Faculty of Electrical and Electronic Engineering Technology

THE DEVELOPMENT OF CAR SEAT ALERT SYSTEM BY USING IoT

SYUKUR BIN SAMSUDIN

Bachelor of Electrical Engineering Technology with Honours

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THE DEVELOPMENT OF CAR SEAT ALERT SYSTEM BY USING IoT

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A project report submitted
in partial fulfillment of the requirements for the degree of
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DECLARATION

I declare that this project report entitled "The Development of Car Seat Alert System By Using IoT" is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : 

Student Name : SYUKUR BIN SAMSUDIN

Date : 06/01/2022

APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electrical Engineering Technology with Honours.

Signature : 

Supervisor Name : EN ADAM BIN SAMSUDIN

Date : 06/02/2022

Signature : 

Co-Supervisor Name (if any) : PN KAMILAH BINTI JAFFAR

Date : 06/02/2022

DEDICATION

To my beloved parents especially my mother, Noriani Binti Shariff, and my father, Samsudin Bin Harun that give their full support during my journey to complete this project in term of moral support and encouragement until I able to finish this project, and also my dearest siblings and my friend that also help moral support in term of giving some ideas and opinions to fulfil the requirement to finish this project. Praise is to Allah S.W.T that I get family and friend that very understand and always give me some idea that might help this project. Thankful for all advices I am very blessed .

ABSTRACT

The overall goal or purpose of this paper was to design and build a car seat alert system for children who have been left in vehicles and have died from heatstroke. This is known as vehicular heatstroke, and it is extremely harmful for a newborn due to the fact that young bodies heat up three to five times faster than adults. 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. Heatstroke mortality among children in automobiles are on the rise these days, with an annual increase in the number of cases. A caring parent mistakenly left their child in most kid vehicle heatstroke deaths. This initiative was created to inform and alert parents who may forget their children in any kind of situations. NodeMCU ESP8266 is utilized as a microcontroller to control all the input and output devices in this system, making it more realistic. 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, an 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 WhatsApp application for monitoring and notifying the alert message. To ensure that the specified aims are archive, extensive research has been conducted that will serve as references throughout these studies for this project.

ABSTRAK

Tujuan keseluruhan laporan ini adalah untuk merancang dan membina satu sistem amaran tempat duduk kereta untuk kanak-kanak yang ditinggalkan di dalam kenderaan yang boleh nengakibatkan meninggal dunia akibat serangan panas. Serangan panas dikenali sebagai serangan panas kenderaan dan sangat berbahaya bagi bayi yang baru lahir kerana badan mereka tiga hingga lima kali lebih cepat panas daripada orang dewasa. Dalam pada itu, bahagian dalam kenderaan juga menjadi panas dengan cepat adalah merupakan salah satu masalah utama bagi ibu bapa yang ingin melakukan perjalanan dengan kereta bersama anak-anak mereka. Kematian strok panas di kalangan kanak-kanak dalam kenderaan semakin meningkat pada hari ini, dengan peningkatan jumlah kes tahunan yang amat tinggi. Seorang ibu bapa yang prihatin secara tidak langsung tidak sedar telah meninggalkan anak mereka dalam kenderaan yang kebanyakannya kematian akibat strok panas dalam kenderaan. Justeru itu, inisiatif ini dibuat untuk memberi tahu dan memberi amaran kepada ibu bapa yang mungkin terlupa anak-anak mereka di dalam kenderaan yang ditinggalkan terlalu lama. Oleh itu, NodeMCU ESP8266 digunakan sebagai pengawal mikro untuk mengendalikan semua peranti input dan output dalam sistem ini untuk menjadikannya lebih realistik. Peranti ini dilengkapi dengan lampu penunjuk, *LED strip* dan bel untuk memberi amaran kepada ibu bapa apabila berlaku kecuaian yang telah ditetapkan. Selain itu, LCD digunakan untuk menunjukkan kehadiran kanak-kanak di tempat duduk serta suhu di dalam kenderaan pada waktu semasa. Selain itu, modul GPS digunakan untuk memberitahu pengguna lokasi anak yang ditinggalkan di dalam kenderaan jika suhu di dalam kenderaan melebihi paras bahaya. Disamping itu, sistem ini juga akan menghantar pesanan amaran kepada pengguna melalui aplikasi WhatsApp untuk memantau dan memberi tahu pengguna pesanan amaran. Untuk memastikan bahawa tujuan yang dinyatakan adalah tercapai, penyelidikan yang luas telah dilakukan untuk dijadikan rujukan sepanjang kajian projek ini.

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My highest appreciation goes to my parents, and family members for their love and prayer during the period of my study. An honourable mention also goes to my supervisor Encik Adam Bin Samsudin and co-supervisor Puan Kamilah Binti Jaffar for all the motivation and understanding. And to all my friends, thanks for involving giving their opinions.

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LIST OF SYMBOLS

$°C$	-	Degree Celcius
μ	-	Micro
k	-	Kilo
m	-	Mili

LIST OF ABBREVIATIONS

V	-	Voltage
LCD	-	Liquid Crystal Display
GPS	-	Global Positioning System
IoT	-	Internet of Things
CRS	-	Child Restraint System
RF	-	Radio Frequency
SMS	-	Short Message Service
GSM	-	Global System for Mobile Communication
FSR	-	Force Sensitive Resistor
PIR	-	Passive Infrared
$GPRS$	-	General Packet Radio Service
$CO2$	-	Carbon Dioxide
SDK	-	Software Development Kit
$Wi-Fi$	-	Wireless Fidelity
$GPIO$	-	General Purpose Input/Output
DCF	-	Distributed Control Function
BSS	-	Basic Service Set
$P2P$	-	Peer to Peer
CPU	-	Central Processing Unit
ROM	-	Read Only Memory
$SRAM$	-	Static Random Access Memory
RTC	-	Real Time Clock
DHT 11	-	Digital Temperature and Humidity Sensor
DC	-	Direct Current
IDE	-	Integrated Development Environment
PCB	-	Printed Circuit Board
V	-	Voltage
Hz	-	Hertz
LED	-	Light Emitting Diode

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Background

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.

Several unfortunate accidents have occurred in which children were left unintentionally in closed parked cars after the drivers had arrived at their destination. Due to the greenhouse effect, when a car is parked with all windows closed in direct sunlight, the interior temperature will easily rise to dangerous levels. In addition to the greenhouse effect, children with a less functional thermoregulatory system are more likely to develop hyperthermia, a disorder in which the body absorbs more heat than it can release. Children are more likely than adults to develop hyperthermia because of their inability to efficiently lower their body temperature, owing to their greater surface to body ratio, increased metabolic heat production, and decreased sweating power.

Since 1998, there have been a total of 882 heat stroke related deaths among children left in vehicles. There were 24 cases registered in 2020. Then, a total of 467 cases related to the forgotten child in parked vehicles had been reported until February 2021,

where more than half of these cases involved children of 2 years old and below. The most common scenario involved a caregiver especially a parent forgetting about the infant.

The project goal is to create a dependable system for alerting parents or caregiver when leave their children in a car seat inside a vehicle using the WhatsApp Messenger app.

1.2 Problem Statement

Today, the IoT is defined as “the ability of everyday objects to connect to the Internet and send and receive data” on their own. Every enabled device that can be integrated, such as the smartphones will be connected to the car and so on as part of the Internet of Things.

Heat stroke occurs as the body is unable to dissipate the heat it generates and absorbs because of being stuck in an enclosed car parked outside after being left unattended. 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 demands attention.

Two reasons children are more susceptible to vehicle related heat stroke than adults. Firstly, children are most likely to be left alone in a parked vehicle compared to adults and unable to exit by themselves. Second, children's bodies are less equipped to deal with the extreme heat that can quickly build in a parked vehicle.

A project titled "The Development of Car Seat Alert System by Using IoT" has been proposed to avoid this type of accident by sending out a safety alert signal to parents or caregivers.

1.3 Project Objective

The main aim of this project is to propose a systematic and effective system to develop of car seat alert system by using IoT. Specifically, the objectives are as follows:

a) To study the existing infant car alert detection system.

b) To design a temperature level detection system with automatic roll down window and safety alert system in vehicle.

c) To develop an infant car seat alert system through WhatsApp Application.

1.4 Scope of Project

The scope of this project are as follows:

a) The project Car Seat Alert System by Using IoT is a system for children in cars to user monitor and alert system.

b) NodeMCU, a small microcontroller that also serves as a control unit, oversees this system. The two basic components of this suggested system are the detection mechanism and the preventive mechanism, both of which are coupled to the control unit.

c) The detection system is utilised to detect the presence of a children within the car as well as the temperature.

d) The preventive mechanism is used monitoring and alert the parent or caregiver the presence of a baby in the seat. GPS technologies are used to send an alert message with a real-time tracking system, in which the approved user will be informed of the location in terms of longitude and latitude via the WhatsApp application.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The search databases used for the literature review were ScienceDirect, Google Scholar and Web searches. “Safety Alert System in Vehicle”, “Car Seat Alert System”, “Baby Car Seat Safety”, “IoT Technologies”, “Vehicle Detection System”, “Heatstroke”, “Arduino”, “Forgotten Child” and “Sensors” are some of the search phrases. In addition, the search was limited to the between 2015 and 2020 (5 years). The quest was limited to English-language papers. The things were chosen based on the title, abstract, and full text.

2.1.1 Unattended Child in Car

Heatstroke deaths of 1-3 year old children occurred in 6 out of 9 cases across Malaysia between 2011 and 2018. Those who made it through the ordeal of being trapped in a passenger car were left alone for 30 to 40 minutes. The victims in the six fatal cases were trapped inside the car for four to nine hours in the sweltering sun [3].

The primary cause of such tragedies was carelessness on the part of either the parents or the caregivers. Although uncommon, these so-called "hot car accidents" show that the problem of a child left alone in a vehicle must be solved, perhaps by the use of technology that can warn the driver to take appropriate precautions.

2.1.2 Heat stroke

Malaysia tropical climate features dry, humid weather with occasional downpours during the year. Regardless, the heatwave that hit Malaysia a few years ago (owing to the El Nino phenomenon) was said to have had some health consequences for Malaysians, mostly due to the dramatic rise in ambient temperature. The worst-affected places included Chuping in Perlis, Alor Setar in Kedah, Ipoh and Lubuk Merbau in Perak, and Batu Embun and Temerloh in Pahang [3].

As a result, one of the factors that could have an effect on human health is extreme weather or a heatwave, as many places in the northern states of Penang, Kedah, and Perlis witnessed temperature rises of more than 38 degrees Celsius in 2016. It's also important to remember that both vehicle heating and physical activity can cause heat-related illnesses.

2.1.3 Effect of Heat stroke

The human body needs a temperature of 37 degrees Celsius to function properly. Furthermore, our body temperature rises in tandem with our physical activity. Its important to keep in mind that infants and young children are not miniature adults. Both physiologically and behaviorally, they are distinct [3].

As a result, infants and children absorb heat from the atmosphere faster, are unable to increase their cardiac performance, and experience decreased sweating as well as increased body heat production from a physiological standpoint. In terms of behaviour, children are known to be unaware of danger and rely on their caregiver to understand the effects of heat and take appropriate action.

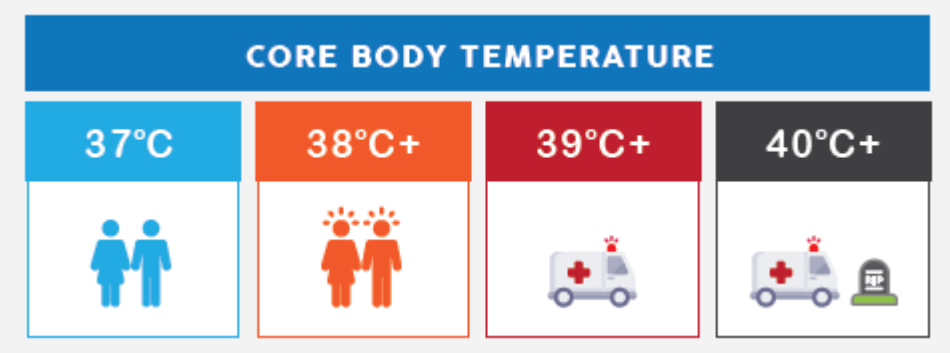

Figure 2.1 The human body needs a normal core temperature of 37 degrees Celsius to function properly (99 degrees Fahrenheit).

2.2 Overview of Existing Project System

At similar or lower ambient temperatures ranging from 22°C to 35°C, a 4°C rise in internal temperature is forecast, placing children at risk [4]. Several surveys, research and inventions have been undertaken in recent years to resolve the issue of unintended children left in cars. As shown in figure 2.2, proposed a device consisting of the Sensor Unit, Processor Unit, and Response Unit. Its aim was to detect any movement in the vehicle as a sign of human activity and decide if the environment was unsafe. Via the response unit, the device will then alert relevant authorities or conduct interventions such as lowering the vehicle window [5].

Figure 2.2 The child heat injury prevention scheme is represented in a block diagram.

2.2.1 Baby Care Alert System for Prevention of Child Left in a Parked Vehicle

The consists of a drivers 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 three main components in the safety pad. 1Sheeld receives the transformed and amplified load sensor signal from Arduino UNO and sends a notification to the drivers smartphone. The keychain warning system, on the other hand, determines the range between the keychain and the child car seat using a radio frequency signal. An alert will be sent to the driver via the smartphone if the weight of a child is detected in the CRS when the keychain warning system is within a certain range. As the keychain warning devices distance from the set range increases, a message is sent to the driver, informing him or her that they have left the vehicle without the infant [6].

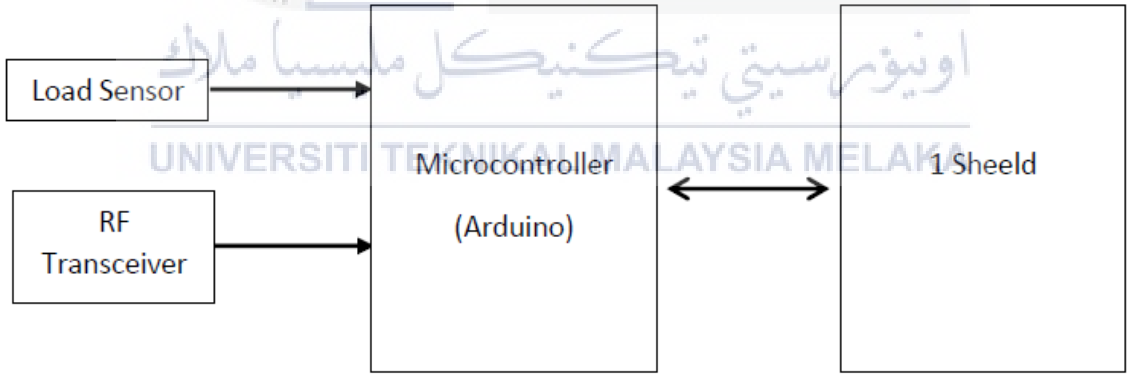

Figure 2.3 The block diagram of safety pad is made up of a load sensor, an Arduino UNO, and 1 Sheeld.

2.2.2 Design of SmartSeat Car Seat System to Prevent Child Vehicular Heat Stroke

The system using Bluetooth pairing, the car seat a protection mechanism analyses the ambient temperature and weight to alert parents that a children is at risk of vehicular

heatstroke. Other than that, the system is made up of three separate boards which is a control board, power transfer board, and monitoring board, each of which perform a different role. The system protection framework is completed through thecollaboration of the three committees [7].

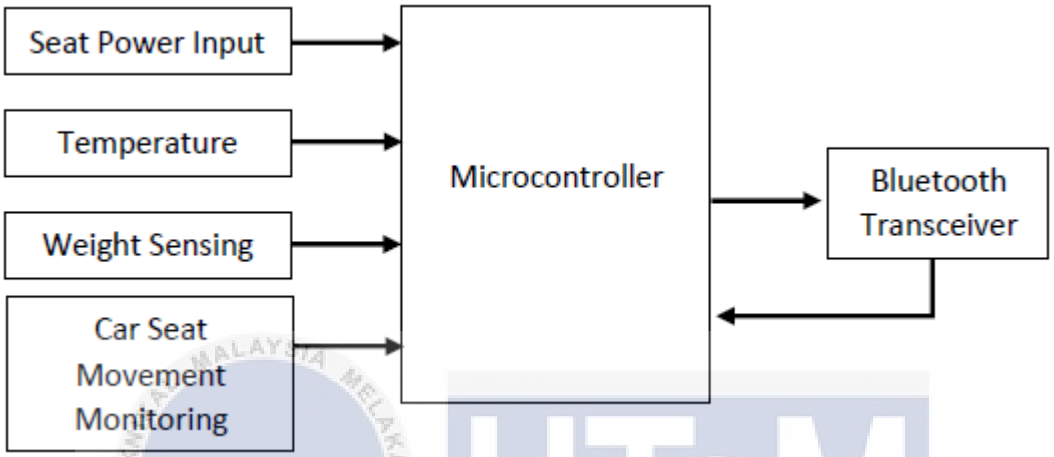

Figure 2.4 The block diagram of SmartSeat.

2.2.3 Minimizing Heatstroke Incidents for Young Children Left inside Vehicle

Two versions of apps were proposed. The accelerometer sensor is used in the first app, and then the Bluetooth detector is used in the second app. An accelerometer sensor can be found in any smartphone. The users movement can be detected using this sensor. The pedometer app is one of the applications that makes use of this sensor. It allows users to track how many steps they have taken. To keep an eye on the kids, the apps concept is simple, when the user starts walking, an alarm will sound. The most crucial moment is when the parent gets out of their car and goes to work. It is important if they have forgotten that their children are still in the car. The accelerometer sensor can sense the users movement and will sound a warning to alert them. The disadvantage of this approach is that the alarm will continue to ring while the consumer is driving. To address this, the alarm can

be programmed to sound only at certain times, such as from 7:00 a.m. to 8:00 a.m., when the parent is expected to arrive at work. The first apps drawback is that they can only be used for a certain period. In fact, we travel not only to and from the workplace, but also to other locations such as the supermarket at random times. To get around this, they suggested using a Bluetooth interface that could attach to a smartphone. If the device is more than a certain distance away from handset, an alarm will be triggered [8].

Figure 2.5 Overview of the system connections.

2.2.4 Development of Comprehensive Unattended Child Warning and Feedback System in Vehicle

A system for detecting the presence of minors, including children in an autonomous vehicle was proposed by a researcher. Figure 2.6 show the detection and feedback systems, which are two major components of the system. Inside the car, the detection device detects speech, odor, motion, and temperature. This knowledge would cause the feedback system to execute feedback functions in stages. First, if a child presence is identified, the system sends a warning to the drivers cell phone via a quick messaging system. Second, if no action is

taken by the driver, the system activates the vehicles alarm system. Then, the system lowers the window to reduce the temperature inside the vehicle [9].

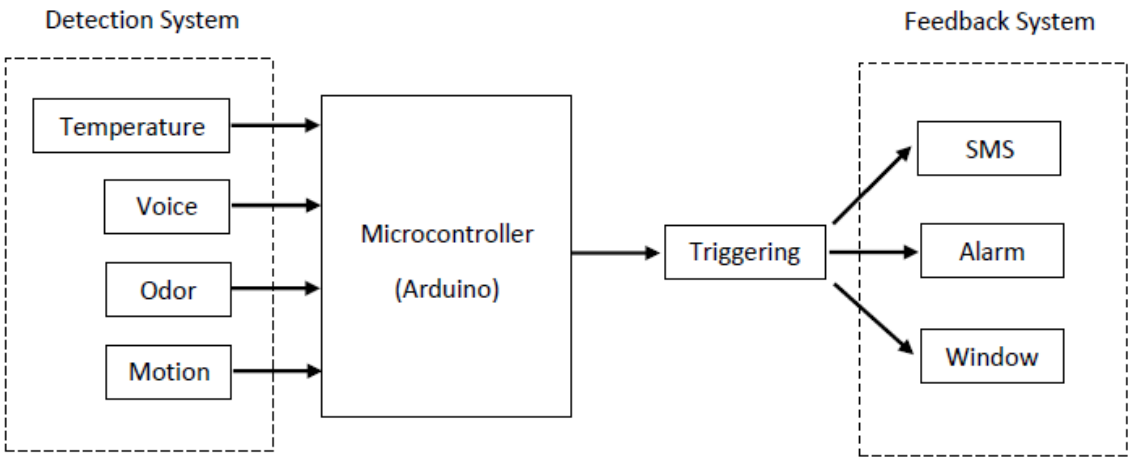

Figure 2.6 The detection and feedback mechanism block diagram.

2.2.5 Unattended Children in Cars – Radio Frequency Based Detection to Reduce Heat Stroke Fatalities

A new way to reduce the risk of children dying from heatstroke. The radio frequency-based device can detect breathing as well as heartbeats in sleeping babies and infants. 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 CRS [10].

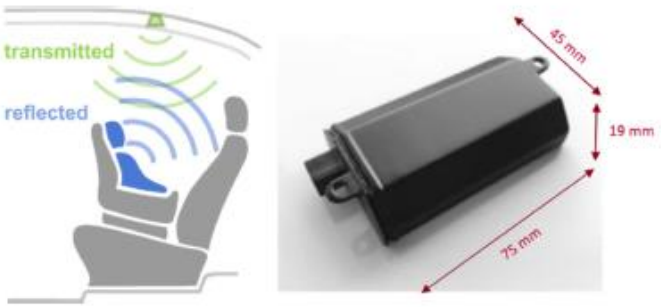

Figure 2.7 The sensor position in a radio frequency-based device.

2.2.6 Development of an Automatic Vehicular Heat Stroke Detection System

The study offered caretakers answers by combining many sensors in a child monitoring system and selecting the ideal sensor location for a more efficient system. A human test subject and an experimental setup are used in the selection process. The results of a detection system prototype reveal that utilising a mix of ultrasonic and motion sensors produces the greatest results. The motion and ultrasonic sensors should be installed above the kid seat and in the vehicle's centre, respectively. A variety of tests are performed on the detection and warning device prototype to determine its accuracy, adaptability, and reliability [11].

2.2.7 Arduino Based Solution for In Car Abandoned Infants Controlling Remotely Managed by Smartphone Application

The research proposed the system includes a smartphone app that allows users to receive warning or status alerts as well as photographs taken directly from the vehicles cockpit. Furthermore, the software also enables for remote control of a variety of car functions, including as horn activation, window lowering, and door locking and unlocking. The huge number of sensors utilised enables for the resolution of certain detectability concerns that similar detection systems have. This is due to effective cross-checking of the gathered knowledge [12].

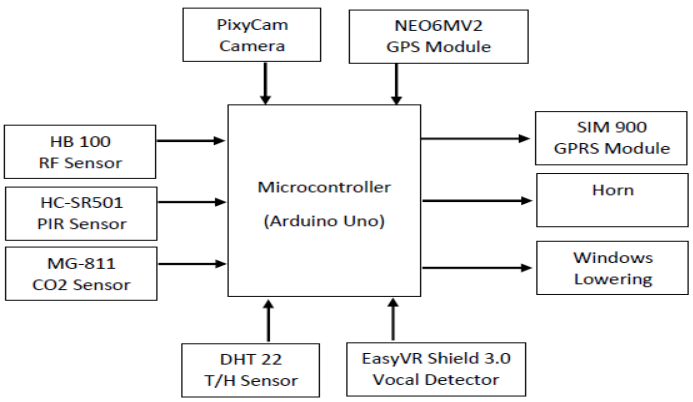

Figure 2.8 The block diagram for the purposed system.

2.2.8 Development of Child Safety Car Alert System Using Arduino and GSM Module

The Arduino Child Safety Car Alert System is a built-in device that alerts the driver if a child is mistakenly left in the vehicle. The device is based on an Arduino board with sensors and a GSM module included. Using pressure and motion sensors, this device identifies the presence of a youngster in the vehicle's rear seat. Meanwhile, the GSM (Global System for Mobile Communication) enables the system to quickly warn the driver. GSM was chosen because of its ability to provide higher data rates while using less energy per bit. The sensors utilised are the Force Sensitive Resistor (FSR) and the Pressure Infrared (PIR). The warning system is activated when both sensors detect the presence of a children in the back seat, and the parents or driver are automatically notified by text message [13].

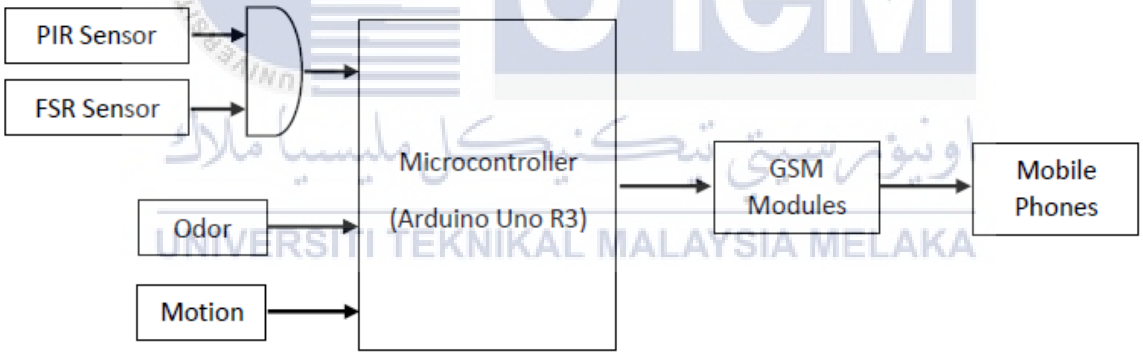

Figure 2.9 The block diagram of Child Safety Car Alert System.

2.3 Comparison with Existing Project

Table 2.1 The Comparison of Existing Project.

Title	Scope	Method	Advantage	Disadvantage	Devices	Input	Output
Development of Comprehensive Unattended Child Warning and Feedback System in Vehicle (2016)	To detect the presence of minors, including infants, in an unattended car using a combination of human physiological indicators.	The proposed system detects any signals generated by speech, odor, motion, or temperature sensors in the vehicle's interior and delivers a brief message to the parents.	E-nose technology is used to create an odor recognizer.	The sensitivity of the motion sensor.	Arduino	Temperature sensor, PIR sensor, Voice recognizer, and odor sensor.	SMS and alarm.

Title	Scope	Method	Advantage	Disadvantage	Devices	Input	Output
Unattended Children in Cars – Radio Frequency Based Detection to Reduce Heat Stroke Fatalities (2017)	To detect a sleeping baby's little breathing movements and, in some cases, to detect the child in difficult situation, such as via the sunshade of a rearward-facing child seat.	To detects a child's vital signs using radiofrequency (RF) signals.	All the vehicle's capabilities may be use.	Warning alarm not most effective. .	Radiofrequency	Frequency Signal	Alarm
Development of an Automatic Vehicular Heat Stroke Detection System (2018)	To determine the suitable sensor and the placement of the sensor.	Experiment with the sensors range, average reaction time, false alert rate, and cost.	Accuracy and reliability.	Only have an alarm as an output.	Arduino Uno	PIR sensor, Ultrasonic sensor, CO2 sensor and Melexis sensor.	False alarm

Title	Scope	Method	Advantage	Disadvantage	Devices	Input	Output
Arduino Based Solution for In Car Abandoned Infants Controlling Remotely Managed by Smartphone Application (2019)	To develop innovative services and solutions to make driving safer and to improve people's lives.	The suggested solution includes a mobile app that allows users to get alarm or status messages as well as photographs directly from the car.	More easily accessible	GPRS only give the location not the exact location and less accurate.	Arduino Uno	RF sensor, PIR sensor, CO2 sensor, T/H sensor, Vocal detector, Camera, GPS module	GPRS module, Horn, Window
Development of Child Safety Car Alert System Using Arduino and GSM Module (2020)	To create a device or system that can send a message to the driver.	The Arduino board was used to create the system, which includes sensor and GSM module integration.	Low cost	GSM only use base station to find the location.	Arduino Uno	PIR sensor, FSR sensor, and switch.	GSM module and mobile phones.

2.4 Product available in the market

Table 2.2 The product available in the market.

No	Title	Company	Features	Price (RM)
1	iRemind Child Car Seat Alarm System	Sunshine Baby	➢ Add-on for wireless car seats ➢ The device will send a warning to your smartphone or key fob. ➢ Installation is quick and easy. ➢ When a certain distance between the key fob and the car seat is reached, the alarm will sound.	420.55
2	Ride N Remind		➢ Ideal for busy parents and private automobiles. ➢ Any number of passengers can be accommodated by a single system. ➢ Complimentary child day care. ➢ It's simple to use, and it brings safety and peace of mind throughout the day. ➢ Voice instructions are heard if there is a delay in responding to the reminder. ➢ Any Car Audio Professional may easily instal it.	535.50
3	Evenflo Advanced Embrace DLX Infant car Seat	Evenflo	➢ Parents are alerted to the existence of a child in the car by the SensorSafe receiver and smart chest clip technology. ➢ SureSafe premium lower anchor connectors are simple to use and push on. ➢ In a car, the handle provides anti-rebound protection. ➢ The whole car seat is available as a product.	614.55

No	Title	Company	Features	Price (RM)
4	ChildMinder Softclip	Baby Alert International	➢ Wireless digital technologies. ➢ For battery conservation, it offers an automatic self-off feature. ➢ Dual low-battery warning system. ➢ It's simple to put together and water-resistant.	631.10

2.5 Microcontroller

The microcontroller is a single-chip computer. The controller denotes a little device, while the micro suggests that it can be used for control. In many ways, the microcontroller differs from the microprocessor since the microprocessor requires a number of other components to function, such as programme and data memory, I/O devices, and an external clock circuit.

2.5.1 NodeMCU ESP-8266

The NodeMCU firmware for the ESP-8266 wifi chip is open source and written in the LUA programming language. A few development platforms that can programme the ESP-8266 include Espruino, Mongoose OS, Espressif's software development kit (SDK), and the ESP-8266 add-on for Arduino.

The ESP-8266 may either host the application or offload all Wi-Fi networking tasks from another application processor thanks to its self-contained Wi-Fi networking solution. The ESP-8266 features significant on-board computing capabilities and adequate storage, GPIO (General Purpose Input/Output) allows it to be integrated with sensors-specific devices with minimal work up-front and minimal loading during runtime [14].

The ESP-8266 has a low cost and a lot of functions, making it an excellent Internet of Things module (IoT). It can be used in any application where a device has to be connected to a local network or the internet.

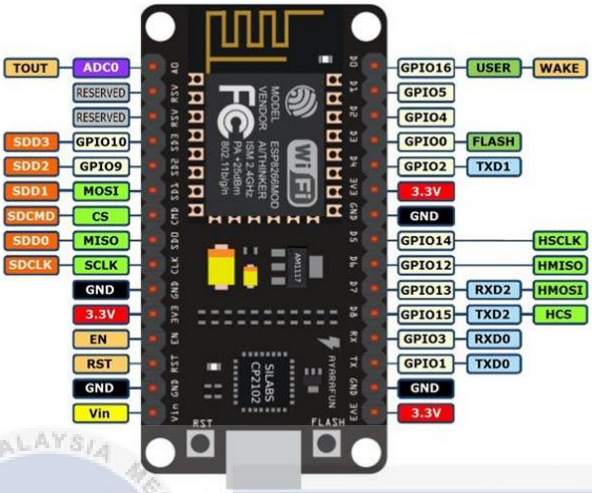

Figure 2.10 The NodeMCU ESP-8266 Pin diagram.

2.5.2 NodeMCU ESP32

The ESP32 microcontroller framework supports the TCP/IP protocol, as well as the entire 802.11 b/g/n/e/i WLAN MAC and Wi-Fi Direct standard. The microcontroller can deliver Basic Service Set (BSS) STA and SoftAP functions using the Distributed Control Function (DCF) protocol. Peer-to-peer (P2P) grouping is also supported, which is in line with the current Wi-Fi P2P protocol. It can thus serve as a station that is connected to the internet, or as a server and access point that provides a user interface to a smartphone that is running a mobile app.

The ESP32 dual-core system is powered by a Harvard Architecture Xtensa LX6 CPU. All embedded memory, external memory, and peripherals are located on the data bus and instruction bus of these CPUs. The microcontroller has two cores, one for protocol and the other for application, although their functions aren't set in stone. The data and instruction

buses each contain 4GB of address space, but the peripheral bus only has 512KB of address space. Additionally, the device includes 448KB of ROM, 520KB of SRAM, and two 8KB RTC memories. Externally, up to four times the 16MB Flash memory can be stored [15].

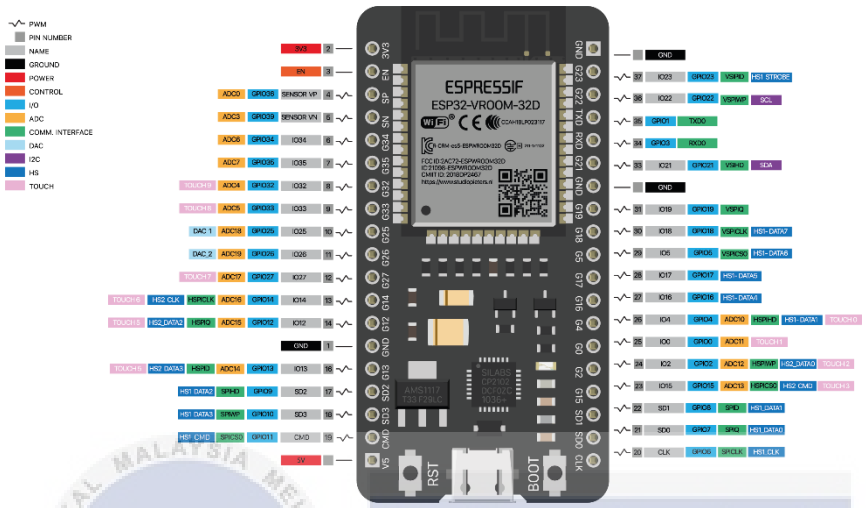

Figure 2.11 The NodeMCU ESP32 Pin diagram.

2.5.3 Comparison of NodeMCU ESP-8266 and ESP32

Table 2.3 The Comparison of NodeMCU ESP-8266 and ESP32.

NodeMCU	ESP-8266	ESP32
MCU	Xtensa Single-core 32-bit L106	Xtensa Dual-Core 32-bit LX6 with 600 DMIPS
802.11 b/g/n Wi-Fi	HT20	HT40
Bluetooth	X	Bluetooth 4.2 and BLE
Typical Frequency	80 MHz	160 MHz
SRAM	X	✓
Flash	X	✓
GPIO	17	36
Hardware /Software PWM	None / 8 channels	None / 16 channels

NodeMCU	ESP-8266	ESP32
SPI/I2C/I2S/UART Serial com	2/1/2/2	4/2/2/2
ADC	10-bit	12-bit
CAN Bus	X	✓
Ethernet MAC Interface	X	✓
Touch Sensor	X	✓
Temperature Sensor	X	✓
Hall effect sensor	X	✓
Working Temperature	-40ºC to 125ºC	-40ºC to 125ºC
Price	RM 12.50 – RM 25.00	RM 25.00 – RM 49.50
Hall effect sensor	X	✓

2.6 Summary

In this chapter, all the theories about this project are discussed, such as the related product and theories, the process of product design and development and the critical part or components used for electrical appliances in wireless Ethernet for Internet of things. The project can then proceed after having been familiar with all of the information and data.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter describes in detail the “Development of Car Seat Alert System by Using IoT” system that will be implemented. There are two phases to this project which is installing hardware and implementing software. The hardware framework for the system is made up of a variety of components. An outline of how the system project approaches this project will be provided throughout this chapter. This projects development is described and can be seen throughout this chapter.

3.2 Project Flowchart

Flowcharts are used in designing and documenting simple processes of the system. By identifying the opportunities that have around, the idea came out to create an application of the system. By using a flowchart, it helps to understand the step in a process and how a process is done. Then, other steps as shown in Figure 3.1 is followed in order to design and fabricate an efficient product.

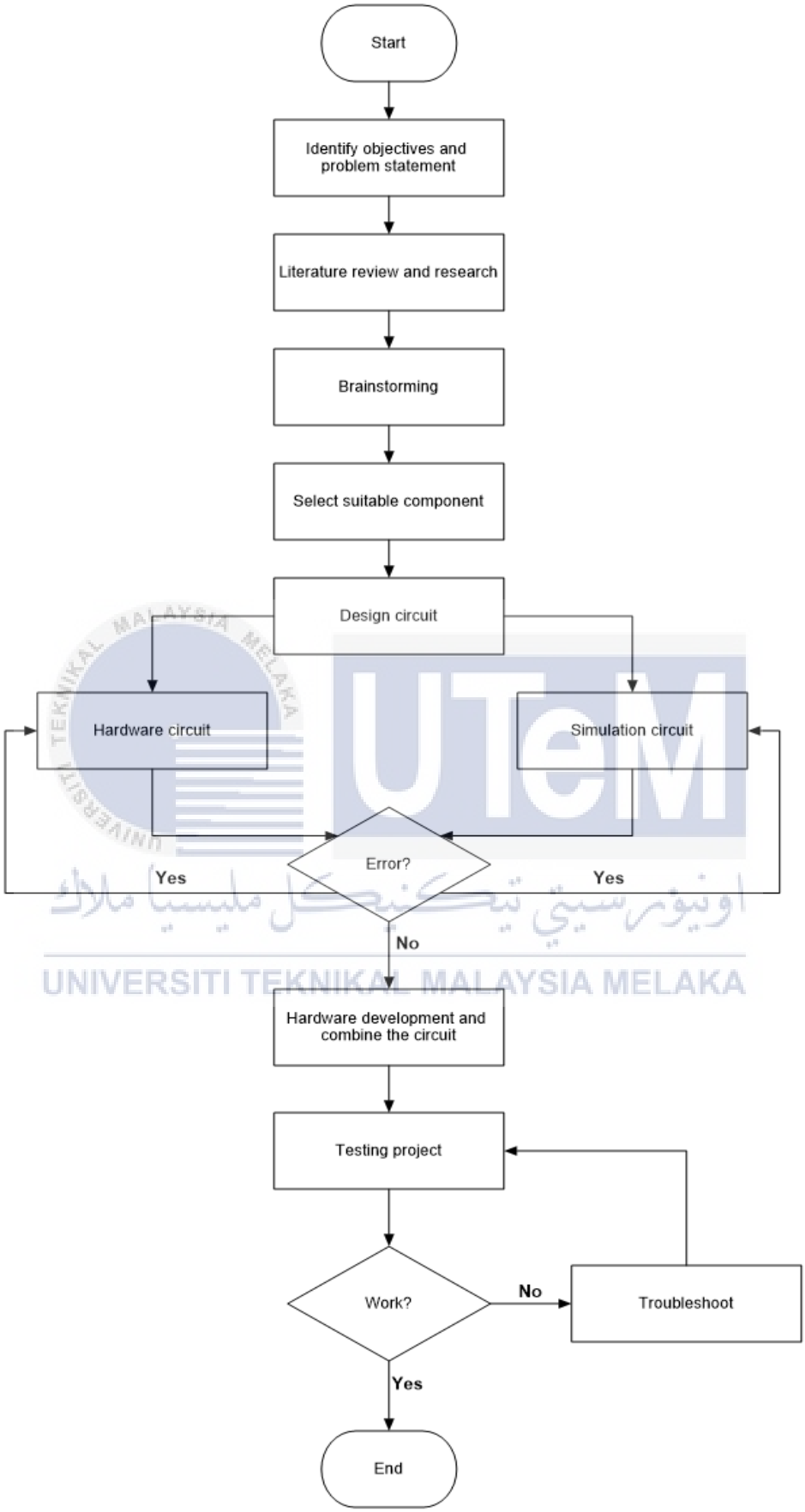

Figure 3.1 The Project Flowchart.

3.3 Project Development Process

The Development of Car Seat Alert System By Using IoT is entirely controlled by a programme called NodeMCU ESP8266, which has been installed in the project's 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 simplify 44 output operations, including indicator light, LED strip, buzzer, GPS module, and power window motor, to protect the infant from heatstroke. The operation will begin when a children 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 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.

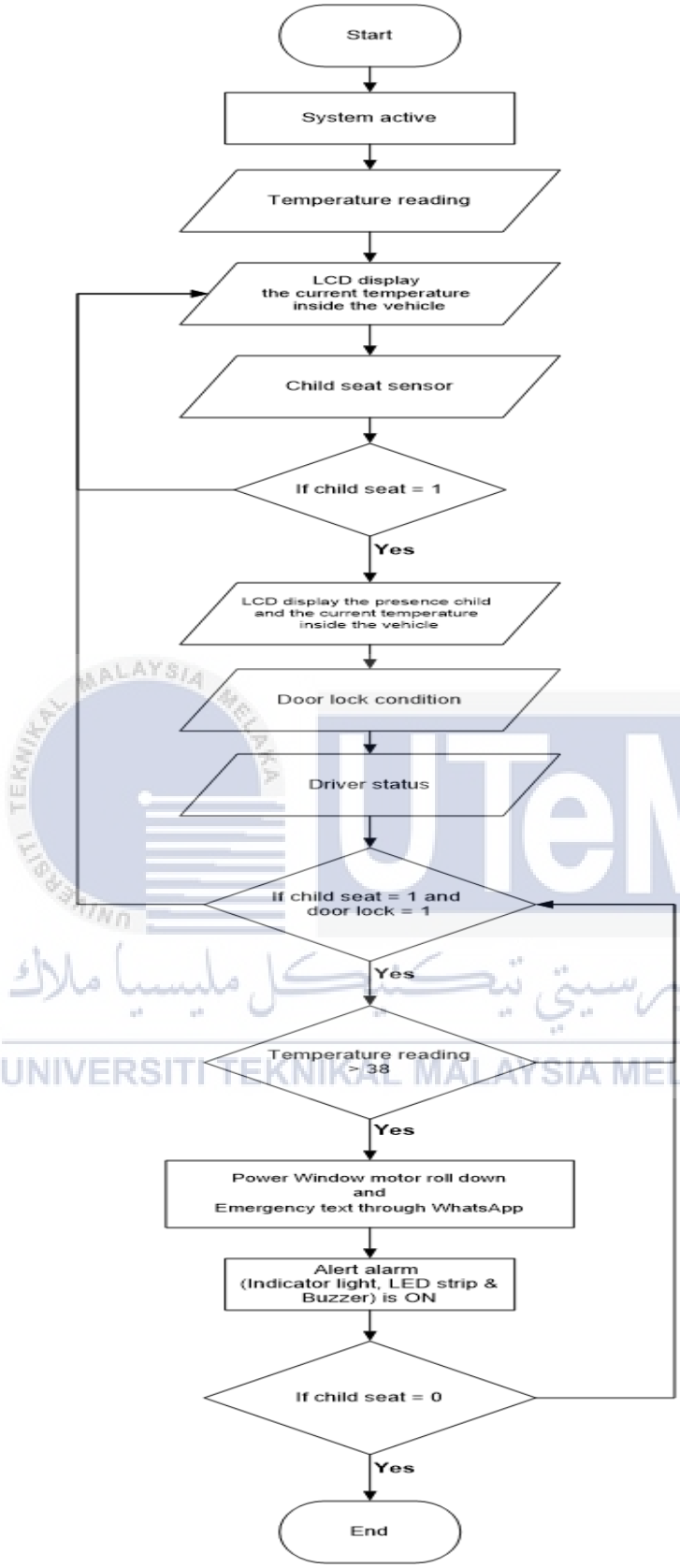

Figure 3.2 The Project Development Process Flowchart.

3.4 Hardware development

This section addresses possible equipment suitable for use in this system project. Basically, a lot of hardware input and output is used in this project, such as NodeMCU ESP-8266, Power Supply, Force Sensor, Magnetic Switch, Temperature Sensor, LCD Display, GPS Module, Power Window Motor, Indicator Light, Buzzer and LED Strip that will be used in this project will be described as below.

3.4.1 Block Diagram

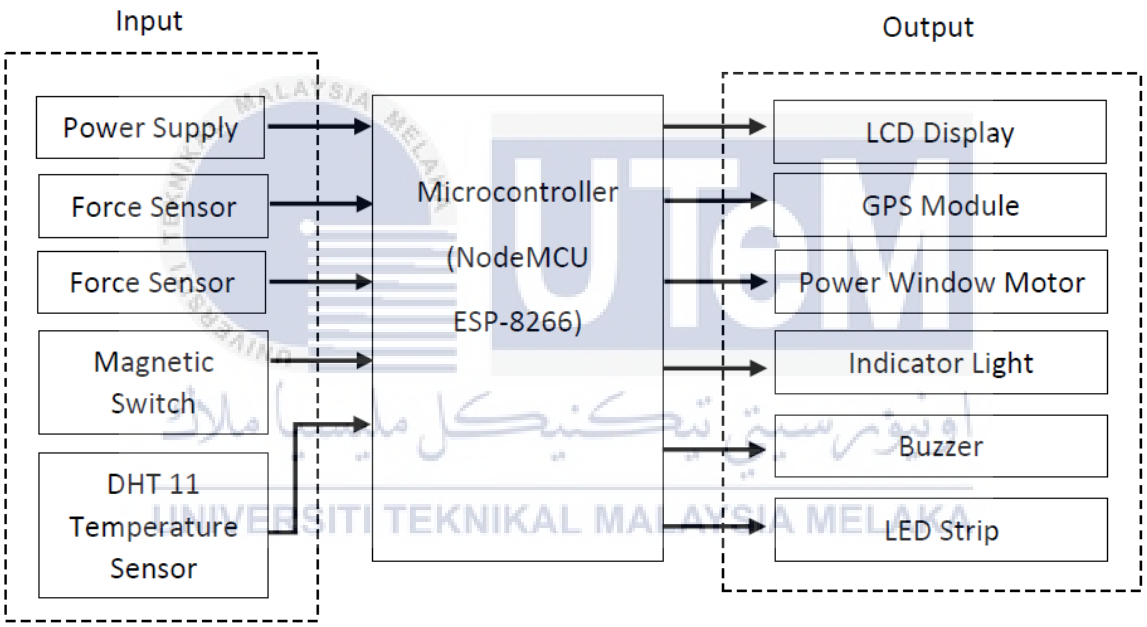

Figure 3.3 The Project block diagram for the system.

3.4.2 NodeMCU ESP-8266

The ESP8266 development board comes with NodeMCU firmware, which can be used to test the chips features. The hardware design can be edited, modified, and built because NodeMCU is an open-source framework. A Wi-Fi enabled ESP8266 chip makes up the NodeMCU Dev Kit/Board. Espressif Systems has developed the ESP8266, a low-cost Wi-Fi chip.

The ESP8266 NodeMCU is used to interface with sensors and upload environmental data to IoT platforms because of its inexpensive cost. By using an API Key, NodeMCU may connect to IoT and cloud services. The NodeMCU ESP8266 is an ideal microcontroller for communicating with the WhatsApp application.

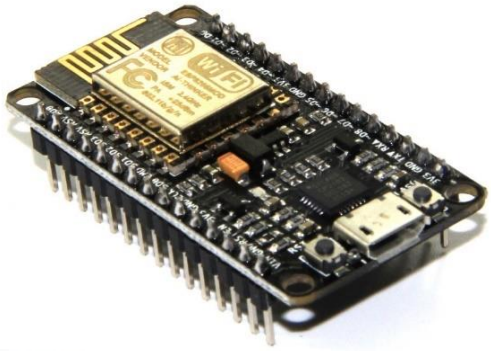

Figure 3.4 NodeMCU ESP8266.

3.4.3 Power Supply

This battery is a 9 VDC power supply that is powered directly by the battery voltage. Each battery has two electrodes, despite the varying voltage. The cathode and anode share it. The negative terminal of the battery is linked to the anode, and the positive terminal to the cathode. All of the Arduino Uno systems components, such as the DHT 11 temperature sensor, force sensor, magnetic switch, LCD display, buzzer, and GPS module, will be powered by the 9 VDC.

Figure 3.5 9 VDC Battery.

3.4.4 Force Sensor

A force sensor is a device that converts a mechanical load, weight, tension, compression, or pressure into an electrical output signal (load cell definition). Force Transducers and Force Sensors are two terms that are often used interchangeably. Load cells come in a variety of shapes, sizes, and capacities. In this project, the force sensor is used to detect the presence of a child and driver in the car seat.

Figure 3.6 Force Sensor.

3.4.5 Magnetic Switch

In the presence of a magnetic field, a magnetic switch makes or breaks contact. Moving elements cannot make direct contact with the switch in situations where it is not desirable or practicable, such as in explosive environments or when submerged in liquids, and when repetitive contact with a mechanical switch would cause unwanted wear. In this project, this magneic switch will use as a door locked or unlocked.

Figure 3.7 Magnetic Switch.

3.4.6 DHT 11 Temperature Sensor

The DHT11 is a simple and inexpensive electronic temperature and humidity sensor. It uses a capacitive humidity sensor and thermistor to measure the ambient air temperature and calibrates a digital signal on the data pin. The device is simple to use and has a high level of reliability. It has strong measurement stability and low inaccuracy. This sensors operational voltage ranges from 3.3 to 5 volts, with an operating current of 0.3 mA and a standby current of 60 uA. The greatest temperature that this device can read is 50 degrees. It has a better temperature reading than DHT22, but DHT22 has a superior humidity reading.

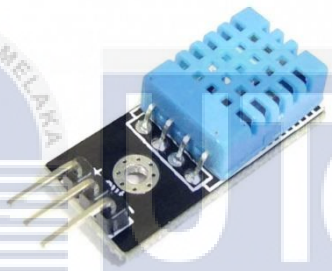

Figure 3.8 DHT 11 Temperature Sensor.

3.4.7 Liquid Crystal Display (LCD)

The 16x2 LCD is an electrical device that uses a liquid crystal to generate a viewable image. The LCD display function in this project is to show the presence of the infant as well as the temperature inside the car. It includes a monitor, which is a common DIY and electronics component. This LCD display is used to indicate the presence of a children as well as the temperature inside the project.

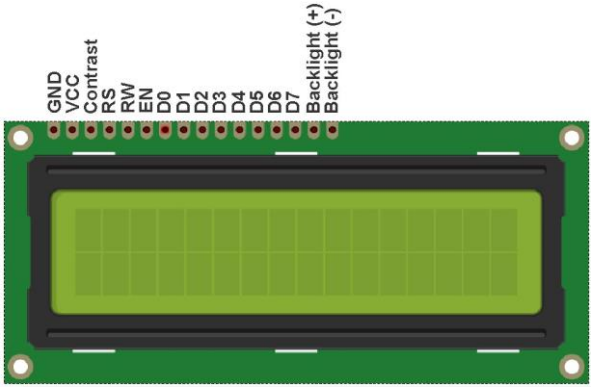

Figure 3.9 Liquid Crystal Display (LCD).

3.4.8 NEO-6M GPS Module

The NEO-6M GPS module is a self-contained GPS receiver with excellent positioning capabilities. This module is designed for devices that use the battery as a limited-cost, limited-capacity resource, with optimised architecture, power, and memory, making it very easy to use. The GPS module is utilised to provide longitude and latitude coordinates for the childs position. It's also very compatible with any type of microcontroller, making connecting a breeze.

Figure 3.10 NEO-6M GPS Module.

3.4.9 Power Window Motor

The Automobile motors and mechanisms mounted inside the car door that regulate the movement of the window glass, allowing windows to roll up and down, are known as power window motors. Power window motor are special types of DC motors. They work in

the same way as any other DC motor. In fact, a DC motor has two electrical wires, known as the positively and negatively terminals, which must be differentiated.

The motor rotates clockwise as the positive cable connects to the positive terminal of the power supply and the negative cable connects to the negative terminal of the power supply. The motor can rotate in the opposite direction if the wire polarity is reversed.

Figure 3.11 Power Window Motor.

3.4.10 Indicator Light

Indicator light a small electric light used to signify something. Then, these lights exist in a variety of colours and voltages and are frequently used to signify an operating condition or whether power is on. The indicator light with call pilot light, panel light or power on or off light. An indicator light is most commonly used on circuit or mechanical equipment to monitor and alarm the equipments working status.

Figure 3.12 Indicator Light.

3.4.11 Buzzer

A buzzer is an electrical device that emits a beeping signal when electricity is supplied to it. The oscillator has a frequency of 2-4 kHz and is made up of a piezo core. When an electrical source is applied to a crystal form, the effect is called "piezoelectricity." The sound is produced by adjusting the frequency of the transmission. A transistor and a cable are included with the buzzer. This device will operate as an alert signal to the user in the project "The Development of Car Seat Alert System By Using IoT."

Figure 3.13 Buzzer.

3.4.12 Relay Module

A relay usually consist of three pins or terminals. It consists of a coil, a normally open pin, a typically closed pin, and a common pin. When the coil power on magnetic field is formed, the contacts connected to each other, this is the basic operation of a relay. The relay also only require 5V of supply to operate it. The 5V power supply can be obtain at NodeMCU ESP8266 output voltage terminal. Therefore, the purpose of choosing this relay module is because it is compatible and programmable by using the NodeMCU ESP8266 microcontroller.

Figure 3.14 Relay Module.

3.4.13 LED Strip

A LED strip light also known as an LED tape or ribbon light is a flexible circuit board with an adhesive backing containing surface mounted light-emitting diodes (SMD LED) and other components.

Figure 3.15 LED Strip Light.

3.4.14 Switch ON/OFF

The ON/OFF Switch, also known as a minuscule snap-action switch, is a small snapping mechanism made up of two split springs that is used to activate an electric switch with very little physical power. ON/OFF switches come in a range of sizes and forms, as well as different terminal configurations.

Figure 3.16 Switch ON/OFF.

3.4.15 Fuse

A fuse is a safety device that protects electrical circuits from the effects of high currents in electrical engineering. A fuse is typically constructed up of a current-conducting strip or wire composed of easily fusible metal that melts and interrupts the circuit of which it is a part anytime the circuit is made to carry a current greater than that for which it was designed.

Figure 3.17 Fuse and Holder.

3.5 Software Development

In software development part, this involved the software used to complete the project. Since NodeMCU ESP8266 is chosen as the brain of the system, the Arduino IDE must be used to run the program and the coding of the system.

3.5.1 Arduino IDE Software

The Arduino Integrated Development Environment, a cross-platform application based in the Java programming language, is provided by the Arduino project. It was created for people with no deep electronic knowledge. It includes a code editor with features like syntax highlighting, suitable braces, cutting or pasting text, scanning or deleting text, and automated indentation, as well as a one-click compilation and uploading mechanism for

Arduino boards. A message area, a text terminal, a toolbar with typical feature buttons, and a series of menus are also included.

The NodeMCU microcontroller has an integrated development environment that allows it to run a variety of applications. It is developed and developed in such a way that anyone, whether a novice or an expert, can programme the controller. Because the NodeMCU programmes are written on paper in the languages C or C++, the Arduino IDE software is used to programme them.

The Arduino website provides free access to this programme. It operates on the Java Platform and is compatible with a range of operating systems, including MAC, Windows, and Linux. It has built-in functions and commands for debugging, creating, and creating code.

Figure 3.18 Arduino Software.

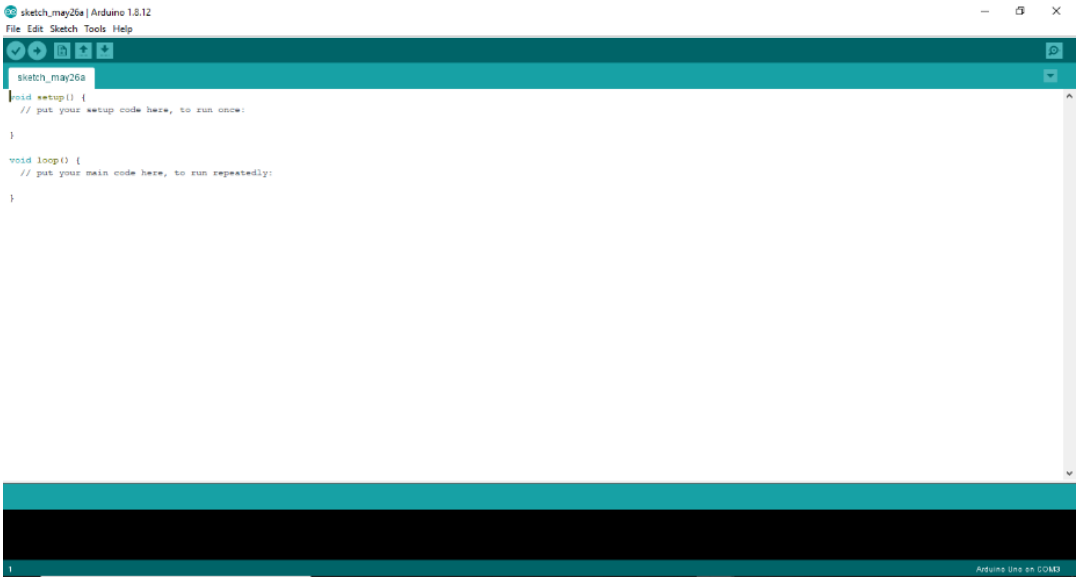

Figure 3.19 Arduino IDE in Window OS.

3.5.2 Tinkercad Software

Tinkercad is a free, user-friendly 3D design, electronics, and coding programme. Teachers, students, enthusiasts, and designers utilise it to envision, develop, and construct anything. Tinkercad constructs models using a simplified constructive solid geometry approach. A design is made up of "solid" or "hole" primitive shapes. New forms can be constructed by combining solids and holes, and then the solid or hole property can be ascribed to them. A user can design custom shape generators using a built-in JavaScript editor, in addition to the basic library of primitive shapes.

Figure 3.20 Autodesk Tinkercad.

3.5.3 Proteus Design Suite Software

The Proteus Design Suite is a closed-source software toolset designed to automate electronic design. The software is primarily used by electronic design specialists and technicians to create schematics and electronic prints for printed circuit board manufacturingThe Proteus Build Suite is a Windows application that allows you to record, simulate, and design PCB layouts. Depending on the scale of the designs being developed and the microcontroller simulation needs, it comes in a variety of ways. Basic mixed mode and an autorouter all PCB design solutions offer SPICE simulation capabilities.

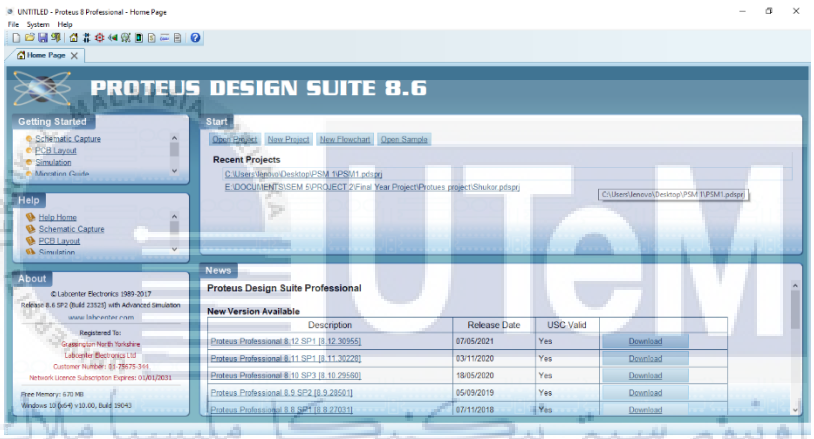

Figure 3.21 Proteus Design Suite 8.6.

3.5.4 Fritzing Software

Fritzing is an open-source hardware project that allows to use electronics to express creativelyProvide a software tool, a community website, and services that allow users to document their prototypes, share them with others, teach electronics in a classroom, and layout and construct professional pcbs in the spirit of Processing and Arduino. The reason for using this software is that the component will allow you to see clearly.

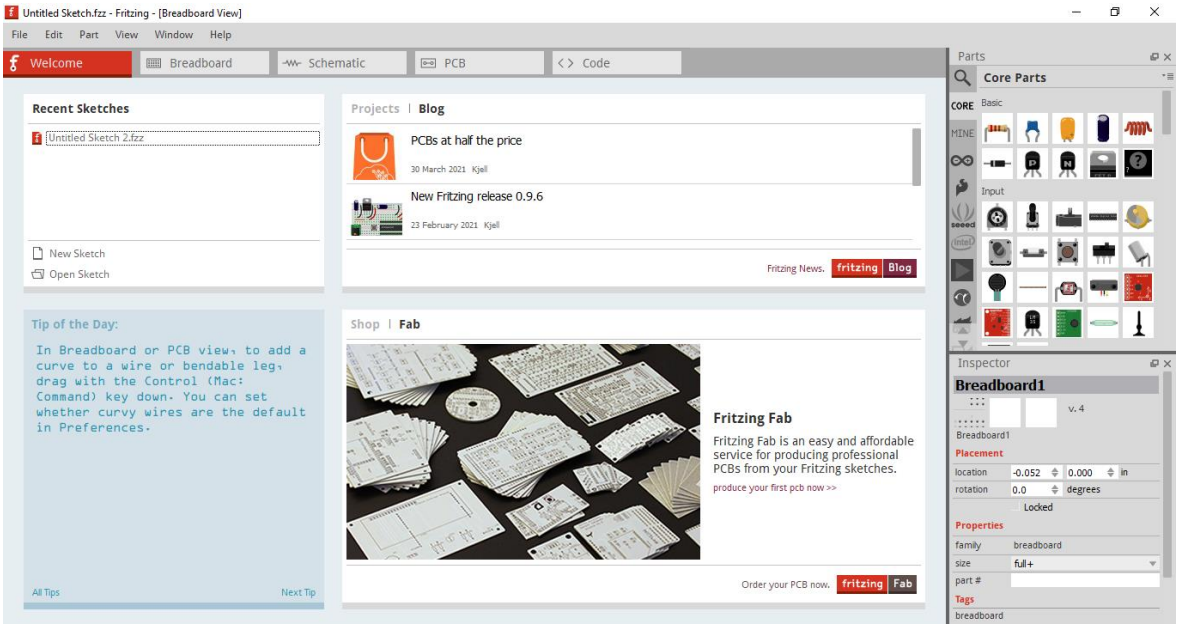

Figure 3.22 Fritzing Sketch.

3.6 Summary

The proposed methodology for developing a new system project is presented in this chapter. To achieve all of the project's goals, each development in this chapter must be completed well. This chapter describes all of the hardware and software stages required for the system. In addition, system activity is detailed by using a flowchart and a block diagram to show how the project system works. In this chapter, the hardware and software chosen for this project were thoroughly discussed, and the basis for their use was elucidated.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter would explain the progress of the project, particularly in the area of circuit and coding. Testing of the product and analysis can be seen in this chapter, such as the output outcome and the influence of the product using the variance in input distance, and an analysis will be made to see whether or not the final project is capable in a new age. There are many advances towards producing the expected product.

4.2 Experimental Setup

This section will go over the hardware and software construction process in detail. This section would cover everything from the foundation to the wiring, as well as all electronic component and wiring. Aside from that, this section goes through the tools needed to render the WhatsApp application as well as the wiring.

4.2.1 Design of Prototype

The whole prototype design is shown in Figure 4.1 and Figure 4.2, which was created using SketchUp. 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, NodeMCU, DHT 11, relay module and GPS module.

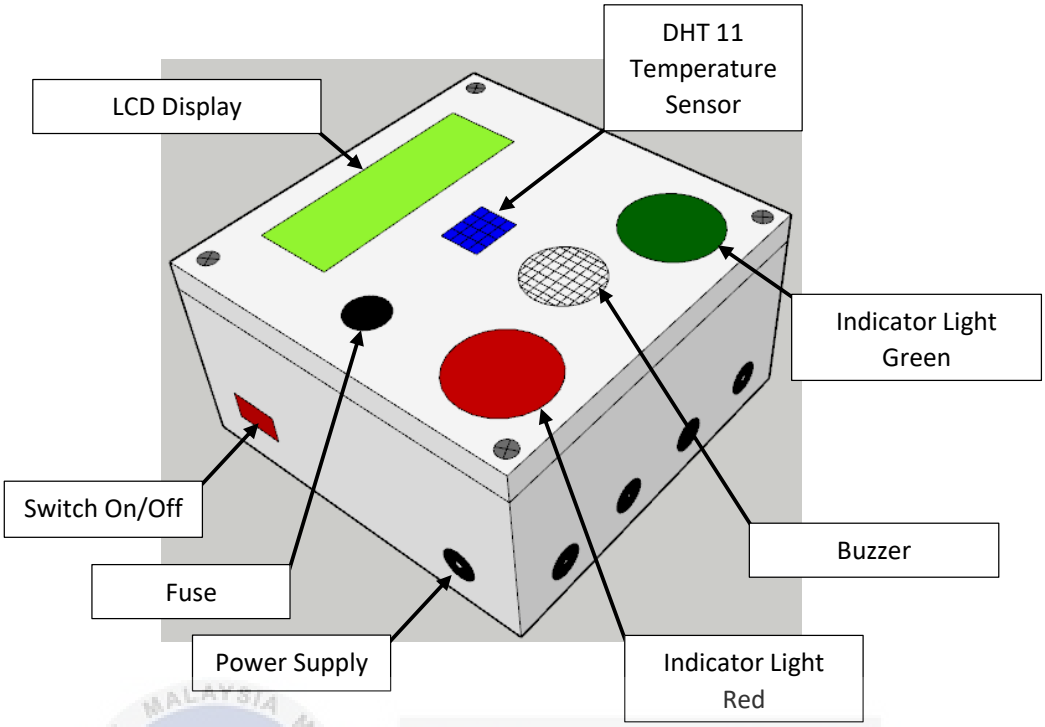

Figure 4.1 Design of Prototype as Left Side View.

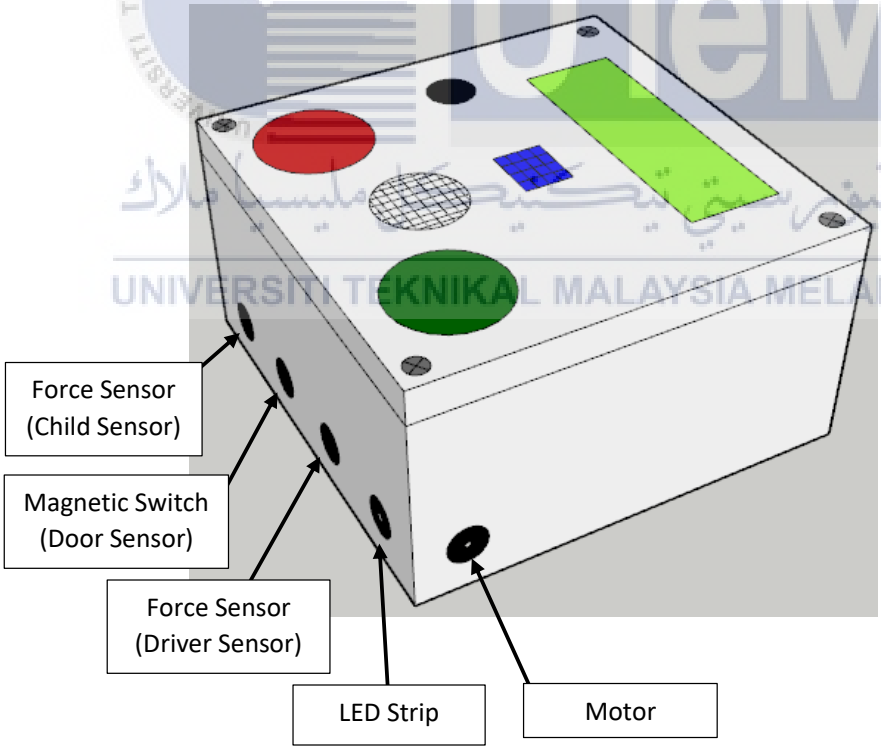

Figure 4.2 Design of Prototype as Right Side View.

4.2.2 Circuit Design

Figure 4.3 shows the connection simulation circuit design created with Fritzing for the project. The box has NodeMCU, GPS module, relay module, power window motor, force sensor, magnetic switch as sensors, buzzer, temperature sensor, indicator lamps, LED strip and Liquid Crystal Display (LCD).

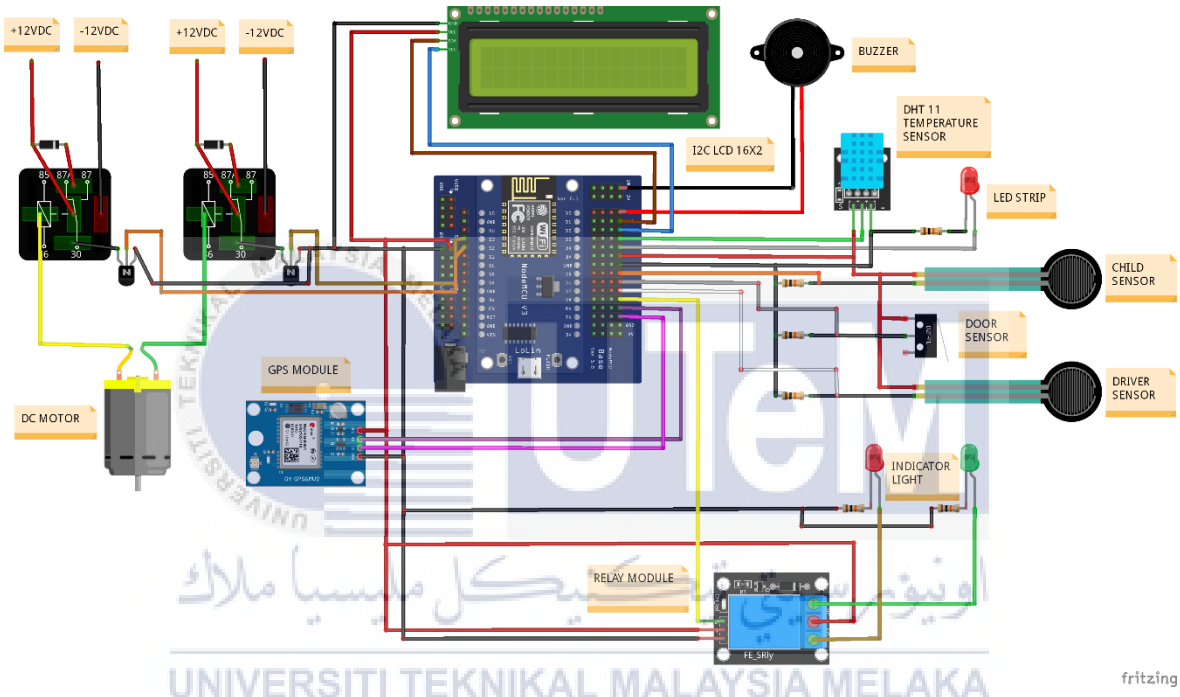

Figure 4.3 Circuit Design in Fritzing.

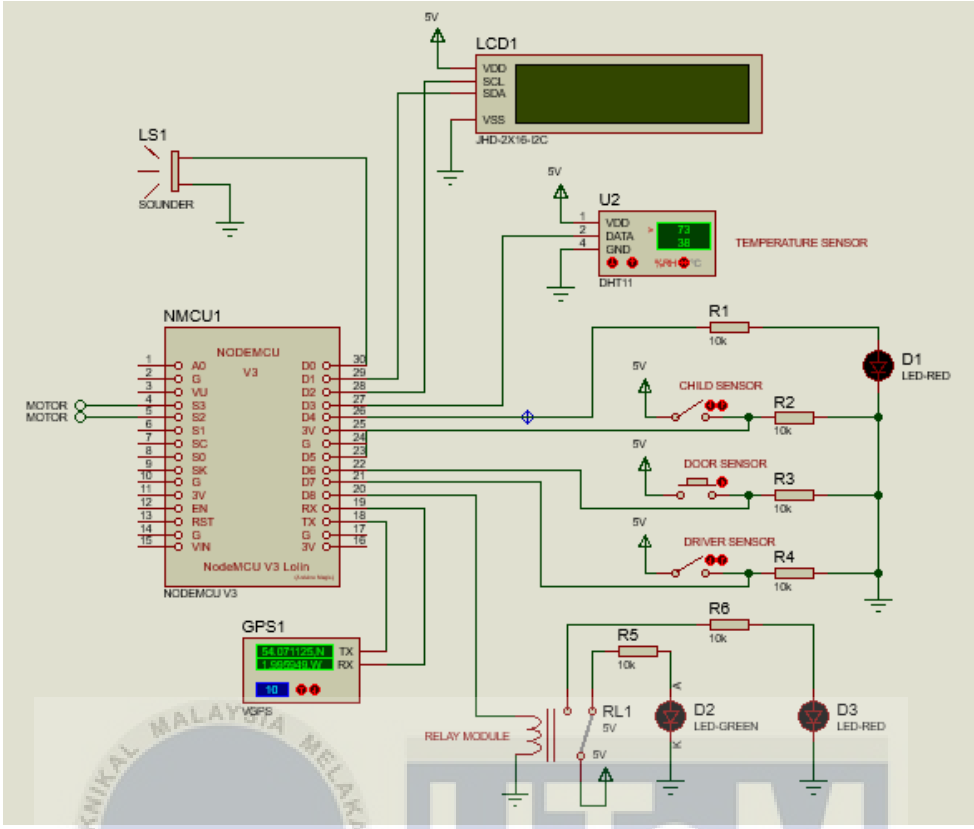

Figure 4.4 Circuit Diagram in Proteus.

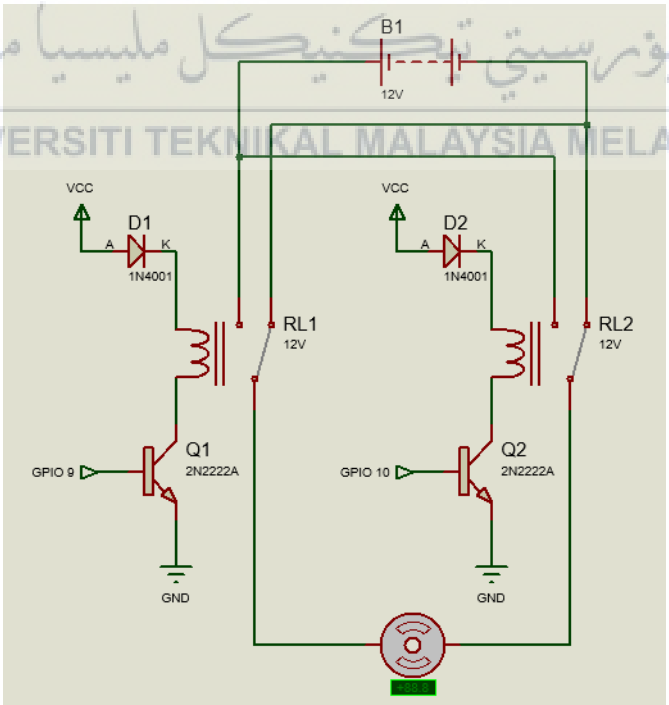

Figure 4.5 Circuit Motor Diagram in Proteus.

In this circuit, a NodeMCU ESP8266 is utilised to control all of the components by uploading code from the Arduino IDE programme. Components linked to the NodeMCU ESP8266 port are required to run during simulation.

In the simulation part, the GPS module TX-RX is connected to the TX-RX NodeMCU ESP8266. The digital pin D5 is connected to the force sensor as child sensor. The magnetic switch as door sensor and force sensor as driver sensor are connected to digital pins D6 and D7. Each switch has a 10k resistor attached to it. Then, the NodeMCU is linked to a Liquid Crystal Display (LCD) that displays the child present and the temperature inside the car. When the force sensor detects a child, the display will show "BABY IN CAR."

The motor that opens and closes the window is attached with relay to digital pins GPIO 9 and 10. When the system detects a childs in danger, the buzzer and indicator light and LED strip will activated. The buzzer, LED strip and indicator lights connected to digital pins D0, D4 and D8. The temperature sensor DHT11 is attached to digital pin D3 to detect the temperature inside car.

The child must sit at the force sensor to turn ON the system. The NodeMCU will then be linked to WiFi and will be able to communicate with ThingESP and Twilio via the WhatsApp Messenger app. The GPS module functions to send the coordinates of the seat childs location to the user via WhatsApp Messenger to alert the user. When the child not sit at the car seat, the user also can monitoring the system in vehicle via WhatsApp Messenger.

4.2.3 Hardware Development

Figure 4.6 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 users mobile phone receives the alert massages and monitoring through the WhatsApp application.

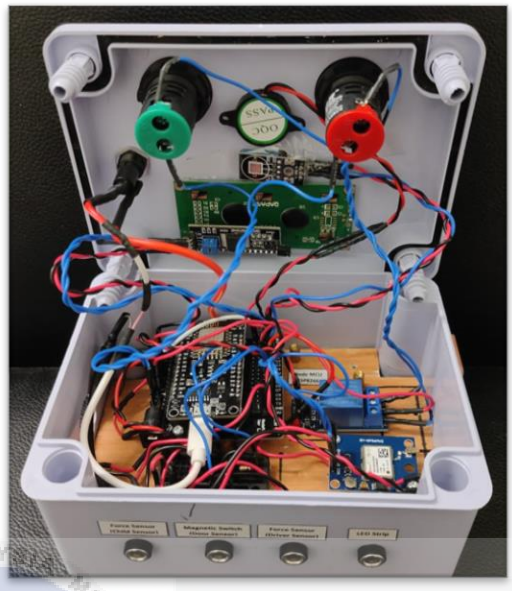

Figure 4.6 Prototype of the Project.

Figure 4.7 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 or not the child is safe.

Figure 4.7 Top view of the Project.

Figure 4.8 show the side view of the project and figure 4.9 front view of the project. The force sensor is used to detect the presence of the baby in the car seat, and to detect the presence of the driver. Then, the magnetic switch to detect the door is locked or unlocked.

Figure 4.8 Side view of the Project.

Figure 4.9 Front view of the Project.

4.3 Result and Analysis

In this subtopic, we will test the prototype and conduct an analysis based on the project goal. The analysis will be carried out by repeatedly testing the main functionality, the speed of data transmission between WhatsApp application and NodeMCU, and the time spent by user to receive the alert message and monitoring the project system through WhatsApp Application.

4.3.1 Component Testing

Table 4.1 Table of Voltage Testing.

Component	Minimum Voltage (V)	Maximum Voltage (V)
NodeMCU	3	12
DHT 11 Sensor	3	5
Buzzer	3	5
Liquid Crystal Display	3	5
Indicator Light	5	12
LED Strip	5	5
Force Sensor	5	5
Magnetic Switch	5	12
GPS Module	3	5
Relay Module	5	5
Power Window Motor	12	12

Depending on the result in table 4.1, the highest voltage that NodeMCU ESP8266 can control is 12V, while the other component can be turned on at 3V and the maximum voltage that can be handled is up to 12V.

4.3.2 Speed of data transmission between different line sim card

The prototype will analyze the speed of data transmission between different line sim cards. DiGi and U Mobile are the line sim cards that will be tested because the WhatsApp application uses internet data to communicate with the ESP8266, each sim card should have its own internet data. The total number of tests is 10 times with the goal of analyze the consistency of the results and the speed of data transfer in real time. The table of results from the tests can be found below.

Table 4.2 Analysis of WhatsApp application with DiGi sim card.

Attempt	Speed of data (megabyte per second)
1	49 mb/s
2	51 mb/s
3	50 mb/s
4	53 mb/s
5	51 mb/s
6	52 mb/s
7	53 mb/s
8	50 mb/s
9	50 mb/s
10	49 mb/s

Table 4.3 Analysis of WhatsApp application with U Mobile sim card.

Attempt	Speed of data (megabyte per second)
1	51 mb/s
2	48 mb/s
3	51 mb/s
4	49 mb/s
5	51 mb/s
6	51 mb/s
7	50 mb/s
8	49 mb/s
9	48 mb/s
10	49 mb/s

In terms of data transmission speed between the line and the sim card, DiGi is the fastest since the higher the data transmission speed, the better the quality of the data transmitted to the receiver. DiGi will be first, followed by U Mobile, according to Malaysia Mobile and Fixed Broadband Internet Speed with Malaysia in quarter three with a speed core. Unfortunately, if the testing region is moved, the results will vary, because all line data sim cards are based on the signal towers internet coverage.

4.3.3 Time taken that users receive the alert messages

This chapter will be analyze on the response time of the NodeMCU ESP8266 link to the WhatsApp application. Since it provide caution messages to the WhatsApp application, the NodeMCU ESP8266 will deliver alert messages. The study scenario is the amount of time it takes NodeMCU ESP8266 to deliver alert messages via WhatsApp application with different range. The range will start 10 meter away from the system project, after that 20 meter then from 30 meter. According to table 4.4, the time recorded for NodeMCU ESP8266 to deliver alert messages to the WhatsApp application is five times with a different range.

Table 4.4 Analysis of time taken that user receive the alert messages.

Range	**Attempt**	**Time (second)**
10 meter	1	8
	2	7
	3	8
	4	7
	5	7
	Average	7.4
20 meter	1	12
	2	10
	3	11
	4	12
	5	12
	Average	11.4

Range	Attempt	Time (second)
30 meter	1	15
	2	14
	3	15
	4	13
	5	14
	Average	14.2

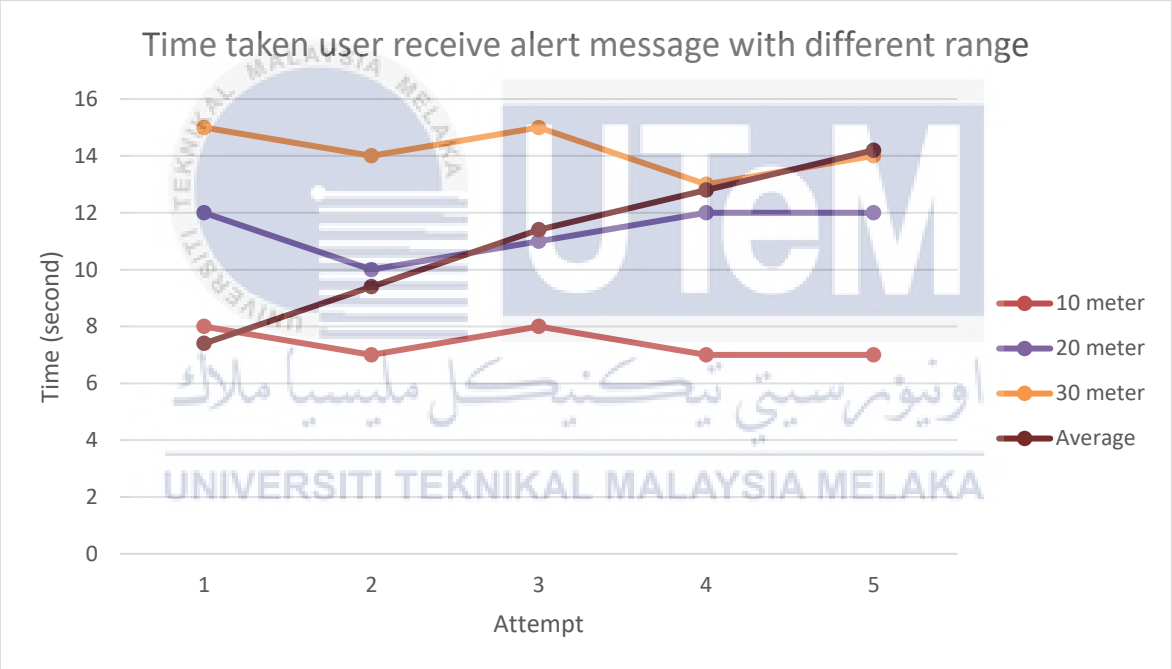

Figure 4.10 Graph for the time taken that user receive the alert messages.

Figure 4.10 show the graph for the time taken that user receive the alert messages with different range. The shortest time to trigger the system is 7 seconds and slowest time is 8 second with range 10 meter based on 5 attemp. The system take an average of 7.4 second to start.

Then, the shortest time to trigger the system for 20 meter is 10 seconds and slowest time is 12 second based on 5 attemp. The system take an average of 11.4 second to start.

Finally, the shortest time to trigger the system for 30 meter is 13 seconds and slowest time is 15 second based on 5 attemp. The system take an average of 14.2 second to start.

4.3.4 Temperature against time taken in a closed car condition

This part will be analyze on the temperature change in a closed car condition. The time will be taken 10 minutes to identify the changes of the temperature. The table 4.5 below show the result of the temperature againts time taken in a closed car condition and figure 4.11 below show the graph temperature versus time taken in a closed car condition.

Table 4.5 The reading of temperature that recorded 10 minutes in a closed car.

No.	Time	Temperature
1.	1 minutes	34.30 °C
2.	2 minutes	34.50 °C
3.	3 minutes	34.70 °C
4.	4 minutes	34.70 °C
5.	5 minutes	34.70 °C
6.	6 minutes	35.10 °C
7.	7 minutes	35.40 °C
8.	8 minutes	35.80 °C
9.	9 minutes	36.30 °C
10.	10 minutes	37.10 °C

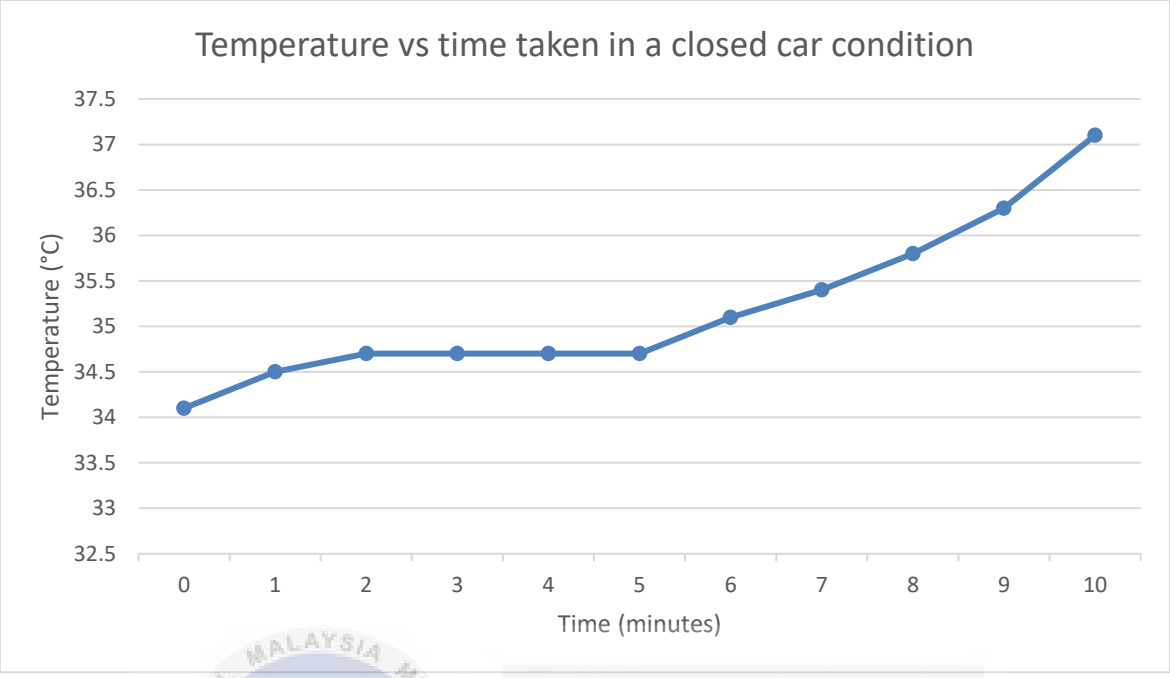

Figure 4.11 Graph for temperature versus time taken in a closed car condition.

From the graph above, it shows that the temperature increase in 10 minutes from 34.30 °C to 37.10 °C.

4.3.5 Temperature against time taken in a open window condition

This part will be analyze on the temperature change in a open window condition. The time will be taken 10 minutes to identify the changes of the temperature. The table 4.6 below show the result of the temperature againts time taken in a open window condition and figure 4.12 below show the graph temperature versus time taken in a open window condition.

Table 4.6 The reading of temperature that recorded 10 minutes in a open window.

No.	Time	Temperature
1.	1 minutes	37.10 °C
2.	2 minutes	36.60 °C
3.	3 minutes	35.90 °C
4.	4 minutes	35.40 °C
5.	5 minutes	34.90 °C
6.	6 minutes	34.70 °C
7.	7 minutes	34.50 °C
8.	8 minutes	34.40 °C
9.	9 minutes	34.30 °C
10.	10 minutes	34.10 °C

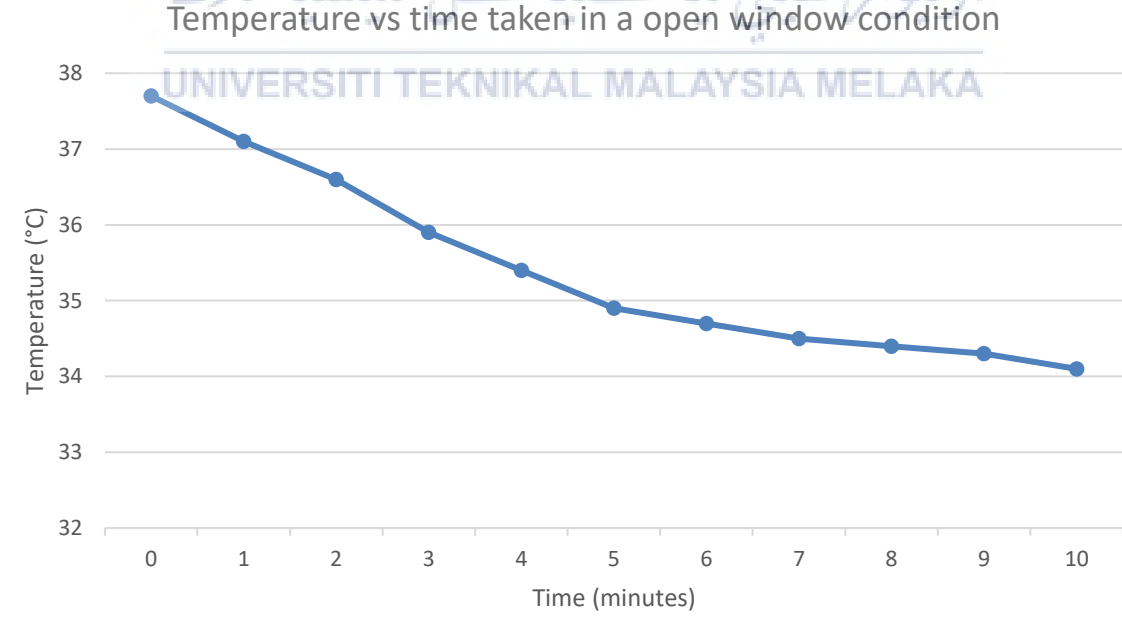

Figure 4.12 Graph for temperature versus time taken in a open window condition.

From the graph above, it shows that the temperature decrease in 10 minutes from 37.10 ℃ to 34.10 ℃.

4.3.6 The result of development Car Seat Alert Sytem by Using IoT

This part will explain about the results produced by "The Development of Car Seat Alert System by Using IoT" according to different situations. Table 4.7 below shows the result based on different scenario.

Table 4.7 The result based on different scenario.

No.	Scenario	Result
1.	When the system active.	The LCD will display "Car Seat Alert System" and "Please Press start to begin". Then, LCD will display current temperature and humidity inside the vehicle.
2.	When the user type "Start" in WhatsApp application.	WhatsApp application will show some function to monitor the system. User can check the presence of the child, check the door locked or unlocked, check status of driver, check the current temperature inside vehicle, check current location of vehicle and user can turn ON/OFF buzzer and LED.
3.	When the child sits in the car seat, the force sensor will trigger.	The LCD will display "BABY IN CAR" and current temperature and humidity inside the vehicle.
4.	When the child at the seat, the driver status is not in car and the door condition is unlocked.	NodeMCU ESP8266 will send the alert message through WhatsApp application to notify baby in car.
5.	When the child at the seat, the door condition is locked, the driver status is not in car and temperature inside vehicle higher than 38.0 ℃.	The indicator light, LED strip at car seat and buzzer will be activated, the LCD will display "HELP BABY IN CAR" and current temperature and at the same time power window motor will roll down. The NodeMCU ESP8266 will send the alert message through WhatsApp application to notify the user of hazardous temperature in vehicle current location of the vehicle and at the same time help baby in car.

No.	Scenario	Result
6.	When the temperature inside vehicle less than 38.0 °C.	The indicator light, LED strip at car seat and buzzer will be deactivated and at the same time power window motor will roll up and NodeMCU ESP8266 will stop send alert message to user. The LCD will display current temperature and baby in car.

4.4 Hardware Circuit Simulation

Figure 4.13 depicts the hardware circuit that is attached to and mounted at the prototypes base. When the power supply is turned on, the circuit is activated. The Proteus software circuit is at the heart of the system. The NodeMCU ESP8266, power window motor, GPS module, Buzzer, indicator light and DHT11 are all included, as well as a Liquid Crystal Display, magnetic switch for door sensor, force sensor for child and driver sensor, and LED strip.

Figure 4.13 The hardware and display part.

4.4.1 Program in Arduino IDE

4.4.1.1 Program to communicate with WhatsApp application

```
ThingESP8266 thing("username", "ssid", "password");
```

Figure 4.14 Program to communicate with WhatsApp application.

Figure 4.14 show the Arduino IDE to declare the ThingESP8266 username. The username must be configured and create in the ThingESP project. Then, create account in twilio to configured the API token that use in ThingESP project.

4.4.1.2 Program to declare pin of input and output

```
//sensor
  pinMode(buttonPin_child, INPUT); //child
  pinMode(buttonPin_door, INPUT); //door
  pinMode(buttonPin_driver, INPUT); //driver

  //relay
  pinMode(relay, OUTPUT);

  pinMode(LED, OUTPUT);
  pinMode(BUZZER, OUTPUT);
```


Figure 4.15 Program to declare pin input and output.

Figure 4.15 will show specify input and output components pins. The magnetic switch for the door sensor, and the force sensor for the driver and child sensor have all been declared as inputs. In the software, the LED strip, relay, and buzzer are all declared as outputs.

4.4.1.3 Program for NodeMCU connected with WiFi

```
thing.SetWiFi("ssid", "password");

thing.initDevice();
```

Figure 4.16 Program to connected with WiFi.

Figure 4.16 demonstrates how the NodeMCU is connected to the Wi-Fi network. It will first try to connect, and the serial monitor will display the connection. The system will be activated if the connection with Wi-Fi was successful.

4.4.2 Project Overview

Figure 4.17 show when the system active, the LCD will display “Car Seat Alert System” and “Please Press start to begin”. Then, figure 4.18 LCD will display current temperature and humidity inside the vehicle.

Figure 4.17 The project when system active.

Figure 4.18 The current temperature and humidity.

Figure 4.19 show when the user type “Start” in WhatsApp application. Then, WhatsApp application will show some function to monitor the system.

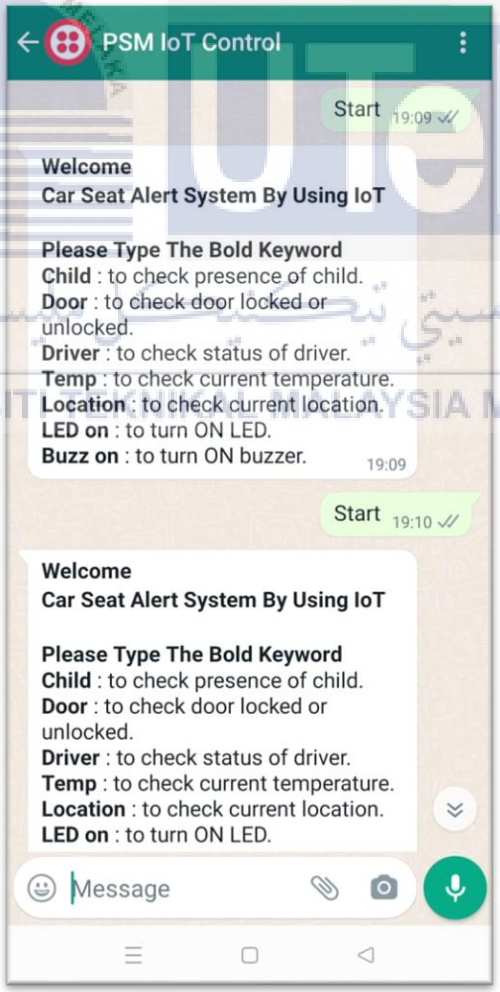

Figure 4.19 The monitoring function system in WhatsApp application.

Figure 4.20 show when the child sits in the car seat, the force sensor will trigger and figure 4.21 show the LCD will display “BABY IN CAR” and current temperature and humidity inside the vehicle.

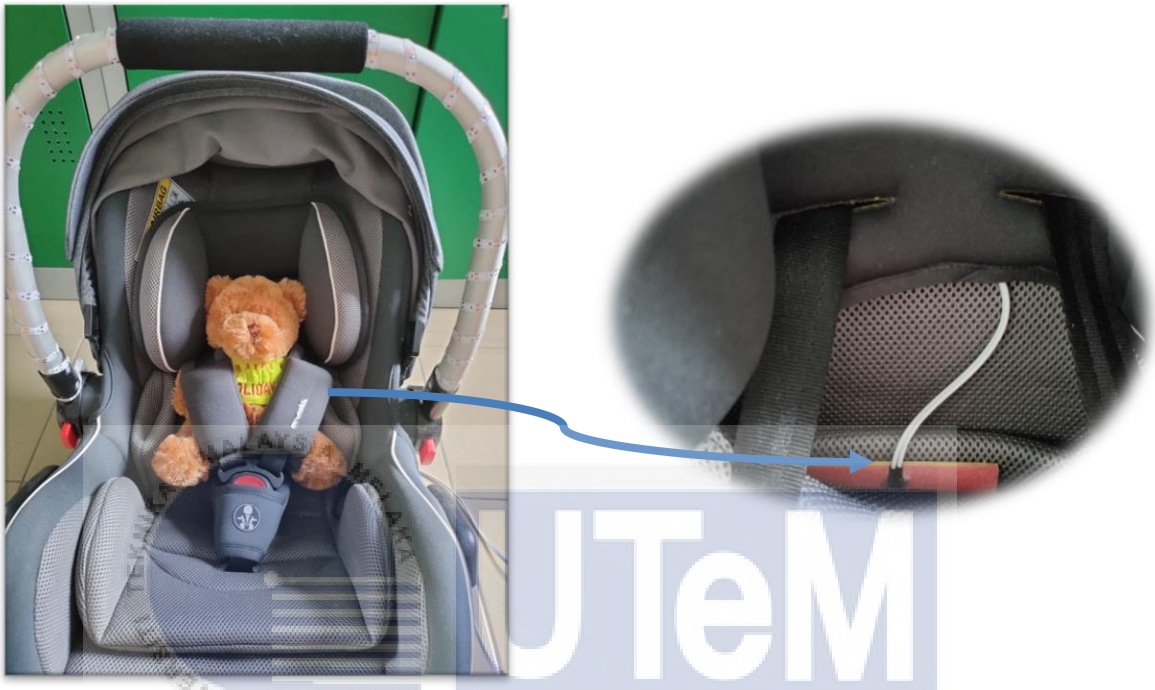

Figure 4.20 The car seat and position of force sensor.

Figure 4.21 The LCD will display current temperature and baby in car.

Figure 4.22 demonstrates when the child at the seat, the driver status is not in car and the door condition is unlocked and figure 4.23 the NodeMCU ESP8266 will send the alert message through WhatsApp application to notify baby in car.

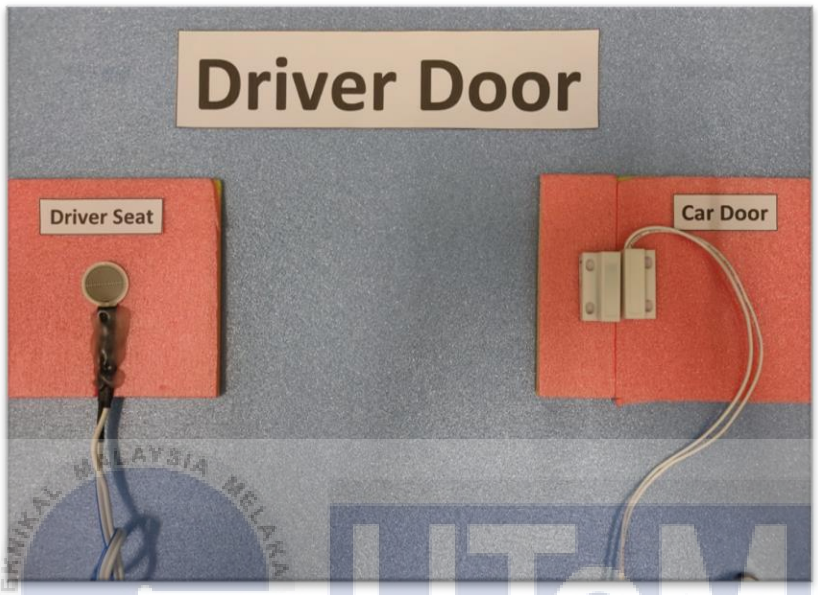

Figure 4.22 The prototype of position driver seat and door.

Figure 4.23 The alert message from WhatsApp application.

Figure 4.24 show the indicator light, LED strip at car seat and buzzer will be activated, the LCD will display “HELP BABY IN CAR” and current temperature and at the same time power window motor will roll down when the child at the seat, the door condition is locked, the driver status is not in car and temperature inside vehicle higher than 38.0 °C.

Figure 4.24 The alert indicator and power window motor.

Figure 4.25 the NodeMCU ESP8266 will send the alert message through WhatsApp application to notify the user of dangerous temperature in vehicle, current location of the vehicle and at the same time help baby in car.

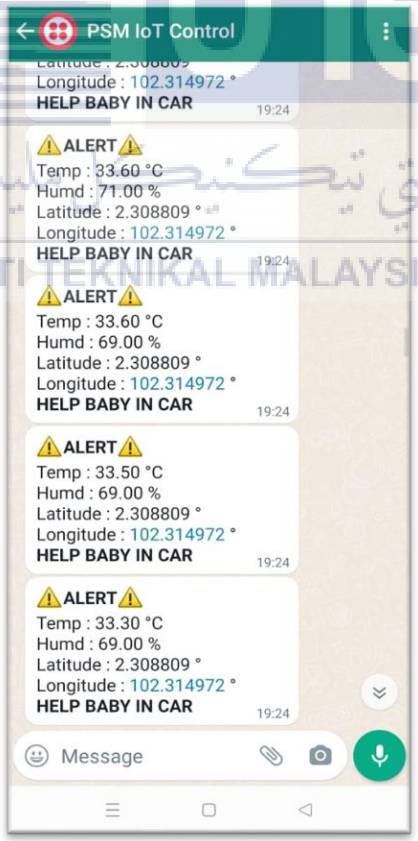

Figure 4.25 The alert message from WhatsApp application.

Figure 4.26 show when the temperature inside vehicle less than 38.0 °C. The indicator light, LED strip at car seat and buzzer will be deactivated and at the same time power window motor will roll up and NodeMCU ESP8266 will stop send alert message to user. The LCD will display current temperature and baby in car.

Figure 4.26 The prototype of The Development of Car Seat Alert System By Using IoT.

4.5 Summary

The success of the "Development of Car Seat Alert System Using IoT" projects is discussed. To assess the performance of the temperature detection system and sensor, several experiments and testing processes were carried out. The experiment yielded a respectable outcome, revealing various design flaws that hampered the temperature detection systems functionality. Overall, the system achieves its goal, and the car temperature detection system and sensor perform well.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

In conclusion, with the rapid expansion of science and technology, the development of a detection device with an IoT system is becoming popular as a way to raise awareness among people in the world today. Due to being trapped in an enclosed car parked outside after being left unattended, the body is unable to release the heat it generates and absorbs, resulting in heat stroke. Furthermore, though the number of children who die from heat stroke caused by automobiles is less than the number of children who die in traffic accidents, the nature of these deaths requires attention. This emphasises the significance of having a temperature alarm system that is completely correct.

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 NodeMCU ESP8266 and the Neo 6m GPS module are also included in this project, as previously stated. It’s a powerful GPS module because it keeps track of up to 22 satellites in different parts of the globe. 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.

5.2 Future Works

For future improvements, the system could be enhanced as follows:

i) Using a radar sensor for a better performance sensor as radar sensor can penetrate more mediums and insulators in the surrounding. Radar signal also does not require transportation as it employs radio signals that travels through air and space.

ii) To using GPRS instead of ESP8266. This is due to the fact that the ESP8266 requires the user to turn on an internet hotspot on their smartphone in order to connect to the system, whereas GPRS already has Wi-Fi, which turns on instantly when the device is turned on. Furthermore, because to the username and password stored in the coding, the ESP8266 can only connect to one internet hotspot at a time. GPRS is advantageous since it makes system operation easier for the user.

iii) Using a dot matrix display so that the display sees more clearly and large. People around will be easy to see.

iv) To use wireless so as not to use a lot of cables and easy to make installation on the vehicle.

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APPENDICES

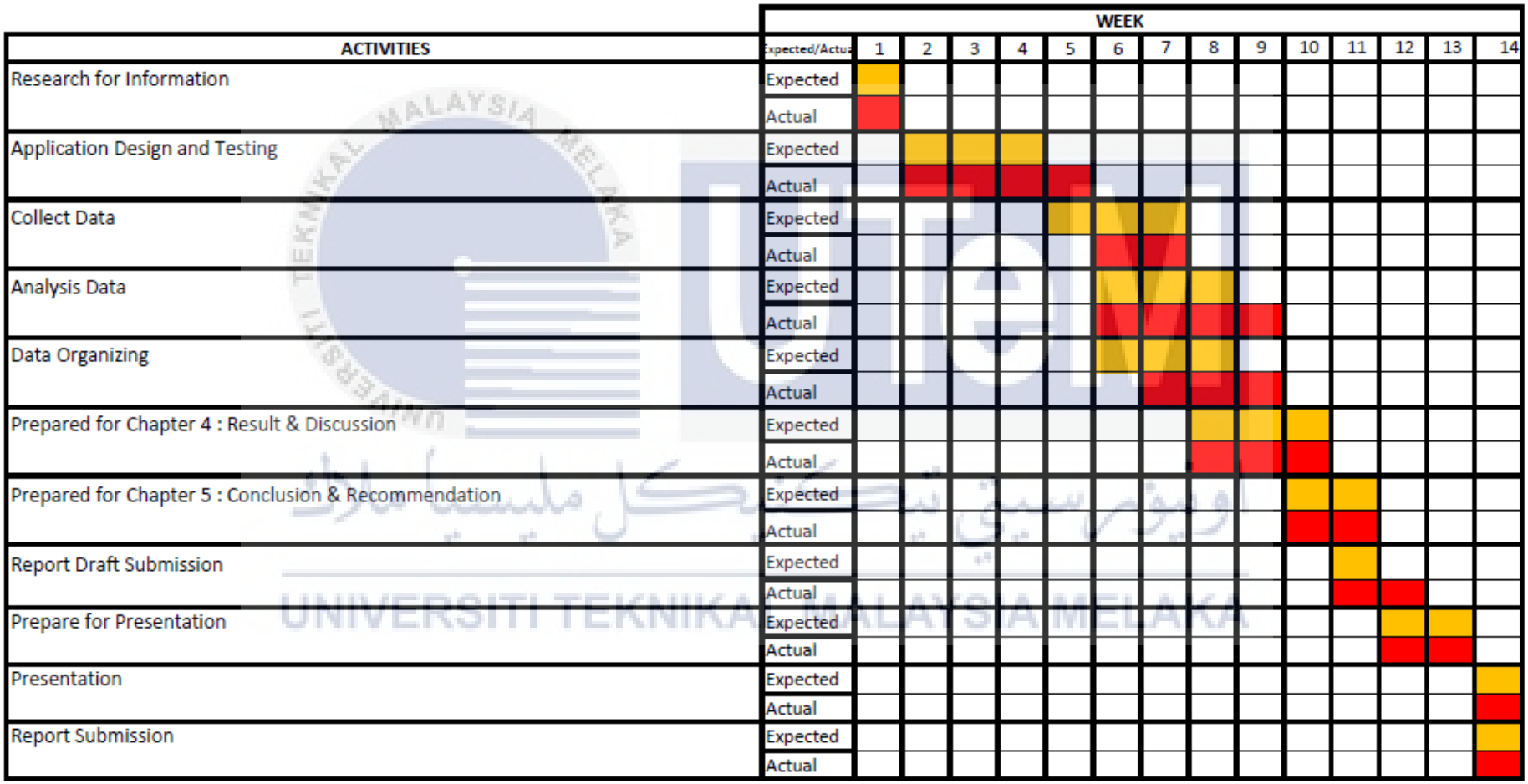
Appendix A The Gantt Chart for BDP 1.

BDP 1 GANTT CHART

ACTIVITIES	WEEK 1	2	3	4	5	6	7	8	9	10	11	12	13	14
BDP 1 Briefing by JK PSM, FTKEE														
Project Title Confirmation														
Chapter 1 Draft Discussion with Supervisor														
Report Writing: Chapter 1 (Introduction, Problem Statement, Objective, Scope)														
Chapter 1 Draft Submission														
Chapter 2 Draft Discussion with Supervisor														
Report Writing: Chapter 2 (Literature Review)														
Chapter 2 Draft Submission														
Chapter 3 Draft Discussion with Supervisor														
Report Writing: Chapter 3 (Methodology)														
Chapter 3 Draft Submission														
Chapter 1,2 and 3 Correction														
Chapter 1,2 and 3 Final Submission														
Construct Presentation Slide														
BDP 1 PRESENTATION AND ASSESSMENTS														

Appendix B The Gantt Chart for BDP 2.

BDP 2 GANTT CHART



ACTIVITIES	Expected/Actual	WEEK 1	2	3	4	5	6	7	8	9	10	11	12	13	14
Research for Information	Expected														
	Actual														
Application Design and Testing	Expected														
	Actual														
Collect Data	Expected														
	Actual														
Analysis Data	Expected														
	Actual														
Data Organizing	Expected														
	Actual														
Prepared for Chapter 4 : Result & Discussion	Expected														
	Actual														
Prepared for Chapter 5 : Conclusion & Recommendation	Expected														
	Actual														
Report Draft Submission	Expected														
	Actual														
Prepare for Presentation	Expected														
	Actual														
Presentation	Expected														
	Actual														
Report Submission	Expected														
	Actual														

Appendix C Coding.

```
#include <ESP8266WiFi.h>
#include <ThingESP.h>
#include <DHT.h>
#include <Wire.h> // lib i2c wire
#include <LiquidCrystal_I2C.h> //lib for i2c
LiquidCrystal_I2C lcd(0x27, 16, 2); // type LCD

//for gps
#include <TinyGPS++.h>
#include <SoftwareSerial.h>

// The TinyGPS++ object
TinyGPSPlus gps;
SoftwareSerial ss(1, 3); // The serial connection to the GPS device

float latitude, longitude;
String lat_str , lng_str;

const int buttonPin_child = 14;     // the number of the pushbutton pin
int buttonState_child = 0;

const int buttonPin_door = 12;     // the number of the pushbutton pin
int buttonState_door = 0;

const int buttonPin_driver = 13;     // the number of the pushbutton pin
int buttonState_driver = 0;

ThingESP8266 thing("username", "ssid", "password");

int BUZZER = 16;
int LED = 2;

DHT dht(D3, DHT11);
float t, h;

const int relay = 15;

void setup()
{
  Serial.begin(115200);
  ss.begin(9600);
  Serial.println();
  lcd.init();
  dht.begin();

lcd.init(); //setup lcd
lcd.backlight(); // nyalakan lcd
```

```
lcd.setCursor(4, 0 );// set kedudukan
lcd.print("Car Seat");
lcd.setCursor(2, 1); // set kedudukan
lcd.print("Alert System");
delay(3000);
lcd.clear();
lcd.setCursor(2, 0 );
lcd.print("Please Press");
lcd.setCursor(1, 1); // set kedudukan
lcd.print("start to begin");
delay(3000);
lcd.clear();

//sensor
  pinMode(buttonPin_child, INPUT); //child
  pinMode(buttonPin_door, INPUT); //door
  pinMode(buttonPin_driver, INPUT); //driver

  //relay
  pinMode(relay, OUTPUT);

  pinMode(LED, OUTPUT);
  pinMode(BUZZER, OUTPUT);

  thing.SetWiFi("ssid", "password");

  thing.initDevice();

}

String HandleResponse(String query)
{

  if (query == "start") {
    return (String)"*Welcome*\n" +
          (String)"*Car Seat Alert System By Using IoT*\n\n" +
          (String)"*Please Type The Bold Keyword*\n" +
          (String)"*Child* : to check presence of child.\n" +
          (String)"*Door* : to check door locked or unlocked.\n" +
          (String)"*Driver* : to check status of driver.\n" +
          (String)"*Temp* : to check current temperature.\n" +
          (String)"*Location* : to check current location.\n" +
          (String)"*LED on* : to turn ON LED.\n" +
          (String)"*Buzz on* : to turn ON buzzer." ;

  }

  else if (query == "temp") {
    return (String)"*Current Temperature*\n" +
          (String)"Temp : " + t + (String)" °C\n" +
```

```
        (String)"Humd : " + h + (String)" %" ;
}

else if (query == "location") {
  return (String)"*Current Location*\n" +
        (String)"Latitude : " + lat_str + (String)" °\n" +
        (String)"Longitude : " + lng_str + (String)" °";
}

else if (query == "led on") {
  digitalWrite(LED, 1);
  digitalWrite(relay, HIGH);
  return "Done: LED Turned *ON*";
}

else if (query == "led off") {
  digitalWrite(LED, 0);
  digitalWrite(relay, LOW);
  return "Done: LED Turned *OFF*";
}

else if (query == "buzz on") {
  digitalWrite(BUZZER, 1);
  return "Done: BUZZER Turned *ON*";
}

else if (query == "buzz off") {
  digitalWrite(BUZZER, 0);
  return "Done: BUZZER Turned *OFF*";
}

else if (query == "child") {
  if (buttonState_child == LOW){
  return "Baby *NOT* in the Car";
  }
  else{
  return "Baby *IN* the Car";
}
}

else if (query == "door") {
  if (buttonState_door == HIGH){
  return "Door is *LOCKED*";
  }
  else{
  return "Door is *UNLOCKED*";
}
}

else if (query == "driver") {
```

```
   if (buttonState_driver == HIGH){
   return "Driver *IN* the Car";
   }
   else{
   return "Driver *NOT* in the Car";
  }
  }

  else if (query == "led status")
   return digitalRead(LED) ? "LED is *ON*" : "LED is *OFF*";

  else if (query == "buzz status")
   return digitalRead(BUZZER) ? "BUZZER is *ON*" : "BUZZER is *OFF*";

  else if (query == "child status")
   return digitalRead(buttonState_child) ? "Baby *NOT* in the Car" : "Baby *IN* the
Car";

  else if (query == "door status")
   return digitalRead(buttonState_door) ? "Door is *UNLOCKED*" : "Door is
*LOCKED*";

   else if (query == "driver status")
   return digitalRead(buttonState_driver) ? "Driver *NOT* in the Car" : "Driver *IN* the
Car";

  else return "Your query was invalid..";

}

void loop()
{

while (ss.available() > 0)
   if (gps.encode(ss.read()))
   {
    if (gps.location.isValid())
    {
      latitude = gps.location.lat();
      lat_str = String(latitude , 6);
      longitude = gps.location.lng();
      lng_str = String(longitude , 6);
    }
   }

  h = dht.readHumidity();
  t = dht.readTemperature();

buttonState_child = digitalRead(buttonPin_child);
buttonState_door = digitalRead(buttonPin_door);
```

```
buttonState_driver = digitalRead(buttonPin_driver);

  //if ((CHILD == HIGH) && (DOOR == HIGH)) {
  //---------------------------------
  if (t > 33 ) {
    //packet data
    String msg;
    msg = (String)"* ⚠ ALERT ⚠ *\n" +
          (String)"Temp : " + t + (String)" °C\n" +
          (String)"Humd : " + h + (String)" %\n" +
          (String)"Latitude : " + lat_str + (String)" °\n" +
          (String)"Longitude : " + lng_str + (String)" °\n" +
          (String)"*HELP BABY IN CAR*";

    thing.sendMsg("phone_number", msg);

    for (int i = 0; i < 5; i++) {
      digitalWrite(LED, HIGH);
      digitalWrite(BUZZER, HIGH);
      digitalWrite(relay, HIGH);
      delay(500);
      digitalWrite(LED, LOW);
      digitalWrite(BUZZER, LOW);
      digitalWrite(relay, LOW);
      delay(500);
      lcd.setCursor(0, 1 );// set kedudukan
      lcd.print("HELP BABY IN CAR");
      delay(500);
    }

  } //end for if temperature (> 35) & (< 35)

  //---------------------------------

lcd.clear();
lcd.setCursor(0, 0 );// set kedudukan
lcd.print("T:");
lcd.print(t);
lcd.setCursor(9, 0); // set kedudukan
lcd.print("H:");
lcd.print(h);
delay(500);

    if (buttonState_child == HIGH){
    lcd.setCursor(0, 1 );// set kedudukan
    lcd.print("  BABY IN CAR");
    delay(500);

    if (buttonState_driver == LOW && buttonState_door == LOW){
    String msg;
```

```
    msg = (String)"* ⚠ ALERT ⚠ *\n\n" +
          (String)"*BABY IN CAR*";
    thing.sendMsg("phone_number", msg);
    }
}
  thing.Handle();
}
```