



## THE DEVELOPMENT OF CAR SEAT ALERT SYSTEM USING IOT

Syukur Samsudin<sup>1</sup>, Adam Samsudin<sup>1</sup>, Kamilah Jaafar<sup>1</sup>, Ezzatul Farhain Azmi<sup>2</sup>,  
 Mohd. Aminudin Razali<sup>3</sup>, Mohamad Aiman Mohd. Ali<sup>4</sup> and Irianto<sup>5</sup>

<sup>1</sup>Department of Electrical Engineering Technology, Faculty of Electrical and Electronic Engineering Technology,  
 Universiti Teknikal Malaysia Melaka, Melaka, Malaysia

<sup>2</sup>Department of Mechanical Engineering Technology, Faculty of Mechanical and Manufacturing Engineering Technology,  
 Universiti Teknikal Malaysia Melaka, Melaka, Malaysia

<sup>3</sup>Department of Engineering Technology, FX Sanhei Mechatronics Sdn Bhd, Puchong, Selangor, Malaysia

<sup>4</sup>Department of Diagnostic Analysis, Twinoaks Sdn Bhd, Seri Kembangan, Selangor, Malaysia

<sup>5</sup>Department of General Education, Faculty of Resilience, Rabdan Academy, Abu Dhabi, United Arab Emirates

E-Mail: [adam.samsudin@utem.edu.my](mailto:adam.samsudin@utem.edu.my)

### ABSTRACT

The objective of this paper is to design and develop a car seat alert system by using IoT. Heatstroke mortality among children in automobiles are on the rise these days, with an annual increase in the number of cases. Furthermore, the inside of a vehicle heats up quickly, which is a major issue for parents who want to travel by car with their children. The car seat alert system is designed to inform and alert parents who may forget their children in any kind of situation. The NodeMCU ESP8266 is used as a microcontroller to control all the input and output devices in this system. This device includes an indicator lamp, LED strip and a buzzer to trigger and alert parents when this sort of carelessness occurs. Aside from that, LCD is used to show the presence of the children in the seat as well as the temperature inside the vehicle. Other than that, the GPS module is used to provide the user with the location of the child who has been left in the car. Apart from that, the system will send the alert message to the user through the WhatsApp application for monitoring and notifying the alert message. This research demonstrated that the car seat alert system was conceived, implemented, and analyzed satisfactorily.

**Keywords:** car seat, alert system, IoT, arduino.

### INTRODUCTION

Every year, mobile data services become less expensive and more widely available. People are spending more time online than ever before, which opens enormous opportunities for ventures involving the Internet of Things (IoT). Around 47% of the world's population currently uses the Internet [1] and the number of Internet connected devices is expected to reach 50 billion by 2020 [2]. If the world population rises to 8 billion people in the same year, that means everyone would have more than six devices connected to the Internet.

In addition, the number of children die from automobile related heat stroke is lower than the number of children die in traffic accidents, the nature of these deaths demand attention. Two reasons children are more susceptible to vehicle heat stroke than adults. Firstly, children are most likely to be left alone in a parked vehicle compared to adults and unable to exit themselves. Second, children's bodies are less equipped to deal with the extreme heat that can quickly build in a parked vehicle.

This paper focused on the design of a temperature level detection system with automatic roll down window and safety in vehicle and development of an infant car seat alert system through WhatsApp applications. The consists of a driver keychain warning device and a reminder system that involves a safety pad fixed into an infant car seat or a child restraint system (CRS). The load sensor, Arduino UNO and 1Sheeld are the component in the safety pad [3]. Other than that, the system using Bluetooth pairing, temperature, weight, and movement sensing are proposed by author [4].

The author [5] suggested that using a Bluetooth interface that could attach to a smartphone. If the device is more than a certain distance away from the handset, an alarm will be triggered. Then, author [6] proposed the detection device detects speech, odor, motion, and temperature. The system sends a warning to the driver's cell phone via messaging. The sensor used electromagnetic waves that can pass through sunshades and clothes, enabling the device to detect infants in forward facing and rear facing in child CRS [7]. The motion and ultrasonic sensors be installed above the kid seat and the vehicle [8].

The research [9] proposed the system include some smartphone apps that allow user to receive warning or status alerts as well as photographs taken directly from the vehicle cockpit. Furthermore, the device is based on an Arduino board with sensor PIR, FSR, motion, odor and GSM module is proposed [10]. The author suggested to create device or system that can send a message to the driver.

### METHODOLOGY

According to Figure-1 "The Development of Car Seat Alert System by Using IoT" project is made up of three operations which is input, process, and output. This system consists of two force sensor, magnetic switch, temperature sensor, NodeMCU ESP8266, LCD display, GPS module, power window motor, indicator light, buzzer, and LED strip.

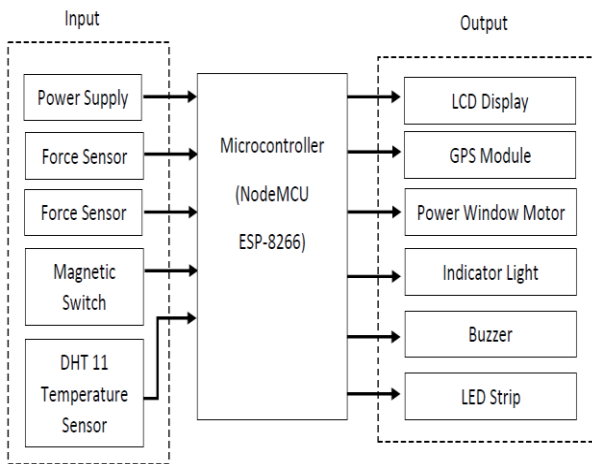


Figure-1. Project block diagram of the system.

**BLOCK DIAGRAM**

The project block diagram of the system is shown in Figure-1. The DHT 11 temperature sensor, force sensor and magnetic switch as well as the child and driver seat sensor and door lock sensor are used as inputs in this project. The temperature sensor will measure the closed vehicle temperature and the force sensor will identify the presence of the baby.

This input will be sent to the NodeMCU ESP8266 microcontroller and with the code that has been implemented inside the microcontroller. The output part will be converted to the LCD display, which will show the child presence in the car seat, while when the temperature reaches a dangerous level, the motor will roll the window down.

Aside from that, the LED strip will light up, as will the buzzer which will continuously beep sound to warn the parent or user that baby is still inside the vehicle. The NodeMCU ESP8266 and GPS module function, a warning text message with user coordinates will be sent to the registered person or parent and the car window will be roll down by the power window motor to decrease the temperature inside the vehicle so that the baby does not suffer from heatstroke. A flowchart of this project is shown in Figure-2.

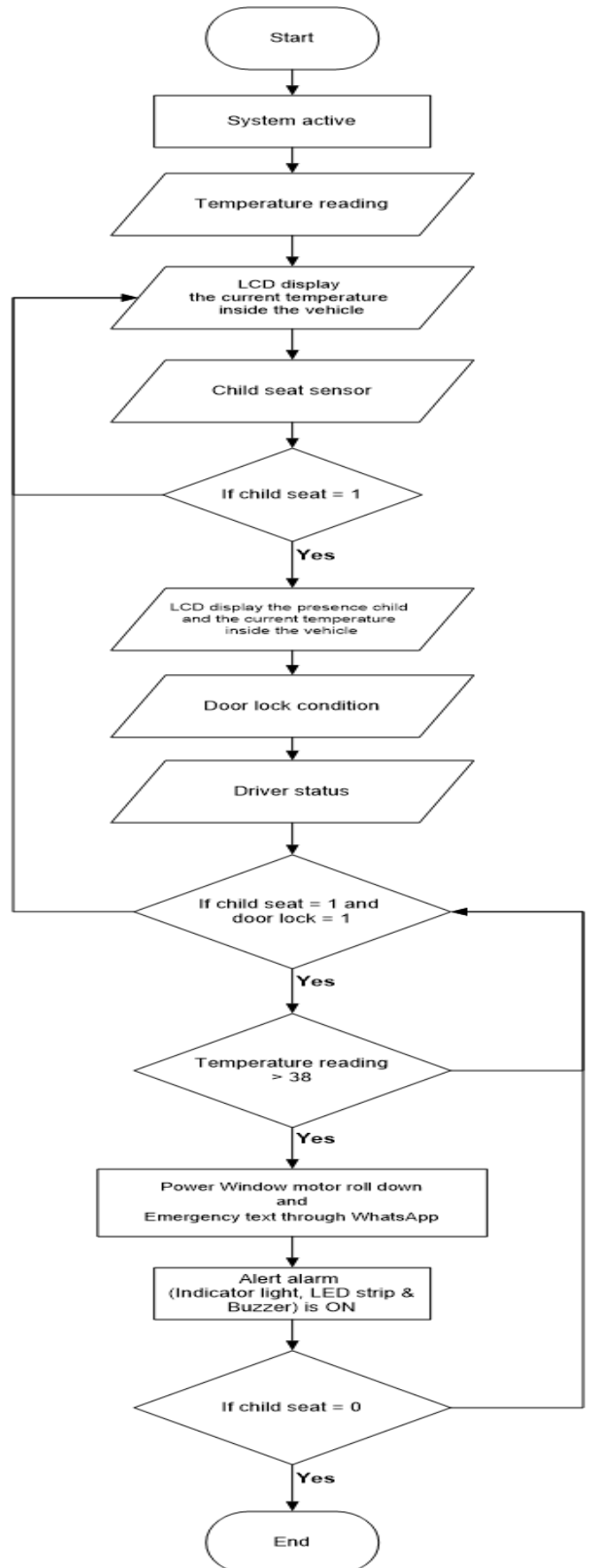


Figure-2. A Flowchart of the project.



### Algorithm

The development of car seat alert system by using IoT is entirely controlled by a programmed called NodeMCU ESP8266, which has been installed in the projects brain. The microcontroller will accept data from input devices such as force sensor, magnetic switch and DHT 11 temperature sensors, and will interpret and display the data on a display such as an LCD display.

Apart from that, the microcontroller will simply 44 output operations, including indicator light, LED strip, buzzer, GPS module and power window motor. The operation will begin when a child is present in the seat, triggering the seat safety features. The temperature inside the vehicle will be measured by the DHT 11 temperature sensor. The temperature and existence of the infant will be displayed on an LCD monitor. If the door lock or closed is activated and there is no input from the driver status, and the temperature inside this prototype exceeds 38.0 °C, which is considered dangerous, the output of the alert system (indicator light, buzzer, and LED strip) will inform the caregivers that the infant is in the closed car.

In addition, the power window motor is activated and will roll down the window to lower the temperature inside the vehicle. On the other hand, through the WhatsApp application, alerts such as warning messages and location will be transmitted to the user or caregiver using the devices.

### Design of Car Seat Alert System Using IoT

Figure-3 shows the connection simulation circuit design with fritzing for the project. The box has NodeMCU ESP8266, GPS module, relay module, power window motor, and force sensor, magnetic switch as sensors, buzzer, temperature sensor, indicator light, LED strip and liquid crystal display (LCD).

Figure-4 shows the hardware development of Car Seat Alert System by Using IoT. When the force sensor detects the presence of a child in the car seat, the device will start working and transmit a signal to the microcontroller, which will instruct the GPS module. As a result, the user mobile phone receives the alert messages and monitoring through the WhatsApp application.

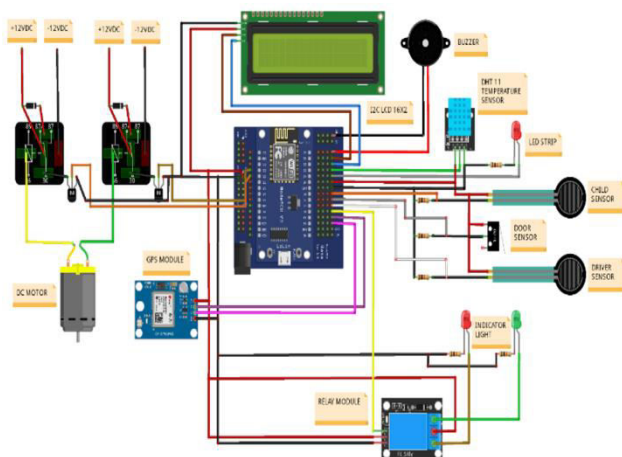


Figure-3. Circuit design.



Figure-4. Interior of the project prototype.

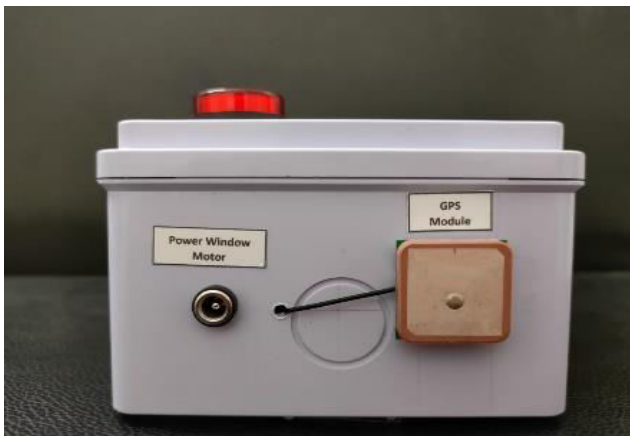
Figure-5 shows the top view of the project. The 16x2 LCD display that shows the baby present and the temperature inside the car. This project uses a power window motor that works when the temperature is above 38 degrees Celsius. The indicator light, buzzer and LED strip is coded to show whether the child is safe.



Figure-5. Top View of the project prototype.



(a)



(b)

Figure-6 (a) and (b). Side view of the project prototype.



Figure-7. Front view of the project prototype.

Figure-6 (a) and (b) shows the side view of the project and Figure-7 front view of the project. The force sensor used to detect the presence of the child in the car seat and to detect the presence of the driver. Then, the magnetic switch to detect the door is locked or unlocked.

**RESULTS AND DISCUSSIONS**

The full prototype design is shown in Figure-8 (a) and (b). The box is 155 mm x 115 mm x 110 mm in length, width, and height. The box was used to control the system input and output such as the force sensor, indicator

light, magnetic switch, LED strip, buzzer, liquid crystal display, power window motor, Node MCU, temperature sensor, relay module and GPS module.

Figure-9 (a) and (b) show when the user type “Start” in WhatsApp application. Then, WhatsApp application will show some function to monitor the system and the NodeMCU ESP8266 will send the alert message through WhatsApp application to notify the user of dangerous level temperature in vehicle, current location of the vehicle and at the same time help baby in car.

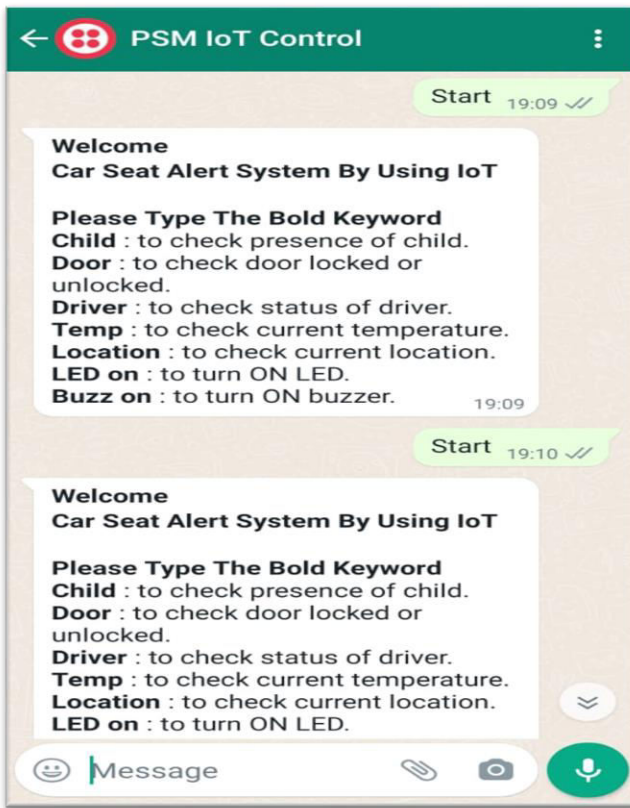


(a)

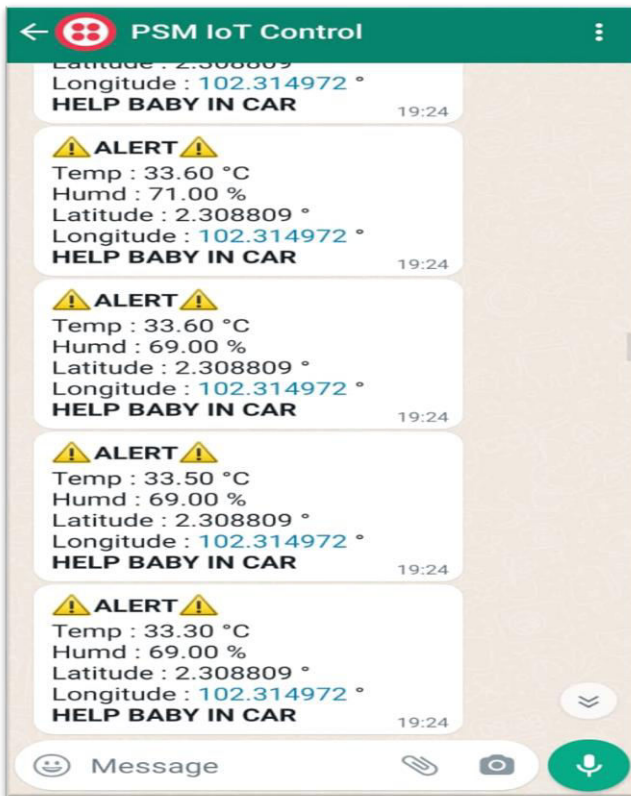


(b)

Figure-8 (a) and (b). Full view of the project prototype.



(a)



(b)

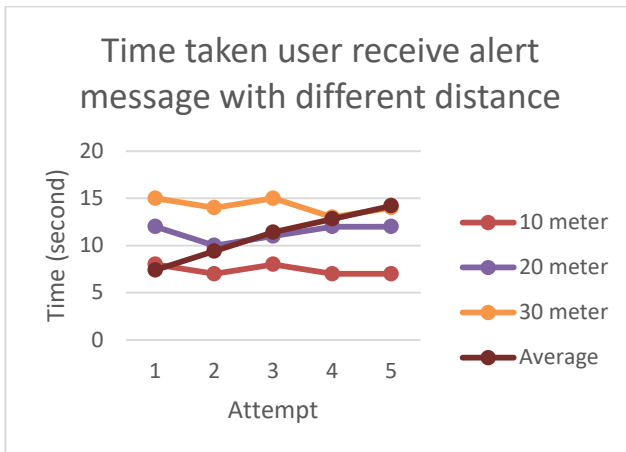
Figure-9 (a) and (b). Message received through WhatsApp application.

The Table-1 below show the time recorded for NodeMCU ESP8266 to deliver alert messages to the WhatsApp application in five times attempt with a different distance range. Figure-10 it shows the time taken for the user to receive the alert messages. This graph shows the time taken that user receive the alert messages with different range. The range will start 10 meters away from the system project, after that 20 meter then from 30 meter. According to graph, the time recorded for NodeMCU ESP8266 to deliver alert messages to the WhatsApp application is five times with a different range. The average time to receive the alert message less than 15 second, this is also according to the current state of the internet used.

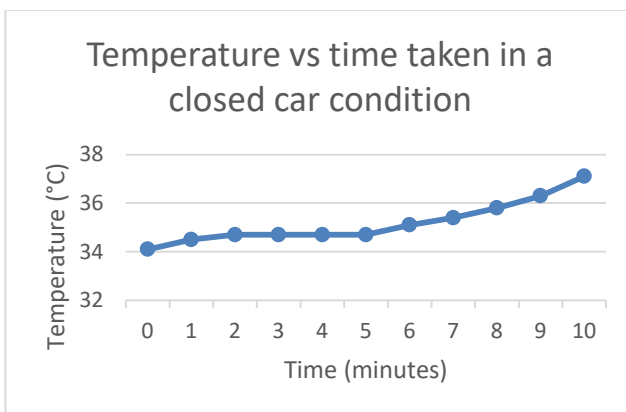
Figure-11 the graph shows the temperature versus time taken in a closed condition. This graph will be analyzed on the temperature change in a closed car condition. The time will be taken 10 minutes to identify the changes of the temperature. From the graph, it shows that the temperature increase in 10 minutes from 34.30 °C to 37.10 °C. Analysis was taken at the current temperature at 34.30 and showed the temperature increased if the car was in a closed condition and not running.

Table-1. Analysis of time taken that user receive the alert messages.

Range	Attempt	Time (second)
10 meters	1	8
	2	7
	3	8
	4	7
	5	7
	Average	7.4
20 meters	1	12
	2	10
	3	11
	4	12
	5	12
	Average	11.4
30 meters	1	15
	2	14
	3	15
	4	13
	5	14
	Average	14.2

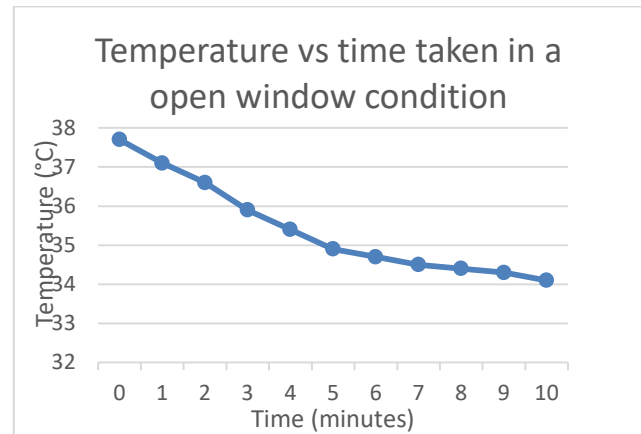


**Figure-10.** Graph of time taken user receive alert message in different distance.



**Figure-11.** Graph of temperature versus time taken in a closed car condition.

Figure-12 graph shows the temperature versus time taken in an open window condition. This graph will be analyzed on the temperature change in an open window condition. The time will be taken 10 minutes to identify the changes of the temperature. From the graph, it shows that the temperature decreases in 10 minutes from 37.10 °C to 34.10 °C. This suggests that if the car window is opened, the temperature in the vehicle can be reduced and can save lives.



**Figure-12.** Graph of temperature versus time taken in a open window condition.

## CONCLUSIONS

In the conclusion, temperature detection system is very important as an alert system to detect temperature in a car and notify the user through WhatsApp application. Auto windows roll down is very useful to minimize the temperature inside the car and prevent the heat stroke for the children and death. The system suggested objective were realized of the detection system is to notify the user about their child to prevent the children from dying from heat stroke by sending an alert message via the WhatsApp application. This technology enhances safety and security more than ever before. The detection method model was quickly preserved at a reasonable price using the WhatsApp application and Wi-Fi coverage. The implementation of "The Development of Car Seat Alert System by Using IoT" projects has satisfied the design problems objectives, according to the results and data analysis.

## ACKNOWLEDGEMENT

The authors would like to thank the Centre for Research and Innovation Management of Universiti Teknikal Malaysia Melaka (UTeM) for sponsoring this work under the Grant PJP/2020/FTKKEE/PP/S01751.

## REFERENCES

- [1] Nemoto, Ryosuke, Katsunori Uchida, Kazunori Hattori, Toru Shimazui, Yukiko Nishijima, Shinsuke Saito, Kenkichi Koiso and Masaoki Harada. 1988. S phase fraction of human bladder tumor measured in situ with bromodeoxyuridine labelling. *The Journal of urology*. 139(2): 286-289.
- [2] C. E. Spilotro., 2016. Connecting the dots: How IoT is going to revolutionize the digital marketing landscape for millennials. 139(2): 286-289.
- [3] C. E. Spilotro. 2016. Connecting the dots: How IoT is going to revolutionize the digital marketing landscape for millennials.



- [4] K. N. Khamil, S. I. A. Rahman, and M. Gambilok. 2015. Babycare alert system for prevention of child left in a parked vehicle. *ARPJ Journal of Engineering and Applied Sciences*. 10(22): 17313-17319.
- [5] A. D. LaMott. 2016. Design of SmartSeat Car Seat Safety System to Prevent Child Vehicular Heat Stroke.
- [6] Mahdin Hairulnizam, Abdul Halim Omar, SitiSalwani Yaacob Shahreen Kasim and Mohd Farhan MdFudzee. 2016. Minimizing heatstroke incidents for young children left inside vehicle. In *IOP Conference Series: Materials Science and Engineering*, IOP Publishing. 160(1).
- [7] Sulaiman, Norizam, Kamarul Hawari Ghazali, Mohd Shawa IJadin, Amran Abdul Hadi, Muhammad Sharfi Najib, MohdSalmizanMohd Zain, Fatimah Abdul Halim, Suhaimi Mohd Daud, Nurdiyana Zahed and Abdul Adam Abdullah. 2017. Development of comprehensive unattended child warning and feedback system in vehicle. In *MATEC Web of Conferences*, EDP Sciences. 90: 01008.
- [8] Mousel Thierry, Peter Larsen and Holger Lorenz. 2017. Unattended children in cars-radiofrequency-based detection to reduce heat stroke fatalities. In *25th International Technical Conference on the Enhanced Safety of Vehicles (ESV): Innovations in Vehicle Safety: Opportunities and Challenges*.
- [9] Chua, SN David, W. J. Goh, S. F. Lim, A. Joseph, Y. B. Oon, and C. V. Sia. 2018. Development of an automatic vehicular heatstroke detection system. In *IOP Conference Series: Materials Science and Engineering*, IOP Publishing. 429(1): 012056.
- [10] Visconti Paolo, Roberto de Fazio, Paolo Costantini, Simone Miccoli and Donato Cafagna. 2019. Arduino-Based Solution for In-Car Abandoned Infants' Controlling Remotely Managed by Smartphone Application. *Journal of Communications Software and Systems*. 15(2): 89-100.
- [11] A. Hazizan, N. A. M. Lazam and N. I. Hassan. 2020. Development of child safety car alert system using arduino and GSM module. In *IOP Conference Series: Materials Science and Engineering*, IOP Publishing. 834(1): 012071.