A System of Child Detection in Car Using Thermal Sensor

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Abstract: There are some cases about the child died in the car that causes by the parent did not aware their child being left in the car in long duration time. Therefore, there is a project that can overcome the problem of children being left behind in the car that is a prototype that can detect children in the car by using heat-sensing technology and effective indicators to users so that users are aware of the indicators in the prototype system be created. The system of the prototype consists of Arduino MKR WIFI 1010, thermal sensor, buzzer, LEDs, relay, and power bank that be constructed in circuit. This work evaluates the prototype able to detect child remain in car using thermal sensor with detection range is 37cm on the rear car seat and also able to notify the user about its using indicator LED and buzzer alarm. The prototype will connect to the car to operate as the flow in the flowchart. This prototype helps the user to prevent the child be left in a car.

Keywords: Car, child detection, thermal sensor

1. Introduction

Many of the victims (children) are left behind with no one remembering where they are when parents leave for work or attend meetings. This year's incident is the seventh in a period of five years. Due to the unpredictable nature of the situation, many parents feel constant anxiety and fear that their child will suffer the same fate later, which is scary [1].

The best car safety controls or car safety applications are designed to prevent children from being injured in a car. Therefore, this danger is reduced. Caring parents should conduct an in-depth evaluation of car seat safety before purchasing one for their child. Even with car seats properly installed, children are not completely safe, because there are other dangers around them that can be deadly and even deadly.

There are products that assist parents in being sensitive to their children's needs, while emphasizing their safety [2]. Since most parents store their phones inside purses and pockets, they may forget to check their phones and may ignore notifications that come from child reminder apps. It would be best to check their phones after getting out of the car and leaving the parking lot. In some cases, the parents do not turn on the phone alarm when trying to send the notification to the phone when the child is in the car [3].

Based on previous work, several systems have been used to detect child in car such as [2] and [3]. Here, the survey shows some advantages and disadvantages of these technology including those technological solutions are used for detection of human presence, but the detection capability is limited, so if people are present, it cannot be detected by using sensors available on the market. Fortunately, thermal sensing can be used to counteract this shortcoming. Based on a project proposed in a previous paper, we decided to propose a new system that uses thermal sensors to detect the presence of people more accurately in the car. For alarms, the notification uses colored LED lights and audible alarms in the system.

The paper demonstrates a highly innovative approach to mechatronics engineering in automotive, using thermal systems to alert the driver of the onboard human detection system within the car. An innovative methodological approach is proposed in this paper to detect the presence of a human being in a car. To determine the thermal sensor system's ability to differentiate between the temperature of the human body and ambient temperature, the thesis' strategies were carefully studied.

2. Methodology

For this project, we are required to develop a system or product that promotes the Arduino program. Arduino in this project is used for microcontroller kits. The Arduino code is written in C++ with an addition of special methods and functions [4]. The first subsection presents the overall block diagram of the system, followed by the flowchart of child detection process.

2.1 Block Diagram

The block diagram is shown in Fig. 2.1. The power supply will supply power to the system through the relay module and ESP32 to make all equipment operate normally. The Arduino microcontroller will receive the data read using the DT6 thermal sensor, and then send the data to the Arduino microcontroller, which has been programmed according to a flowchart designed to detect children in the car. Information will be sent to blue and red LED lights and buzzer alarms to trigger on or off.
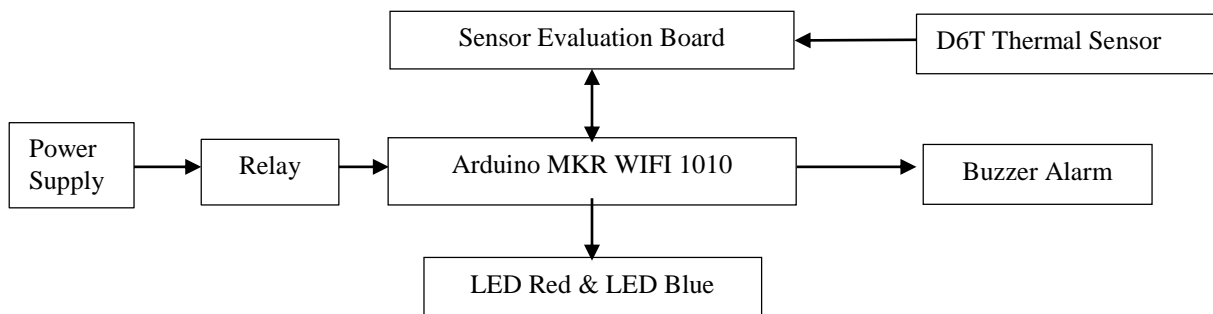
Fig. 2.1 - Block diagram of the child presence detection

The coding will instruct the buzzer alarm and two LED. Fig. 2.2 shows flowchart of the system for child detection being left in the car by using thermal sensor. The system starts when the car engine is off, and the relay acts as a switch to open the Arduino circuit. The thermal sensor will detect the occupants in the detection range. If a person in the car is detected, the buzzer will be triggered by the microcontroller to turn on, and the red LED will light up as an indication of the person in the car. The blue LED will light up in whenever no person in the car.
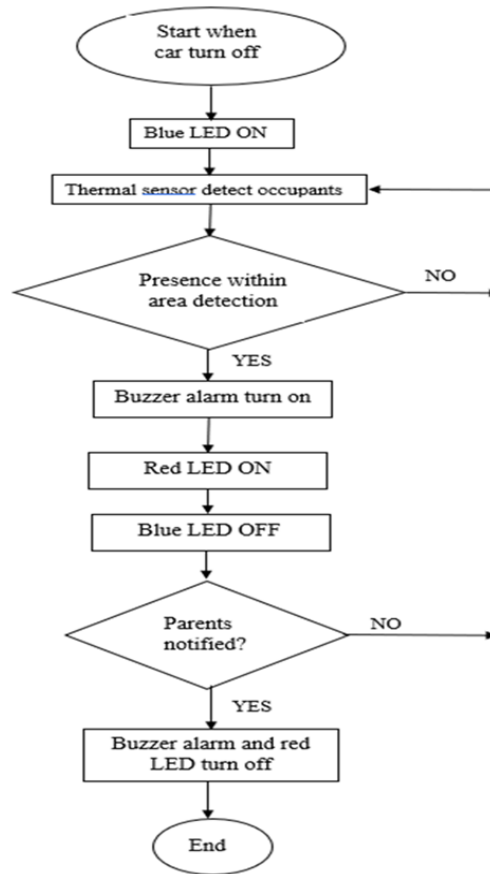
Fig. 2.2 - Flowchart of the work thermal child detection

2.2 Materials

This system of child detection in car using thermal sensor have been built consist of Arduino MKR WIFI 1010, buzzer, red and blue LEDs, relay, power bank, sensor evaluation board for Arduino (2JCIE-EV01-AR1), cable harness (2JCIE-HARNESS-01) and the MEMS thermal sensor (D6T-8L-09H). The component with the model number product by Omron Electronic Components in which last significant manufacturing process was carried out from Japan.

3.   Results and Discussion

This section will discuss the results and analysis obtained from all process that involved in developing the prototype of the system of child detection in the car using a thermal sensor. The prototype and source code discussed in this paper are the result for hardware and software, respectively.

3.1 Results

This section will discuss working by detecting a child being left in the passenger seat using thermal sensor. The device will notify or alert the user by producing a sound of buzzer and led indicator (red led or blue led) which indicate the occupancy in the car. This project has been testing after completely assembling both hardware and software. A lot of troubleshooting has been done in developing a successful prototype. Fig. 3.1 shows the prototype of the child detection system.
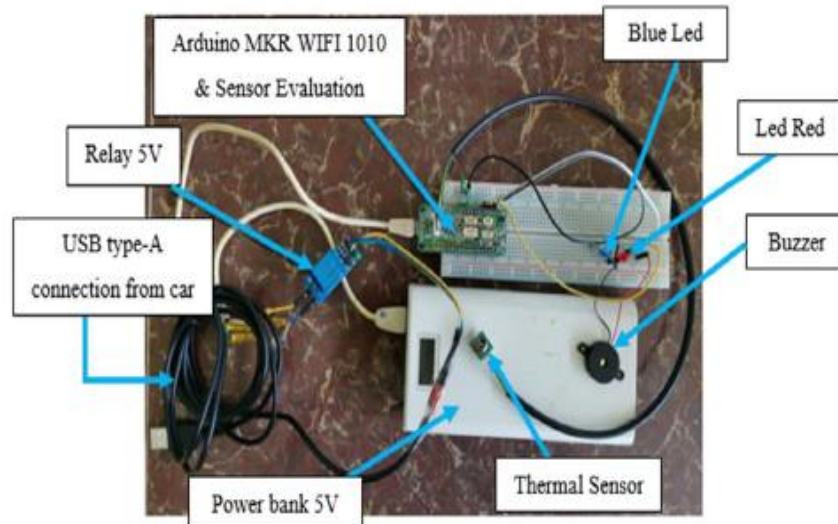
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Fig. 3.1 - Prototype of the child detection system

The prototype that can overcome the problem of children left behind in a car is one that uses heat-sensing technology and effective indicators so that users can be alerted to the indicators displayed in the prototype. It uses a thermal sensor for detection and a buzzer alarm as well as indicator LEDs for notification of the system. A full-seated driver can use this prototype to detect objects at a considerable distance from the vehicle. Where a good region detection is possible, the range effectiveness of the area detection is 37cm. Using a USB Type-A cable, the prototype can be connected to the USB port on the car to enable the system to be implemented.

By using the relay as a switch, the prototype system will start when the engine of the car shuts off. It will detect the presence of Human in the area region if the D6T thermal sensor detects the presence of Human in the area region and if the presence of Human is not detected it will turn on the blue LED and turn off the red LED and the buzzer alarm. Upon detection, the user will be alerted by two different colors: red as a warning sign and blue as a safe sign. Last but not least, this alarm will create a high-pitched sound that causes irritation to the user.

3.2 Discussions

As a part of this study, the thermal sensor was examined in order to determine how well it could detect people sitting in the rear passenger seat. Thermal sensor effectiveness is determined by the range of detection of the sensor. Fig. 3.2 shows the rear seating arrangement of the Proton Persona 2016 CVT, which has three seated passengers with 127cm of legroom. Sensor stands made from cupboards are used to place the sensors at the desired location. On the basis of the upper center sensor location, it has been determined that the detection range of the thermal sensor is 37cm. The yellow dashed line and green frame on the sensor indicate which area of the body it can recognize well. Nevertheless, both red frame areas lack the ability to be detected by the sensor. This illustrates the limited range of thermal sensor detection, which is not able to cover the entire space of rear seat passengers. Due to this, it is imperative to always be mindful of the location of the sensor and its detection range.
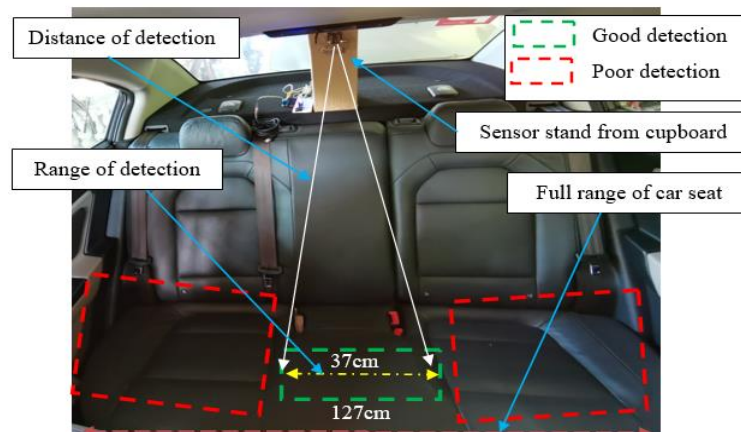

Fig. 3.2 - The range of the detection by the thermal sensor

Fig. 3.3 shows the red LED on and the buzzer beep as the hand is in sensor detection. Here, the multimeter gives a reading due to the buzzer beeping. Fig. 3.4 shows the blue LED on if the area of sensor detection is not occupied while the red LED and the alarm buzzer turns off.
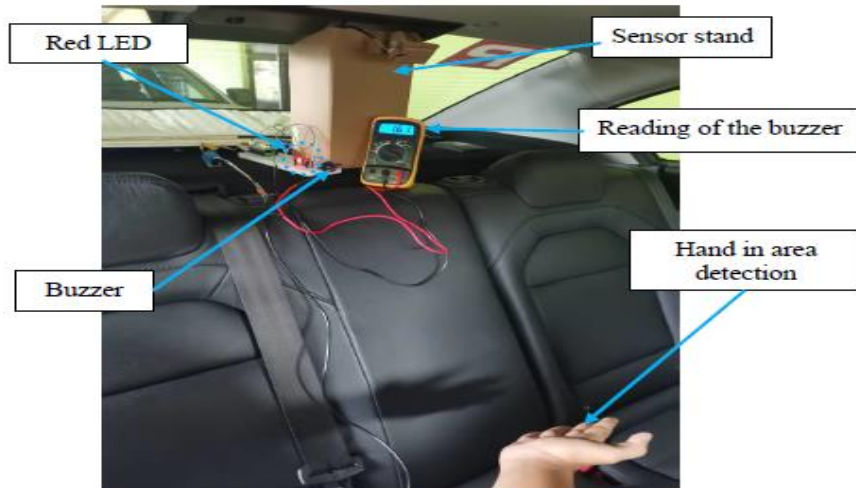

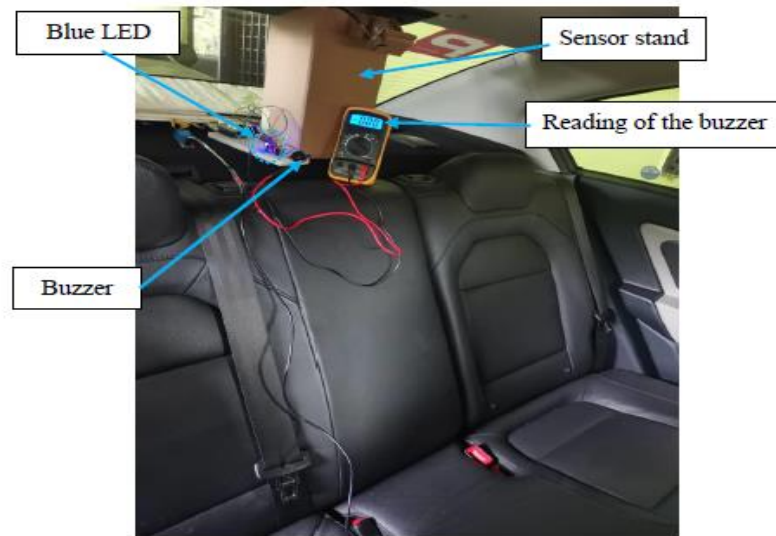**Fig. 3.3 - Red LED and buzzer alarm are on when the hand is detected in sensor detection**

Fig. 3.4 - Blue LED is on when no occupancy in sensor

4. Conclusion

Overall, the proposed system of child detection in car using the thermal sensor was able to detect the occupant in the car whether present or not. In addition, the system able to notify the user by the sound of the buzzer alarm, red and blue of LED as indicator sign. The system capable to detect difference between human and object. Even thought, the sensor the range area detection not wider. There is obvious limitation of this system, which the range of detection sensor cannot be fulfill the desired area detection capacity and also to make real time notification via smartphones. Therefore, further research with improvement of capability specification of the thermal sensor and the system able to implement the IoT technology in term of notification system for the user.

Acknowledgement

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