on the issue. To summarize this section, the death could have been prevented if the parent being

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notified in case, they leave a child behind. To prevent this tragedy, Arduinobased-system is developed to send out a warning message once the system detects the presence of the children based on pressure and motion sensors placed at the back seat of the car after the driver left. This project aims to develop a lab prototype of a low-cost and simple implementation of a Child Safety Car Alert System (SCCAS) using Arduino kits and Arduino IDE 1.8.2 with intended for the system that sends alerts to the drivers The technology has been in the market for a while. Studies and reviews on three existing products similar to this project development have been made to choose the most suitable detection mechanism for building SCCAS [4,7,8,10,11]. Based on the comparison, a Passive Infrared (PIR) sensor is chosen to detect the motion of the child through IR radiation emission. Adding to this is a pressure sensor. Both motion and pressure sensor are used to determine whether the heuristic detected is a human being.

Prevention Alert System for a Child left in a Parked Vehicle

It has been reported that a large number of cases have been identified with the death of children left in a vehicle due to heat stroke and hyperthermia. The aim of this project is to develop a system that can alert parents or care takers that a child is being left in the car. This project applies Software Development Life Cycle (SDLC) for as for the methodology. There are 6 phases in conducting research and implementation of the project which are, project initiation, requirement analysis, design, implementation, testing and evaluation. A system overview diagram is used to help identify the building blocks of system whether they are hardware, software, or mechanics. The project was successfully developed using Arduino and tested. The notification will be sent if there is no motion detected for 2 minutes, and the notification interval will be 10-15 seconds. The system is able to alert parents should they leave the children unattended in the car. Hopefully, this project will help reduce child death from being left in a

car.

Keywords: Vehicle, Arduino, Safety, Child Safety, Sensors, Hyperthermia

This is to discuss the literature reviews on related topics that have been prior to the title. It will start by defining and discussing the current situation around the world, reviewing literature produced by other researchers from journals and related products on the market. Technology is rapidly evolving to replace the traditional system with implementing a computerized system to help better safety and health-related issues. There are a few types of child car seats implemented today, and many studies introduce different methods of implementing a child car seat safety mechanism that researchers have worked on: using a sound sensor, using the seat belt as a sensor, and using a remote sensor, and many more. Review of Current Situation On average, after having been left in a car, 39 children under 15 die each year from heatstroke due to parental or caregiver neglect (Centers for Disease Control and Prevention, 2008). Several cases happen when people get distracted from their hectic lives and do not know that a child is in a situation of death. Busy people appear to put their child in the back of the car, making them forget that they carry their child along when they leave the car. They could go about their daily

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routine and leave the child in a closed windowed vehicle. As Ferrara (2013) and colleagues mentioned, job stress impacts contribute to one of the reasons most people tend to forget (Ferrara et al., 2013). This clarifies that an individual's day-to-day life will affect their actions and lead to one's decision to leave their child in the car unattended due to their frustration and the workload they have. In recent years, there have been numerous research work on this subject (Dadour et al., 2011; Downs, 2015; Kautz, 2010; Lee et al., 2007; Rashidi & Muhamad, 2013).

Proposed system

The proposed system structure is developed using ESP32 microcontroller with a rapid response time. The microcontroller receives the sensor input for child crying, and when it hits the threshold it triggers the windows of the vehicle will be auto rolled down and doors are unlocked. The monitoring of the vehicle it also implements camera for live shorts from the inside of the vehicle and all this information is also displayed on the LCD. The sensors sent the data to the database for storing the values in it again the values, sent to the android phone through IOT. This method is used to avoid the data lost while sending the sensor values from device to device.

Block Diagram

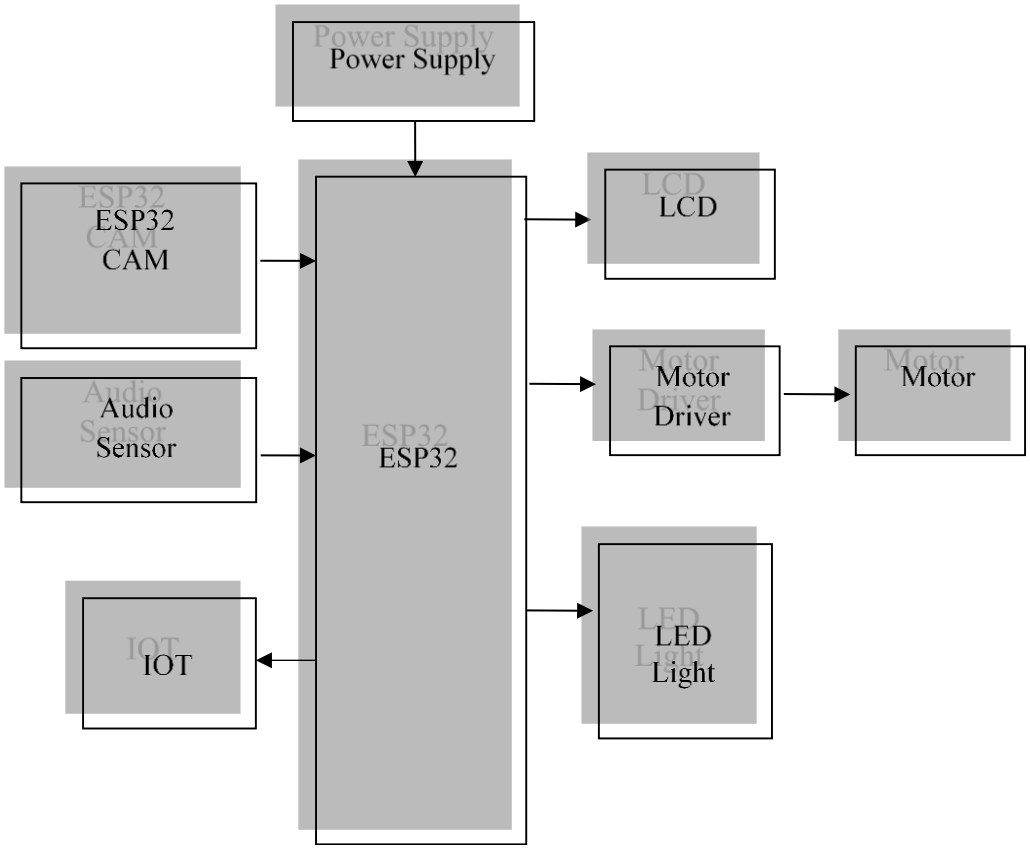

Figure 1 Proposed model

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Hardware Components:

Power Supply:

The power supply section is the section which provides +5V for the components to work. IC LM7805 is used for providing a constant power of +5V. The ac voltage, typically 220V, is connected to a transformer, which steps down the ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation. A regulator circuit removes the ripples and also retains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.

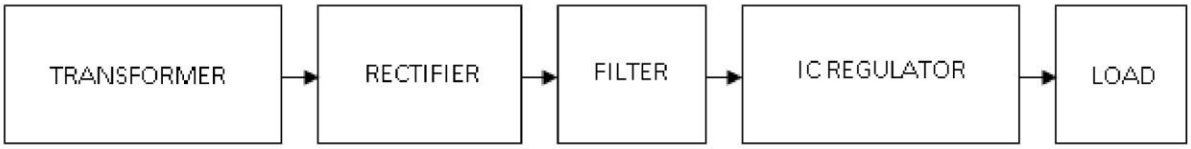

Figure 2 Block diagram of power supply

Voltage Regulators

Voltage regulators comprise a class of widely used ICs. Regulator IC units contain the circuitry for reference source, comparator amplifier, control device, and overload protection all in a single IC. IC units provide regulation of either a fixed positive voltage, a fixed negative voltage, or an adjustable set voltage. The regulators can be selected for operation with load currents from hundreds of milli amperes to tens of amperes, corresponding to power ratings from milli watts to tens of watts.

Figure 3 Voltage Regulator

A fixed three-terminal voltage regulator has an unregulated dc input voltage, Vi, applied to one input terminal, a regulated dc output voltage, Vo, from a second terminal, with the third terminal

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connected to ground. The series 78 regulators provide fixed positive regulated voltages from 5 to 24 volts. Similarly, the series 79 regulators provide fixed negative regulated voltages from 5 to 24 volts. Voltage regulator ICs are available with fixed (typically 5, 12 and 15V) or variable output voltages. They are also rated by the maximum current they can pass. Negative voltage regulators are available, mainly for use in dual supplies. Most regulators include some automatic protection from excessive current ('overload protection') and overheating ('thermal protection').

Many of the fixed voltage regulator ICs have 3 leads and look like power transistors, such as the 7805 +5V 1Amp regulator. They include a hole for attaching a heat sink if necessary.

ESP32

ESP32 is a series of low-cost, low-power system on a chip microcontrollers with integrated Wi-Fi and dual-mode Bluetooth. The ESP32 series employs either a Tensilica Xtensa LX6 microprocessor in both dual-core and single-core variations, Xtensa LX7 dual-core microprocessor or a single-core RISC-V microprocessor and includes built-in antenna switches, RF balun, power amplifier, low-noise receive amplifier, filters, and power management modules. ESP32 is created and developed by Espressif Systems, a Shanghai based Chinese company, and is manufactured by TSMC using their 40 nm process. It is a successor to the ESP8266 microcontroller.

Figure 4 ESP32 Microcontroller

ESP32 Camera

ESP32-CAM is a development board module with a size of 27×40mm. It can be integrated into a camera system with an ESP32 module and camera. ESP32-CAM can be widely used in various IoT applications. It is suitable for home smart devices, industrial wireless control, wireless monitoring, QR wireless identification, wireless positioning system signals and other

IoT applications. It is an ideal solution for IoT applications.

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Figure 5 ESP32 Camera

DC Motor

Figure 6 DC Motor

A DC motor, or direct current motor, is a type of electric motor that converts electrical energy into mechanical energy. It is a common type of motor used in a wide range of applications, from small toys to large industrial machinery. The basic design of a DC motor consists of a stator, which is the stationary part of the motor, and a rotor, which is the rotating part of the motor. The stator contains a set of permanent magnets, while the rotor contains a set of electromagnets. When an electric current is passed through the electromagnets on the rotor, they create a magnetic field that interacts with the magnetic field of the permanent magnets on the stator. This interaction produces a torque that causes the rotor to rotate. DC motors come in various shapes and sizes, from small hobby motors to large industrial motors. They are used

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in a wide range of applications, including robotics, electric vehicles, and industrial machinery. One of the key advantages of DC motors is their ability to provide high torque at low speeds. This makes them ideal for applications where precise control of speed and position is required, such as in robotics and automation. DC motors can also be used as generators, converting mechanical energy into electrical energy. This is known as regenerative braking, and is commonly used in electric vehicles to recover energy during braking.

Motor Driver

A motor driver is an electronic circuit or device that controls the speed and direction of a motor. It is an essential component in many different types of machinery and equipment, from small hobby projects to large industrial systems. Motor drivers come in a variety of shapes and sizes, from simple integrated circuits to complex modules with advanced features. They can be used with different types of motors, including DC motors, stepper motors, and servo motors.

Figure 7 Motor Driver

Audio Sensor

An audio sensor is defined as a module that detects sound waves through its intensity and converting it to electrical signals. Audio sensor consists of an in-built capacitive microphone, peak detector and an amplifier that is highly sensitive to sound. Audio sensors are used in many other days to day applications including consumer electronics such as phones, computers, music systems, security and monitoring systems such as burglar alarms, door alarm, etc. There are different types of audio sensors available in the market, including microphones, piezoelectric sensors, and MEMS (microelectromechanical systems) sensors. Microphones are the most common type of audio sensor, which convert sound waves into electrical signals using a diaphragm that vibrates in response to sound waves. Audio sensors are used in a variety of applications such as speech recognition, noise detection, audio recording, and audio monitoring in security systems. They can also be used in medical devices to monitor heartbeats, breathing, and other vital signs.

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Figure 8 Audio Sensor

LCD Display

LCD Stands for “Liquid Crystal Display.” LCD is a flat panel display technology commonly used in TVs and computer monitors. It is also used in screens for mobile devices, such as laptops, tablets, and smartphones.

LCD displays don’t just look different from bulky CRT (Cathode Ray Tube) monitors, the way they operate is significantly different as well. Instead of firing electrons at a glass screen, an LCD has a backlight that provides light source to individual pixels arranged in a rectangular grid. Each pixel has a RGB (Red, Green, and Blue) sub-pixel that can be turned on or off**.** When all of a pixel’s sub-pixels are turned off, it appears black.

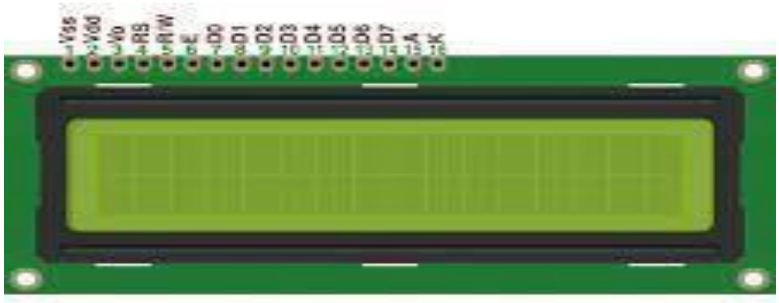

Figure 9 LCD Display

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Result

Finally, we have successfully implemented the circuit. It can be easily implemented in cars and wagons.

The proposed system structure using the ESP32 microcontroller with a rapid response time appears to be an effective solution for detecting and responding to a crying child in a vehicle. By setting a threshold for the sensor input, the system can quickly determine when a child is in distress and trigger the automatic opening of the vehicle windows and unlocking of the doors. Additionally, the implementation of a camera for live shots from inside the vehicle provides an extra layer of security and reassurance for parents or guardians.

Furthermore, the use of a database to store sensor data and the implementation of IOT technology to transfer this data to an Android phone is a smart move to ensure that information is not lost during transmission. This approach adds an extra layer of reliability to the system and allows for the data to be accessed remotely, which could be useful for parents or guardians who are not in close proximity to the vehicle. Overall, this proposed system structure has the potential to provide an efficient and effective solution for addressing the issue of child safety in vehicles.

Comparison of previous system and proposed system

Features	Child Safety Car Alert System by Arduino	Proposed System using ESP32 Microcontroller
Sensors Used	Force Sensitive Resistor (FSR) Sensor and Pressure Infrared (PIR) Sensor	Child Crying Sensor
Alert System	Sends message to driver's mobile phone	Rolls down windows and unlocks doors, sends message to mobile phone
Microcontroller Used	Arduino Board	ESP32 Microcontroller
Response Time	Short	Rapid
Camera Monitoring	Not implemented	Implemented
Data Storage and Transfer	Not mentioned	Data stored in a database, transferred to Android phone via IoT
Energy Consumption	Not mentioned	Energy consumption per bit lowered with GSM
Integration of Hardware	Integrated	Integrated

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Conclusion

The project **"Implementation of Child Safety Alert System in Automobiles"** has been successfully designed and tested. It has been developed by integrating features of all the hardware components used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly using highly advanced

IC's and with the help of growing technology the project has been successfully implemented. The project "Implementation of Child Safety Alert System in Automobiles" is a result of extensive research and development aimed at addressing the growing concern of child safety in vehicles. The project has been designed and tested with great attention to detail, ensuring that every module and hardware component used is carefully placed to contribute to the system's best performance. The project's success is attributed to the thoughtful integration of all the features of the hardware components used, which work seamlessly to provide a reliable and efficient solution.

The project's success can also be attributed to the use of highly advanced ICs and the incorporation of the latest technology trends. The system is based on the ESP32 microcontroller, which is a high-performance device that can process sensor inputs with great speed and accuracy. The system also employs IoT technology to ensure data integrity and prevent data loss during transmission. These advanced technologies enable the system to provide remote monitoring and control of the child safety alert system in automobiles, making it a reliable and efficient solution.

The successful implementation of the project demonstrates the potential of using technology to address critical issues affecting society. The project's focus on child safety highlights the importance of developing innovative solutions to address societal challenges. The project serves as an excellent example of how the integration of technology and innovation can lead to the development of effective and reliable solutions. The project's success is a testament to the hard work and dedication of the project team and their commitment to delivering a high-quality solution that can make a positive impact on society.

FUTURE SCOPE

- Scope in safe travelling of child.
- Scope in safe driving and accident protection due to child attendance
- Choosing safe transportation options
- Monitoring children during transportation
- Addition of Artificial Intelligence based child voice detection

The future scope of child safety alert system in automobiles is likely to expand in a number of ways, driven by advances in technology and increasing awareness of the importance of child safety in vehicles. Some possible areas of development include:

1. Integration with other safety systems: Child safety alert systems could be integrated with other safety systems in vehicles, such as collision avoidance, lane departure warning, and emergency braking. This would create a more comprehensive safety package and help reduce the risk of accidents involving children.

2. Improved detection and sensing technology: As sensing and detection technology improves, child safety alert systems could become even more accurate and reliable. For example, sensors could be developed that can detect the presence of a child in the vehicle even if they are hidden from view.

3. Customization and personalization: Child safety alert systems could be personalized to individual families, allowing parents to set specific parameters and alerts for their children. For example, parents could set alerts for when their child removes their seatbelt or opens a window.

4. Connectivity: Child safety alert systems could be connected to other devices, such as smartphones or wearable technology, allowing parents to monitor their child's safety remotely.

5. Regulation and standardization: As the importance of child safety in vehicles becomes more widely recognized, regulations and standards could be developed to ensure that all vehicles are equipped with effective child safety alert systems.

6. Overall, the future of child safety alert systems in automobiles is likely to involve a combination of improved technology, greater customization and personalization, and increased regulation and standardization. These developments will help ensure that children are protected and safe while traveling in vehicles.

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