Faculty of Electrical and Electronic Engineering Technology

THE DESIGN OF IOT BABY CAR SEAT WITH UNFASTENED ALERT WITH IOT

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Bachelor of Computer Engineering Technology (Computer Systems) with Honours

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A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Computer Engineering Technology (Computer Systems) with Honours

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2021

DECLARATION

I declare that this project report entitled "THE DESIGN OF IOT BABY CAR SEAT WITH UNFASTENED ALERT WITH 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 : 

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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 Computer Engineering Technology (Computer Systems) with Honours.

Signature : 

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Date : 11/1/22

Signature :

Co-Supervisor :

Name (if any)

Date :

DEDICATION

To my beloved parents,

Sabarudin Bin Sayet & Halijah Binti Harun

My Supervisor

Ts. Niza Binti Mohd Idris

and

my helpful friends

ABSTRACT

The Design of IoT Baby Car Seat with Unfastened Alert with IoT project is designed with a device and system that can generate an alert system and to notify the via android application to the parents when their child unfastened the seat belt of the baby car seat, exposing to the danger. This is why "The Design of IoT Baby Car Seat with Unfastened Alert" concept was created. This system includes a magnetic switch sensor that is fitted inside the seat belt buckle of the baby car seat to determine the status of seat belt, a force sensing resistor that is installed under the seat of the baby car seat to detect pressure also act as system trigger, and a voice alert that warns the parents if the seat belt is loosened, a notify message to the parent smartphone. In this project, Node MCU ESP 8266 is used as the main controller for the system, which will communicate with other components such as a magnetic switch that detects the position of the seat belt buckle, a force sensing resistor that detects the weight or pressure on the baby car seat, an LCD display that displays status of seat belt, a speaker that produces a voice alert and a notify message to parents or guardian smartphones using Blynk application via Wi-fi.

ABSTRAK

Projek Reka Bentuk Kursi Kereta Bayi IoT dengan amaran suara dikembangkan dengan alat dan sistem yang dapat menghasilkan sistem amaran dan untuk memberitahu aplikasi melalui android kepada ibu bapa ketika anak mereka membuka tali pinggang keledar tempat duduk kereta bayi, sehingga terdedah kepada bahaya. Inilah sebabnya mengapa konsep " Reka Bentuk Kursi Kereta Bayi IoT dengan amaran suara". Sistem ini merangkumi sensor suis magnetik yang dipasang di dalam tali pinggang keledar dari tempat duduk kereta bayi untuk menentukan status tali pinggang keledar, perintang pengesan daya yang dipasang di bawah tempat duduk kerusi kereta bayi untuk mengesan tekanan juga bertindak sebagai sistem pencetus, dan amaran suara yang memberi amaran kepada ibu bapa jika tali pinggang keledar dilonggarkan, maklumkan kepada telefon pintar ibu bapa. Dalam projek ini, Node MCU ESP 8266 digunakan sebagai pengawal utama sistem, yang akan berkomunikasi dengan komponen lain seperti suis magnet yang mengesan kedudukan tali pinggang keledar, perintang pengesan daya yang mengesan kehadiran anak pada tempat duduk kereta bayi, paparan LCD yang memaparkan status tali pinggang keledar, pembesar suara yang mengeluarkan amaran suara dan mesej pemberitahuan kepada ibu bapa atau penjaga melalui telefon pintar menggunakanaplikasi Blynk melalui Wi-fi.

ACKNOWLEDGEMENTS

In the Name of Allah, the Most Gracious, the Most Merciful

First and foremost, praises and thanks to Allah, the Almighty, for His showers of blessings throughout my thesis to complete this report successfully. I would like to express my deep and sincere gratitude to my talented supervisor, Ts. Niza Binti Mohd Idris, Lecturer, Department of Electronics & Computer Engineering Technology, Universiti Teknikal Malaysia Melaka (UTeM) for giving me the chance and supervise me in completing this report. Her vision, sincerity and motivation have deeply inspired me. It was a great honor to work and study under her guidance. I also extremely grateful to my father Mr. Sabarudin Bin Sayet for the love, caring, prayers and support through financially in preparing me for my future. I would like to thank to my friends for discussion that related to the project and the sleepiness nights that we were working together. Lastly, my thanks to every people that have supported me to complete my thesis directly or indirectly.

.

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LIST OF SYMBOLS

δ - Voltage angle

LIST OF ABBREVIATIONS

V	-	Voltage
LCD	-	Liquid crystal display
IR	-	Infrared
DC	-	Direct current
GPS	-	Global positioning system
LED	-	Light-emitting diode
RF	-	Radio frequency
UART	-	Universal asynchronous receiver-transmitter
RPM	-	Revolutions per minute
GPIO	-	General-purpose input/output
NPN	-	National producer number
GSM	-	Global system for mobile communications
USB	-	Universal serial bus
IC	-	Integrated circuit
mW	-	Milliwatt
W	-	Watt
Cm	-	Centimeter
S	-	Second
Kg	-	Kilogram

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CHAPTER 1

INTRODUCTION

1.1 Background

According to a recent study, accidents are one of the main causes of mortality and injury in youngsters. According to the World Health Organization [1], road accidents involving children have become a severe epidemic in both developing and industrialized countries. With the increased number of vehicles on the road, traffic accidents are becoming more frequently. In reality, road traffic accidents have now surpassed infectious diseases as the leading cause of death.

The best way to protect a baby or toddler in a car is to place an appropriate baby car seat, also known as a kid safety seat in the vehicle. It is critical that parents or guardians use the appropriate child car seats for their children. However, determining which one is ideal for them is dependent on a number of criteria, including their size, age, and the sort of vehicle you drive. Because some toddlers have a habit of slipping out of their child seat harnesses or loosening the buckle while travelling. This is both concerning and frustrating for parents. It is really tough to stop a youngster once they have learned how to do this. Parents must set a positive example for their children by always wearing their seatbelts whenever they are in the car. Children learn from their elders all the time. The implications of this behavior will be kept from these unpleasant occurrences, where the baby car seat needs to be equipped with a system that alerts the parents or guardians if their children behind in the car are unfastened, putting their lives in jeopardy.

1.2 Problem Statement

- The previous system does not available with IoT based on baby car seat to alert the parents or guardians.
- Absence of voice alert with LCD equip to alert the parents or guardians in case of unfasten belt.
- No notifications message through smartphones to alert the parents.

1.3 Project Objective

- To develop IoT based baby car seat system equip with LCD display.
- To design a system using node MCU to detect the status of seat belt.
- To analyse the system responsive and reliability.

1.4 Scope of Project

The scope of this project is made to inform the feature and components that are being used for this project. This project will use Node MCU as a main microcontroller which will control other components to function. Voice module will also be added to the project the alert the parents in case of unbuckle belt. Magnetic switch will be used to detect the belt status and equip with an LCD display if it fastened or unfastened. 9V battery will be used to powered up the circuit and other components. IoT will be used as a communication to send notification to the parents or guardian smartphones regarding the belt status. Lastly, this project aim is to ensure the safety of toddler or baby in a car seat.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter investigates and examines earlier research, projects, and journals that are relevant to this subject. This chapter contains theoretical topics as well as some practical project ideas. Furthermore, these connected works were carefully assessed in order to increase the project's quality and reliability. Therefore, this will contribute to make sure a proper plan to implement this project.

2.2 Statistic

Seat belts save lives, according to statistics in the United States [2]. Of the 22,215 passengers died in passenger vehicles in 2019, 47 percent were not using seat belts. Seat belts saved an estimated 14,955 lives, with another 2,549 individuals potentially saved if they had been wearing them. Seat belts can reduce the probability of fatal injury to front seat passenger car occupants by 45 percent and the risk of moderate-to-critical injury by 50 percent when used appropriately. In the event of a car accident, rear seat belts are 73 percent more effective at preventing fatalities for the passenger in the back vehicle. In addition, in more than half of all fatal auto accidents, the victims are not adequately strapped. Furthermore, when adults in the automobile use seat belts, children are more likely to be fastened 92 percent of the time; yet, some parents or caregivers overlook the need of a baby car seat belt. Always keep in mind that children will not buckle up if their parents do not, so having a good role model is essential. Buckling up keeps the passenger safe and secure inside the car, whereas not doing so can result in the passenger being completely ejected from the

vehicle in a crash, which is almost always fatal. Air bags are insufficient to protect the passenger; in fact, if not correctly strapped up, the force of an air bag might gravely hurt or even kill the passenger. In contrast, improperly fastening a seat belt, such as placing the strap below the arm, puts children at risk in the event of a collision.

2.3 This importance of seat belt

As shown below, the percentage of seat belt usage affect the rate of passenger fatality injury. In early 2000s the chart shows that less than 75% of passenger or occupant are using seat belt therefore the rate of fatalities is more than 50%. However, over year the importance of seat belt and how it can prevent fatality injury is being aware by the vehicle user.

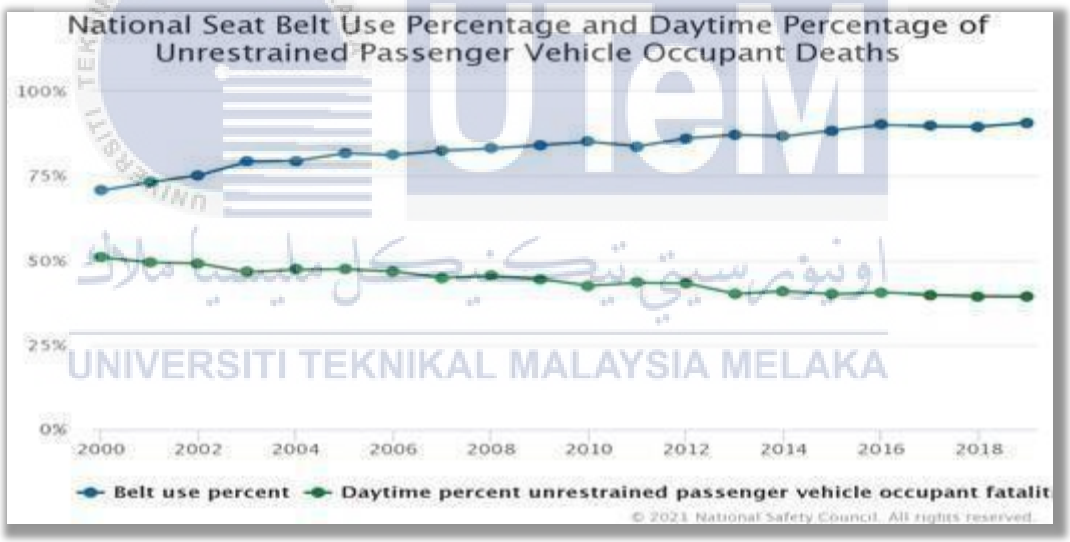

Figure 2.1 Percentage of unrestrained passenger

National seat belt use and daytime percentage of unrestrained passenger vehicle occupant fatalities

Years	Belt use percent	Daytime percent unrestrained passenger vehicle occupant fatalities
2000	70.7%	50.9%
2001	73.1%	49.4%
2002	75.2%	49.1%
2003	79.2%	46.5%
2004	79.5%	47.3%
2005	81.7%	47.4%
2006	81.2%	46.7%
2007	82.5%	44.9%
2008	83.1%	45.4%
2009	84.1%	44.5%
2010	85.1%	42.5%
2011	83.8%	43.4%
2012	86.1%	43.2%
2013	87.2%	40.1%
2014	86.7%	40.9%
2015	88.5%	40.0%
2016	90.1%	40.6%
2017	89.7%	39.8%
2018	89.6%	39.4%
2019	90.7%	39.3%

NSC analysis of NHTSA FARS data and Enriquez, J., & Pickrell, T.M. (2019, January). Seat belt use in 2018 - Overall results. (Traffic Safety Facts Research Note. Report No. DOT HS 812 662). Washington, DC: National Highway Traffic Safety Administration.

Figure 2.3 Seat Belt Usage Fatality Chart

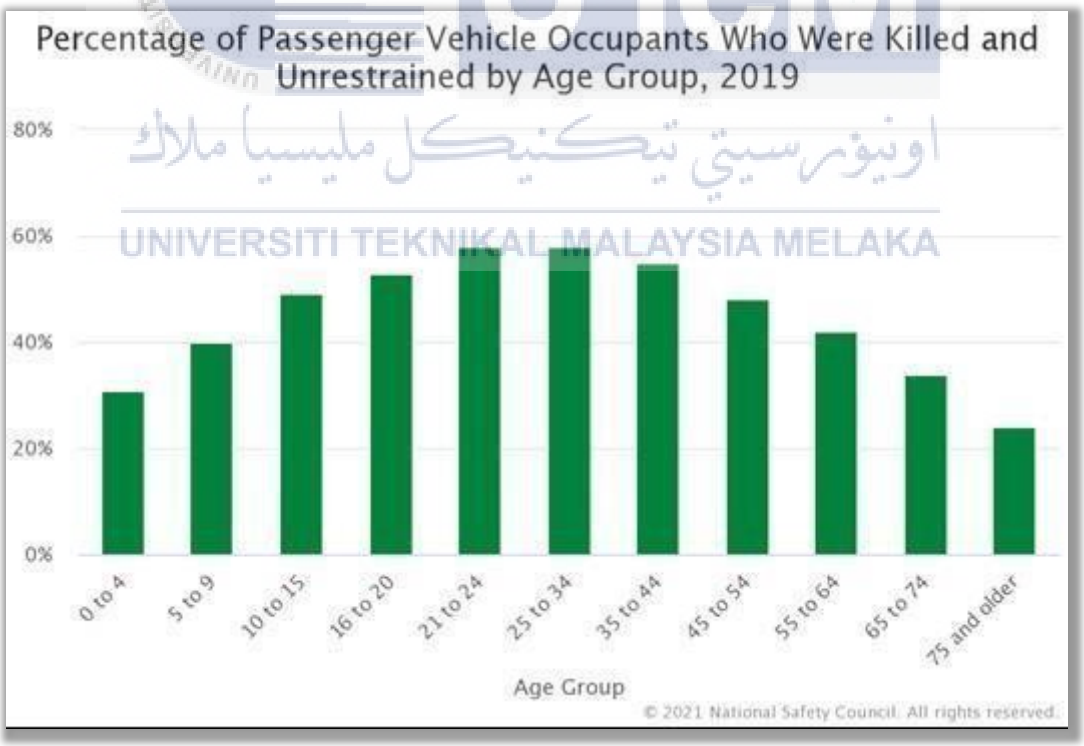

Figure 2.2 Age Group Chart

2.4 Past Research on Related Project

2.4.1 "Developing safety system for monitoring seat belt and controlling speed accordingly to avoid fatal injuries" by Priyal Sheth and Dr. Amarish Badgujar

In this paper that was proposed by a group of researchers[3]. This paper explains a safety system that guarantees the driver and co-passenger wear safety seat belts when driving an automobile. The researchers hope to develop a safety system called "Driver Assistive Safety System" (DASS) that includes ways for teaching mandatory safety precautions through the use of an alert, visual indicator, speed control, and ignition. According to the researchers, fatal injuries from front-seat passengers can be minimized by using a seat belt, citing a study conducted in the United Kingdom.

Figure 2.4 Flow chart of the process of Driver Assistive Safety System

The flowchart above depicts how the system works, as the driver and passenger enter the vehicle, the system will question and display whether they want to drive in highway or city mode. If highway mode is selected, the system will check the engine status. Next, if the

engine is running, the system will monitor the position of the seat belt, while if the engine is not running, the system will check the ignition stage. In addition, the system will monitor the car's seat belt and speed in city mode.

2.4.2 "Babycare Alert System for Prevention of Child Left in A Parked Vechile" by Khairun Nisa Khamli

This research was proposed by [4]. The goal of this study is to create and test a wireless gadget that would sound an alarm and send an alert to the parents if their child is left in the car. The safety pad and the keychain alarm device are the two essential components o f this design. The safety pad's first component is a load sensor that detects the presence of a child in a newborn car seat and alerts parents via smartphone. Second, the keychain alarm devices employ a Radio Frequency (RF) transmitter, which serves as a backup safety feature for the youngster in the event that the parent's smartphone is either not working or lost. When parents walk outside, this device will sound the warning alarm.

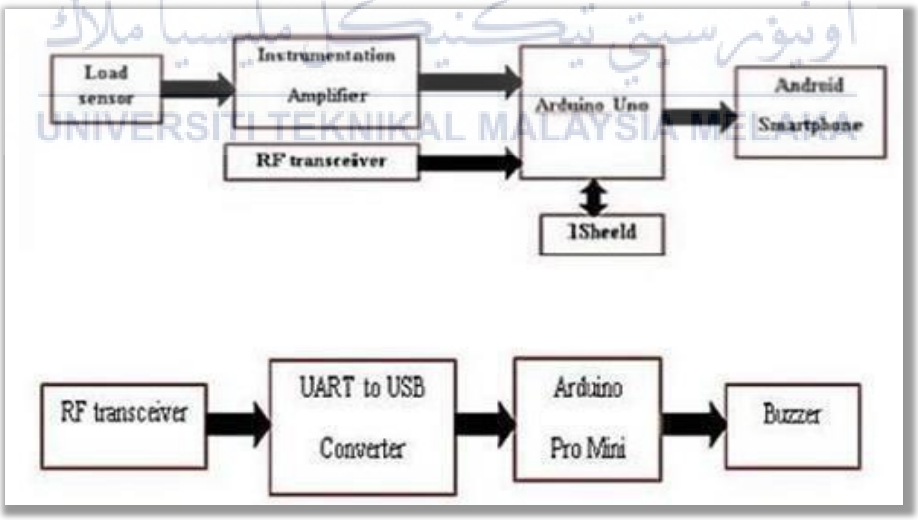

Figure 2.5 Block diagram of safety pad and keychain alarm device

Above is the block diagram for safety pad and alarm device. This system's operation is depicted in the block diagram. Initially, a load sensor was employed to identify the presence of a child in a baby car seat, which triggered the system. The signal from the sensor

will be sent to the RF transceiver, where it will be amplified by the instrumentation amplifier due to the small amount of voltage changes caused. The signal will then pass through Arduino Uno to determine its state, and 1Sheeld will act as an interpreter for the signal sent from Arduino to the Android Smartphone.

The Radio Frequency (RF) transceiver, on the other hand, communicates with the Keychain alarm device by RF signals. The main controller is an Arduino Pro Mini, which is paired with a transceiver that will serve as a proximity sensor. When their RF signals are out of range due to their parents being too far away from the RF transmission range, this will operate as a backup security. The Arduino Pro Mini is a suitable component for restricted space due to the small size required to fit within the Keychain alarm gadget. As for the UART HARDWARE converter, it's used for compiling Arduino code. As a result, the keychain alarm will be a device that serves to inform parents by sounding an alarm anytime a youngster is left inside the automobile owing to a parent's negligence.

2.4.3 "Child In Car Alarm System Using Various Sensors" by Nik Mohd Zarifie Hashim

This research was proposed by [5]. This paper explain about system is designed to detect sound or voice and any movement made by the children that had been left behind in a vehicle. The system's major goal is to construct a comprehensive system that can communicate with humans via the Global System for Mobile Communication (GSM). The module is interacted with and communicated with using a GSM modem. It is used to send and receive Short Messaging System (SMS) messages based on the user's action. The PIC microcontroller serves as the brain of the entire control system. At the end of the process, the system will be able to detect the sound emitted by a human at maximum volume.

The researcher mentioned [5] that to detect the presence of youngsters in a car, the system uses Radio Frequency Identification (RFID) technology. The RFID is packaged in an RFID tag that includes an antenna connected to the tag electronics by a switch. The RFID tag is fastened to the child's seat, and the tag reader is installed in the vehicle's cabin. The tag reader and the tag reader's communication and the tag is wireless. Figure 2.6 below shows the schematic of control system.

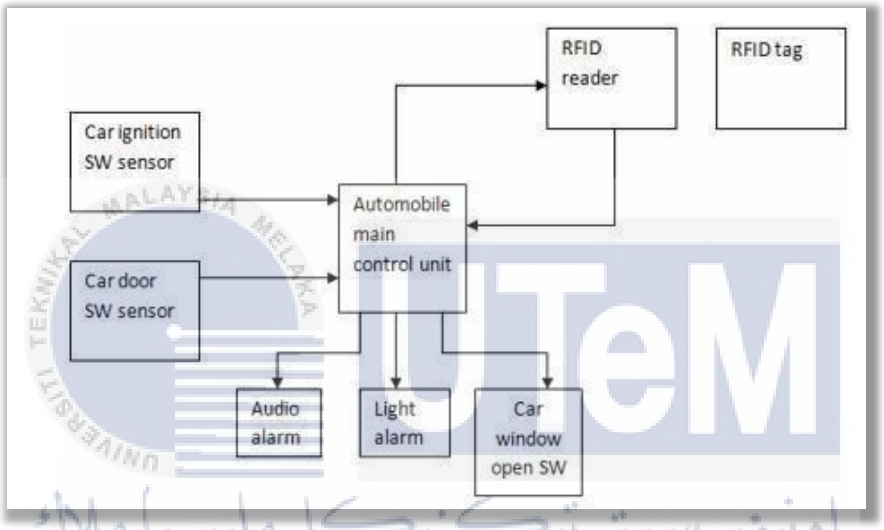

Figure 2.6 Schematic for Control System

The child seat is safely placed in the vehicle's back seat, and the child is fastened in the child seat by a child seat safety belt. These regulations were enacted to safeguard children from harm while being transported in motor vehicles, and they are carefully enforced. However, children have been left behind in unattended vehicles in the past due to a variety of conditions. Figure 2.7 below shows block diagram of the alarm system

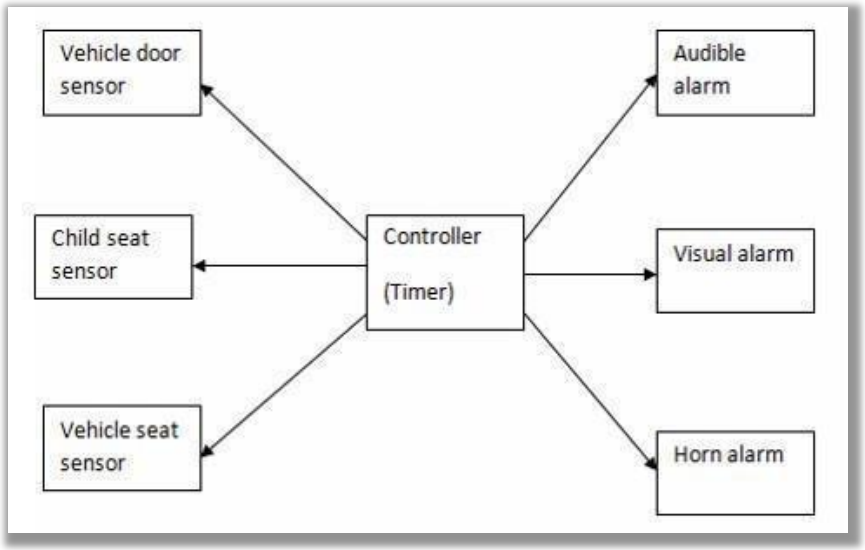

Figure 2.7 Block diagram of the alarm system

2.4.4 "Vehicle Interior Movement Detection and Notification System" by Fairuz Rizal and Mohammad Rashidi

This research was proposed by [6]. This paper explained about a system that will detect any motion or movement from the vehicle's interior and informed the owner by sending an SMS alert message. The researcher mentioned that the main purpose of the alarm is to keep the car safe from outside intrusion, not inside. Therefore, a car must have a notification system that can alert and warn the owner or driver if there is any interior movement while they are away. Because the driver's automobile is normally parked in a remote location, such as a parking lot or a basement, the only option to contact with them is through mobile phone connections. Hence, the notification system requires access to a long-range phone communication system, such as GSM. All that was required was a mechanism for detecting internal movement in a parked car and then sending an SMS text message to the driver alerting them to any movement. Aside from the proposed system's simplicity, the cost must be as low as possible in order for it to be feasible.

The main components of the system will be a microcontroller, a motion detector, and a GSM module. The algorithm will also be kept as basic as possible so that the system can run smoothly without having to perform any difficult instructions. The motion sensor must be programmed to activate only when it detects movements that happened inside the car while it was parked. This circumstance can be set in a variety of ways, such as when the car's doors are locked, the engine is turned off, or the transmission gear in an automatic transmission car is set to "P." When motion is detected, the CPU sends a command to the GSM module, which then sends an SMS text message to the driver. Figure 2.8 below shows the system architecture.

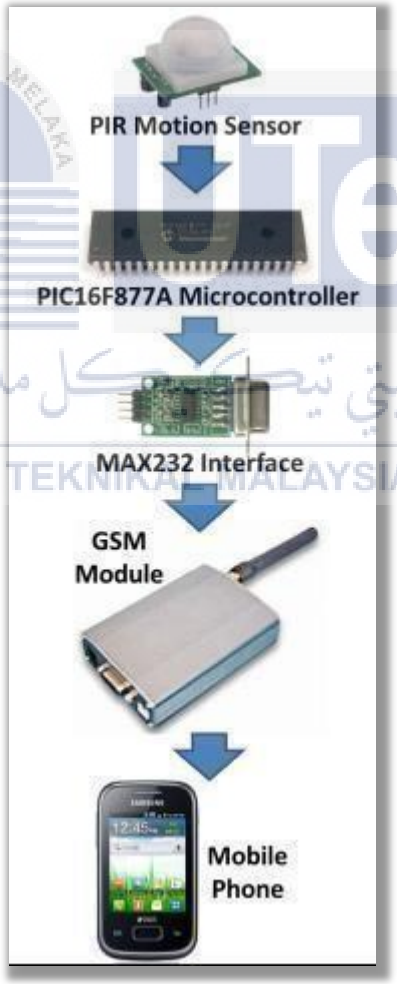

Figure 2.8 System architecture

2.4.5 "Car Safety System Enchancements using Internet of Things" by Vyas Viral M, Viraj Choksi, M.B Potdar

This research was purposed by [7]. This paper describes the Alcohol detection in the automobile, as well as IoT-based accidental location detection. When an accident occurs, an Emergency message with location information is sent for the safety of those who are seated inside the vehicle. These systems must be compelled to be installed inside the vehicle. Also included is proper car seat-belt detection; if the driver's car seat-belt is activated, the car is ready to drive otherwise, it is not.

The researchers mentioned that The Internet of Things (IoT) allows objects to be sensed or controlled remotely over existing network infrastructure, allowing for more direct integration of the physical world into computer-based systems and, as a result, improved efficiency, accuracy, and economic benefit, as well as less human intervention.

Figure 2.9 below shows the flowchart of this system, the system will wait for 3 second of heating coil and will proceed to alcohol sensing if it detected the alcohol value is high the car ignition will not start and a message will display. While, if there is no alcohol value are detected the system will display message and the car ignition will work. However, during the owner driving and the system detects alcohol sensing, the system will display alert message for 3 second.

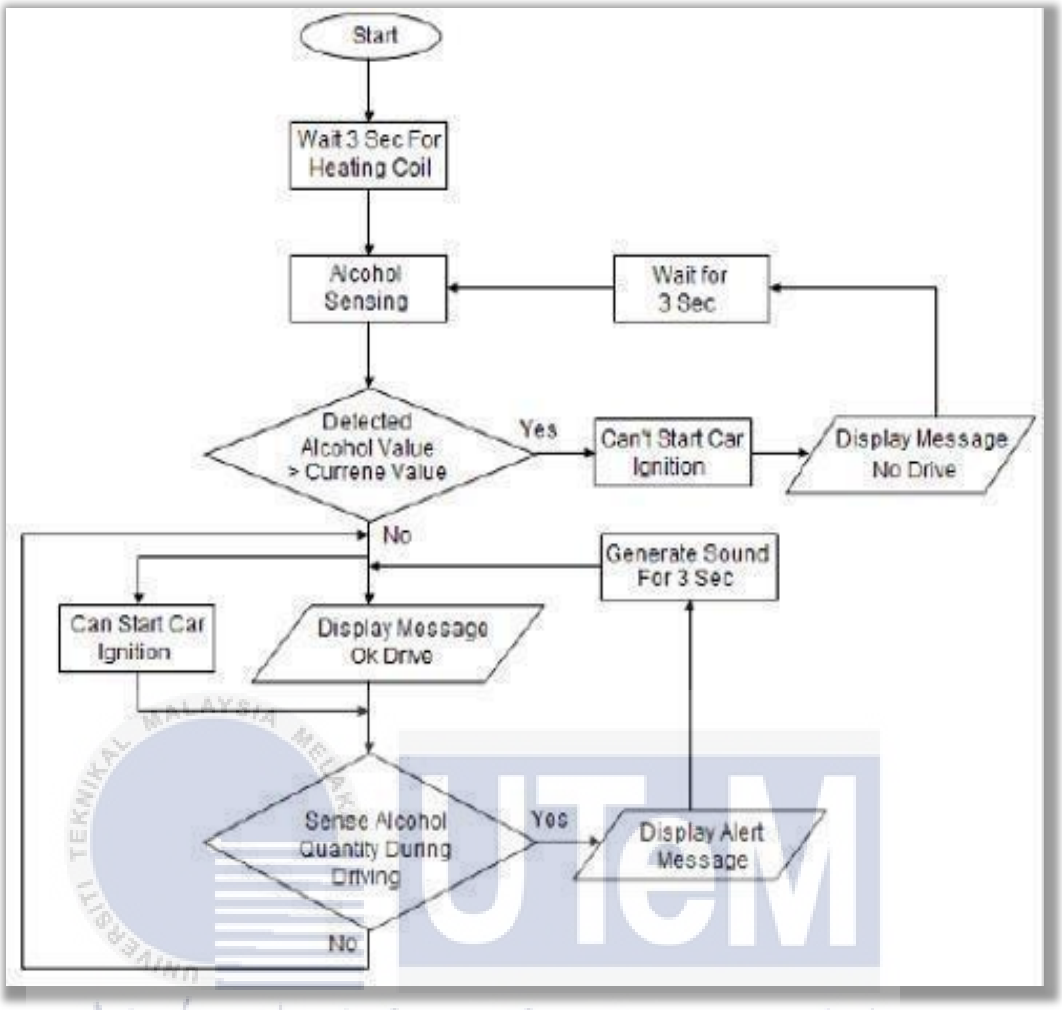

Figure 2.9 Flow Chart of Alcohol Detection

Figure 2.10 below shows a flowchart for the seat belt safety system. For detecting if a proper seat is in place or not, an IR sensor and an encoder wheel were employed to count pulses of sensing how much length of seat belt is being pulled. The ARM-7 receives the output of both sensors. The seat belt is properly connected or not, according to the microcontroller. Thus, if both sensor outputs are valid, the microcontroller determines that the seat belt is securely fastened; otherwise, the seat belt alarm sound will continue to ring.

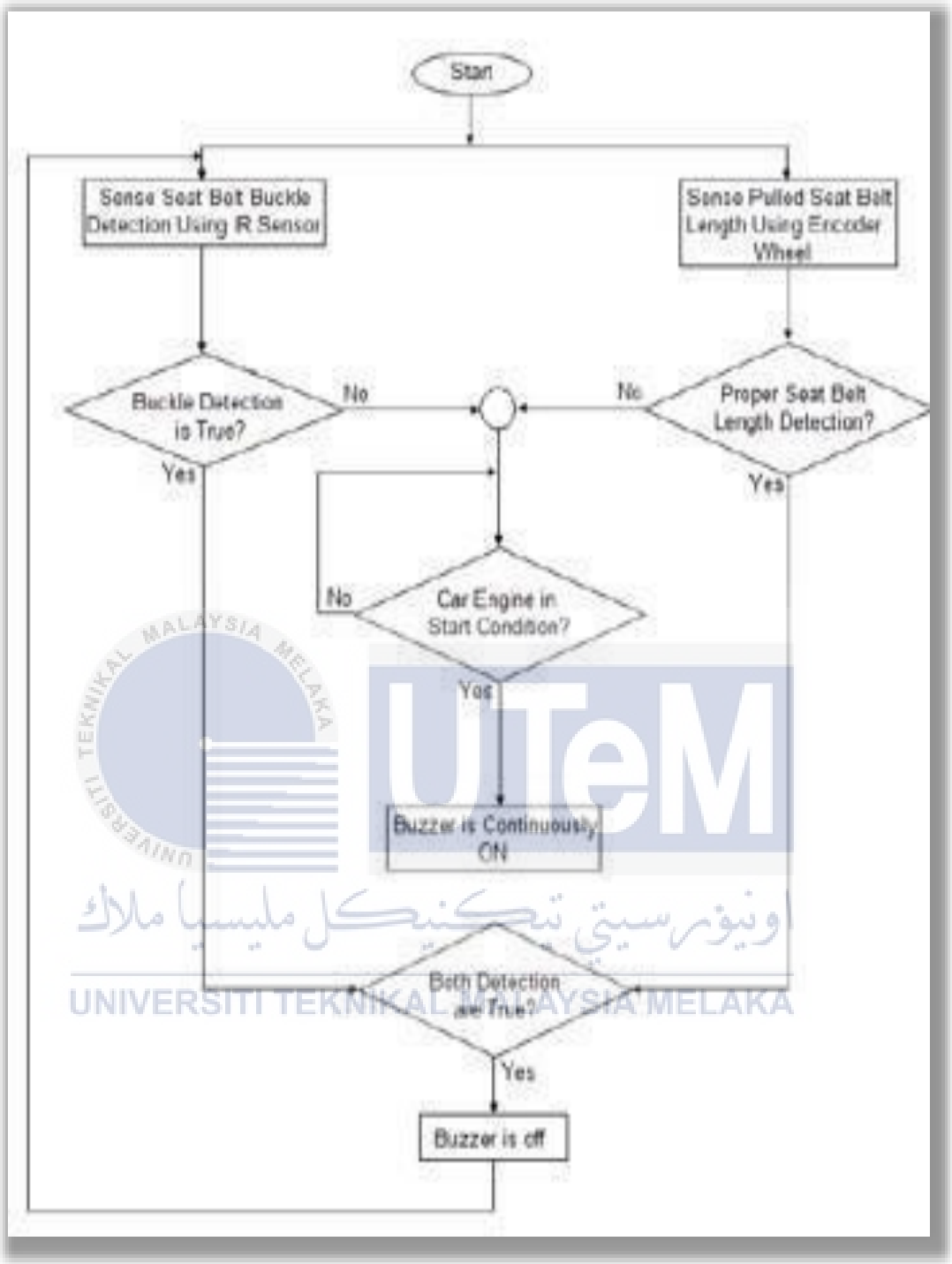

Figure 2.10 Seat Belt detection flowchart

2.5 Matrix Table

No	Title	Author	Summary	Application
1	Developing safety system for monitoring seat belt and controlling speed accordingly to avoid fatal injuries	Prival Sheth, Dr. Amarish Badujar	This study focuses on a safety system known as the "Driver Assistive Safety System" (DASS), Which includes ways for teaching mandatory safety procedures through the use of an alarm visual indicator, speed control, and ignition. This system's purpose is to ensure that the seat belt is already fasten when driving an automobile. On the driver safety system, the concepts of "Ignition interlocking" and "speed control" are applied	Arduino, Photoresistor sensor, wheel speed sensor, relay, LED, Audio system and Display

2	Baby care Alert System for prevention of Child Left in A Parked Vehicle	Khairun Nisa Khamli	The safety pad and keychain alarm gadget are described in this article. A warning alarm will be used to activate the system. The system has been successfully employed as a key technology system, and it has been integrated into smartphones	Arduino Uno, Arduino pro mini, Buzzer, Instrumentation amplifier, load sensor, Transceiver and 1sheeld application.
3	Child in car alarm system using Various sensors	Nik Mohd Zarifie Hashim	This journal describes that the system able to detect motion performed by person and can detect any sounds that produced inside the car. GSM is used to communicate with people at great distance. If the sensor able to detect sound or movement it will send signal to alert the parents.	GSM module, PIR sensor, Smartphones, PIC microcontroller, MAX232 interface

4	Vehicle Interior Movement Detection and Notification System	Fairuz Rizal, Mohamad Rashidi	This journal describes that the system will detect any motion from inside vehicle and alert the owner via SMS message. This system is successfully designed and tested	Mobile phone, MOD 9001-D GSM, GPRS modem, PIC 16F877A, PIR Sensor, LM7805 chip, MAX232 interface
5	Car Safety System Enhancements using Internet of Things	Vyas Viral M, Viraj Choksi, M.B Potdar	This research journal describes that the system called Alcohol Detector in Car is able to protect people in case the owner is affected by alcohol. This system will detect the levels of alcohol consumed if it in danger level the car ignition will not start	ARM 7, LPC2148, GPS module, Tilt sensor, Alcohol sensor, Encoder wheel, IR detector, LCD, Relay, Car ignition and buzzer.

2.6 Summary

In essence, various literature reviews have been developed by a deeper understanding of the Design of IoT Baby Car Seat with Unfasten Alert System that has been gathered from earlier researches, projects, and journals. Furthermore, the literature studies can be used to implement theoretical concepts and some valuable ideas that have been explored and discussed.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter describes each component of the project and provides a theoretical explanation of the project layout. Furthermore, this chapter explains and depicts the project process in detail. As a result, this chapter will clarify the flowchart to understand the project process better. In addition, this chapter will cover the components as well as the steps involved in constructing the circuit. Also included is the Arduino IDE software, which will be used to run the operation and create this project. This chapter covers the entire project, from its inception to completion.

3.2 Work Flow

A flowchart is a formalized diagram that depicts a logic sequence, work or manufacturing procedure, organizational chart, or other types of information. When dealing with a project, it is to explain things to people in plain language. It is used to propose planning and to try to gain people's understanding of the project. To get good results for future projects, it's critical to show a better flow of charts. There are numerous resources and methods that can be used to improve as long as they support the project's design and execution. The resources and methods for the project can be found in research, journals, and other sources as references. The goal is to create a higher-quality project. Furthermore, the analysis process is concerned with the steps that have been identified in order to improve the project plan based on the problem activities encountered during the project's operation. Figure 3.1 below show the process of project

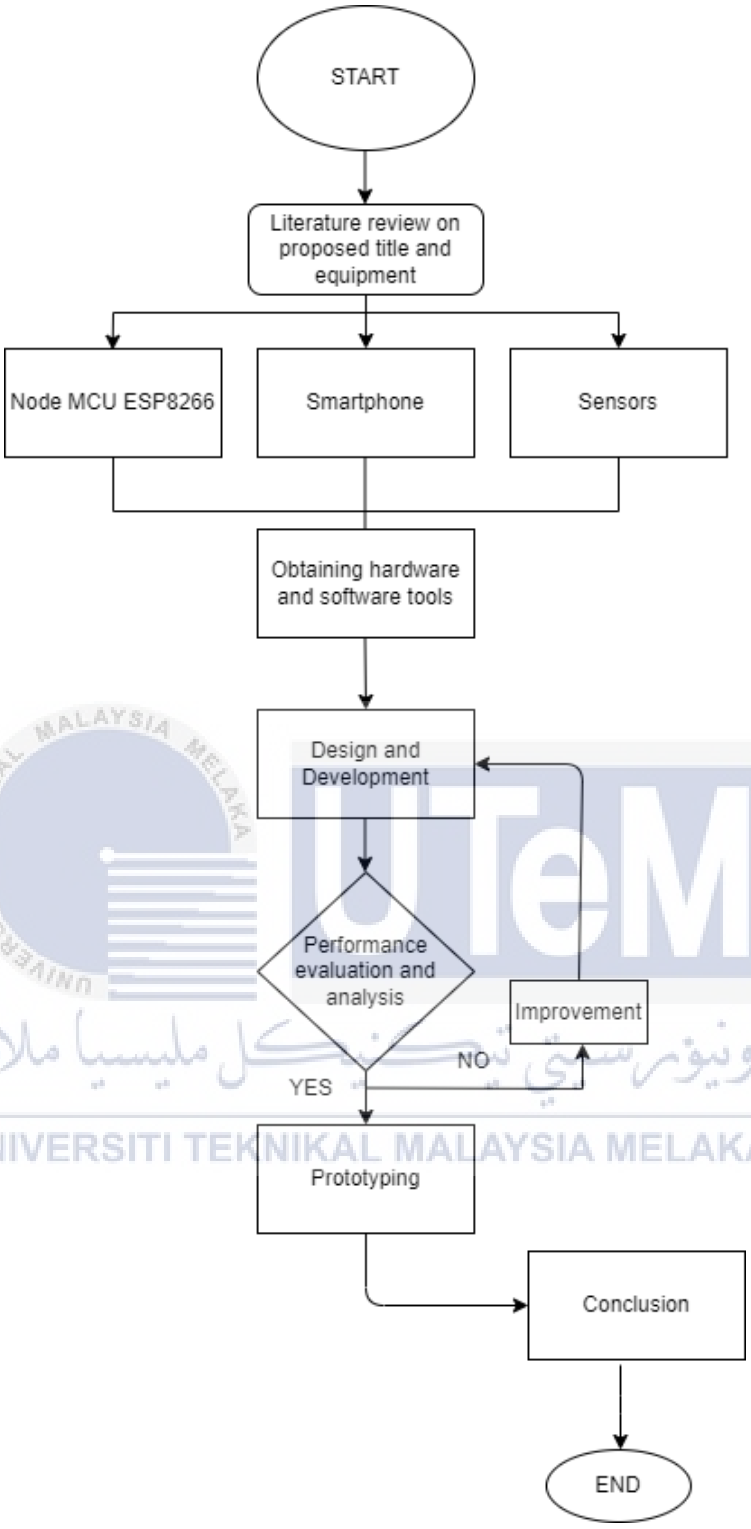

Figure 3.1 Work flow of this project

3.3 Design

Design and Development of project, the project circuit and system will be design based on block diagram. A block diagram is a diagram of a system in which the main components and functions of hardware, software, and mechanisms are represented by blocks that are connected bylines to show the relationships between the blocks. As shown in figure 3.2 below.

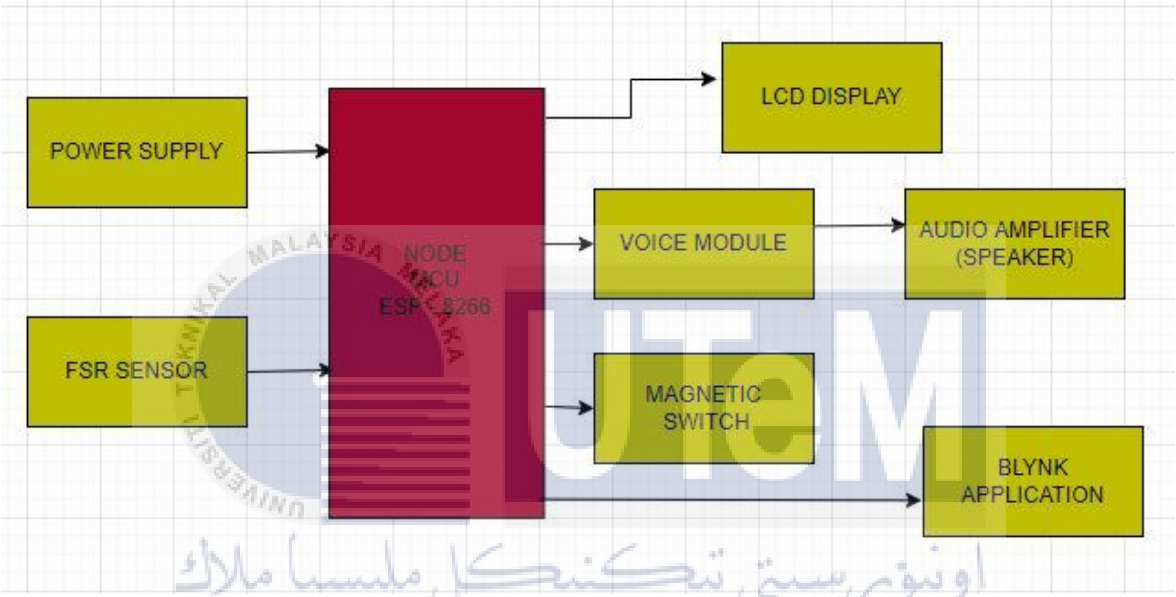

Figure 3.2 Block diagram of the Project

This project, however, is also built on a flow chart. A flow chart is a diagram that shows how a process works. It is a graphic representation of the project's step by step method. The flow chart of an IoT baby car seat with an unfastened alarm is shown in Figure 3.3 below. As shown below parents will get notification on their smartphones whenever the seat is occupied and the magnetic switch are triggered.

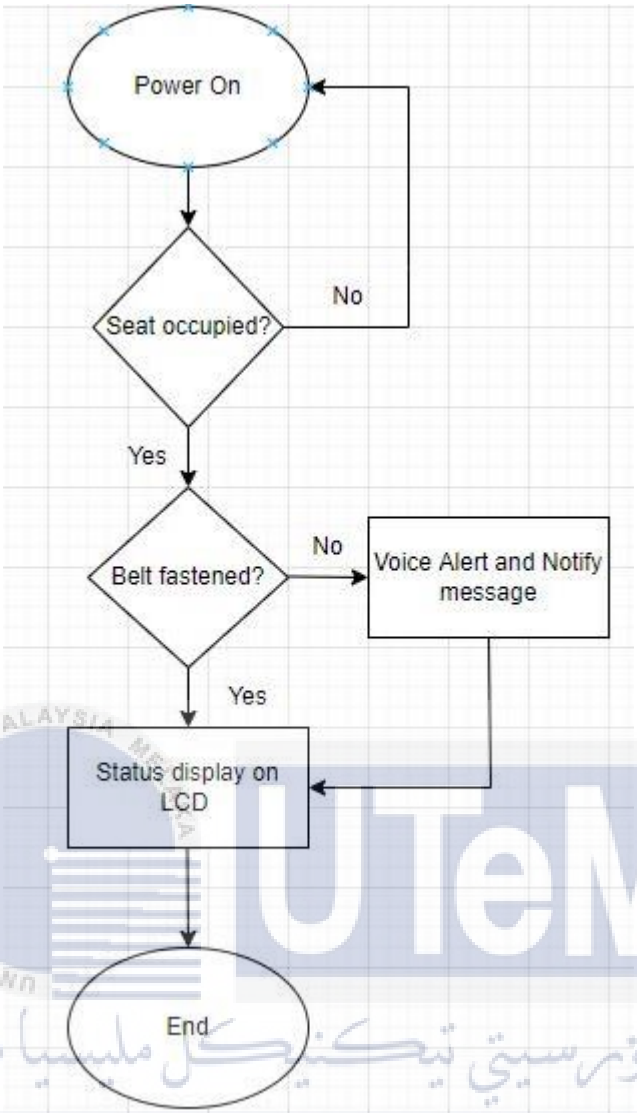

Figure 3.3 Flowchart of the project

3.4 Implementation

Figure 3.4 below shows a schematic circuit of this project. Since the power supply is 9V, a voltage regulator will be use in this project due to Node MCU require only 3.3v to power it. FSR is used to detect pressure which indicate if the seat is occupied by the toddler or not. The magnetic switch is used for the belt to detect if it buckled or not. However, to activate the magnetic switch it will require data from the Node MCU first if the seat is

occupied or not. Once the process is complete the system will display on LCD display and send the notification via Blynk app.

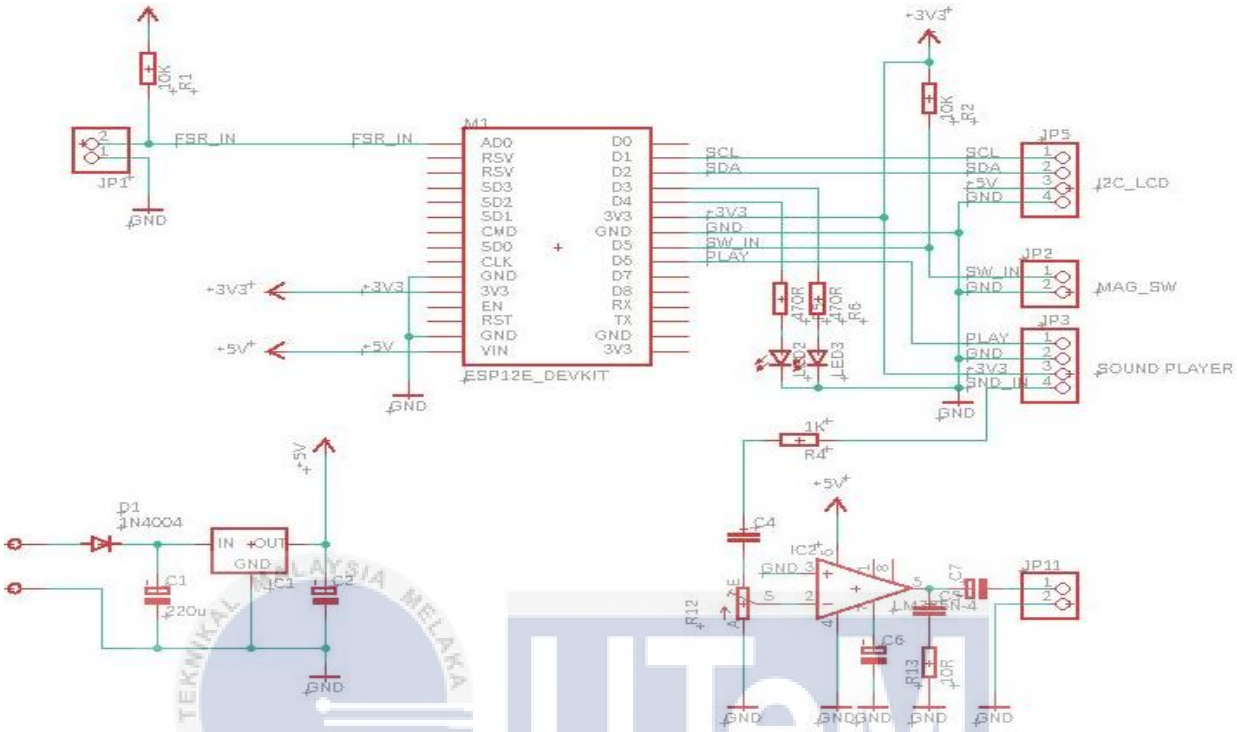

Figure 3.4 Schematic circuit

3.5 Hardware Requirement

3.5.1 Node MCU – ESP 8266

Figure 3.5 Node MCU ESP8266

Since the project is IoT based, Node MCU is the best microcontroller for this type of project due to it is much cheaper cost than Arduino and the in-built Wi-Fi/Bluetooth feature. In order to power up the Node MCU, it can be powered by simply connect it with computer through USB cable or connect it with A/C to D/C adapter or 9V battery since the voltage need to power up this component only required 3.3V plus it has an inbuilt voltage regulator. The function of this Node MCU is to receive the signal from the sensors which are located at belt and vehicle seat. Then it will process the data and determine the exact condition. Then, the status will display to LCD display if the baby or toddler is buckled or not, if the belt somehow unbuckled it will send the notification to the parent smartphones by using Blynk application through Wi-Fi communication. Additionally, Node MCU programmable with Arduino IDE which use same language as Arduino itself. Table 1 below shows the description of pin outs in Node MCU ESP 8266.

Table 1 Pinout description in Node MCU ESP8266

Pin	Name	Description
Power	Micro-USB,3.3V GND, VIN	Micro-USB: Node MCU can be powered through USB port 3.3V: Regulated 3.3V can be supplied to this pin to power board GND: Ground pins Vin: External Power supply
Control Pins	EN, RST	The pin and the button reset the microcontroller
Analog Pin	A0	Used to measure analog voltage in the range of 0-3.3V
GPIO Pins	GPIO1 to GPIO16	Node MCU has 16 general purpose input-output pins on its board
SPI pins	SD1, CMD, SD0, CLK	Node MCU has four pins available for SPI communication.
UART Pins	TXD0, RXD0, TXD2, RXD2	Node MCU has two UART interfaces, UART0 (RXD0 and TXD0) and UART1 (RXD1 and TXD1). UART1 is used to upload the firmware/program.
12C Pins		Node MCU has 12C functionality support

3.5.2 Force Sensing Resistor Sensor

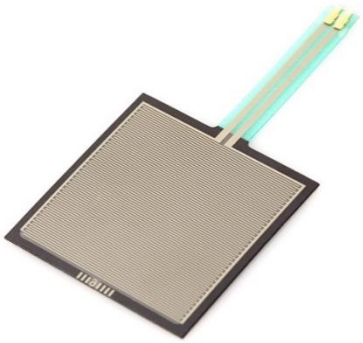

Figure 3.6 Force sensing resistor

This project will use two sensors and one of them is FSR sensor which will be placed under the baby car seat to detect pressure. If the sensor detected a pressure while the belt is unbuckled it will trigger the system and alert the parent via voice module and notification through Blynk application. Since, the FSR is made up of two layers separated by a spacer. The more one presses, the more of those Active Element dots come into contact with the semiconductor, lowering the resistance. FSR are essentially resistors that alter their resistance value in ohms based on how hard they are pressed. These sensors are inexpensive and simple to use, but they are rarely precise. However, for this project, it will be great because the system will be triggered as long as there is pressure on the seat.

3.5.3 Magnetic Switch

Figure 3.7 Magnetic switch

This project will employ a magnetic switch to detect the status of the belt. The switch is made up of two components that can detect whether they are close to one other, making it ideal for seat belts. A reed switch moves in reaction to the presence or absence of a magnetic field in the piece containing the wires. However, to trigger the alert, the FSR must be triggered first when toddler occupy the car seat.

3.5.4 Voice Module

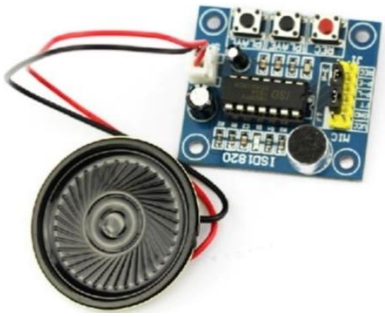

Figure 3.8 ISD 1820

Figure 3.8 above shown the voice module that will be used for the project IoT Baby Car Seat with Unfastened Alert. The Voice record module employs the ISD1820, a multiple-message record playback device. It can record real single-chip voice, save it to non-volatile memory, and then play it again for 8 to 20 seconds. The operational mode selector switch LED will light up if the board is recording. Audio can be recorded for up to 64 seconds. All of the pins on the ISD1932 have been broken out to 0.1" headers. This module is simple to use and may be controlled by a push button on the board or a microcontroller. It requires a supply voltage of 2.4V to 5VDC. 8-ohm speaker driver on-chip Make a recording of up to 20 seconds of audio.

3.5.5 Voice amplifier

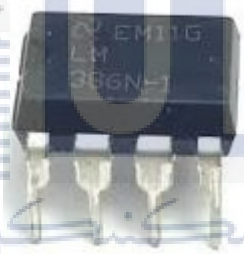

Figure 3.9 LM386n

Figure 3.9 above shows the LM386n. The LM386n is a low-power audio frequency amplifier that's included in a lot of compact audio amplifiers. Because the IC uses very little power, it can easily be powered by a 9V battery. With a configurable gain of 20 to 200, it can easily drive an 8-ohm speaker. Controlling the volume and gain is also possible. The IC is packaged in an 8-pin PDIP box and requires relatively few components to operate, making it extremely simple to use. Since the audio of voice module considered low, the LM386n must be use to amply the audio. Moreover, usually the toddler guardians are elder which some may have hearing trouble. Thus, with this component that able to amplify the audio it is great addition.

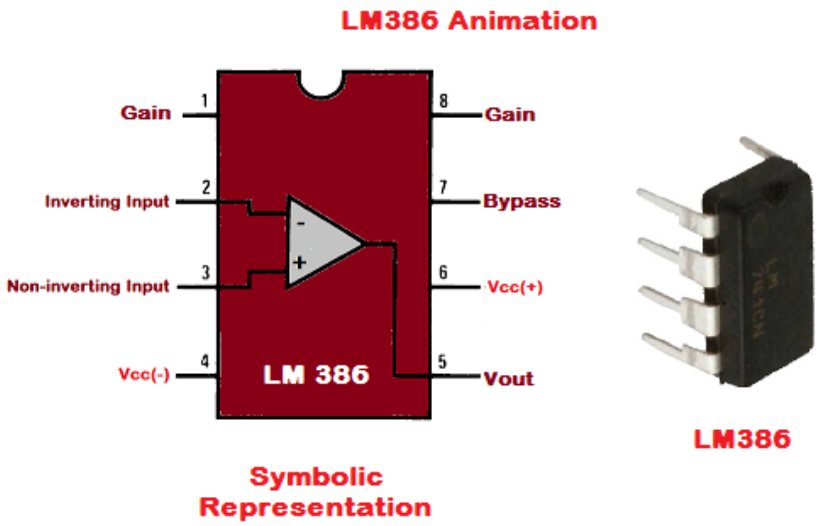

Figure 3.10 Pinout of LM386

3.5.6 LCD Display

Figure 3.11 LCD 1602 Display

Figure 3.11 above shows an LCD display. The liquid Crystal Display (LCD) is a term that refers to a type of display that uses liquid crystals. It is essentially a display unit that generates a visible image using liquid crystals. When current is passed through this unique type of crystal, it becomes opaque, blocking the backlight from behind the screen. As a

result, that particular area will appear darker than the others. That how the letters appear on the screen.

Table 2 Pinouts of LCD 1602

Pin no	Pin name	Description
1	VSS	Ground pin connected to system ground
2	VDD 5V	Powers the LCD display ranging from 4.7V to 5.3V
3	VE	Decides the contrast level of display.
4	Register Select	Connected to microcontroller to shift between command/data register
5	Read/Write	To read or write data. Usually grounded to write data to LCD
6	Enable	Connected to Microcontroller Pin and toggled between 1 and 0
7 - 14	Data pin 0 - 7	Data pins 0 to 7 forms an 8-bit data line. Also, can operate on 4-bit mode
15	LE Positive	Backlight LED pin positive terminal
16	LE Negative	Backlight LED pin negative terminal

3.6 Software

3.6.1 Arduino IDE

This project uses Node MCU ESP 8266 as the main microcontroller which also can use Arduino IDE as the platform to configure the program and compile coding using C language into the Node MCU ESP 8266. This software is very straight forward which have two parts which is Editor and Compiler that can be used to build, compile and upload the code into Node MCU. Figure 3.12 below shows that in order to use the Arduino IDE platform with Node MCU, the board selected must be in Node MCU 12E module.

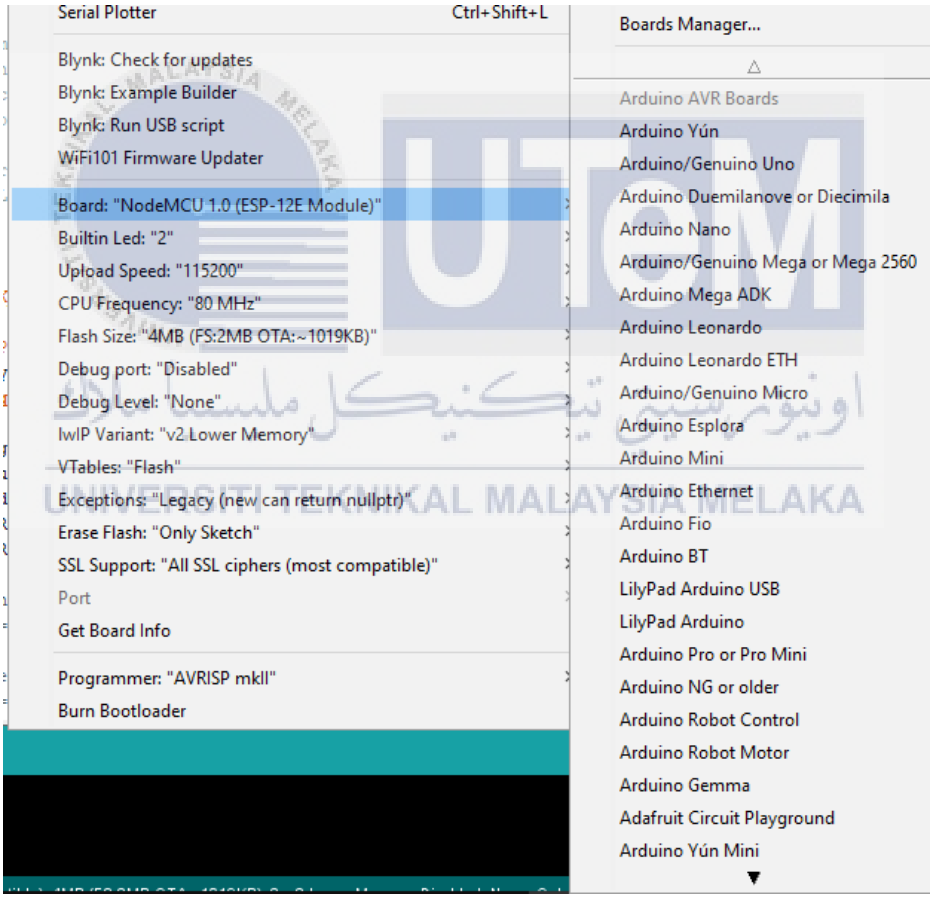

Figure 3.12 Board selected Node MCU

3.6.2 Blynk Application

Blynk is known as the most user friendly IoT platform, consisting of an app builder that can run on iOS and Android operating systems, as well as a set of libraries for creating fantastic IoT apps in minutes with hardware platforms[8]. It enables the user to quickly create interfaces by dragging and dropping widgets to control and monitor hardware projects from iOS and Android devices.

Blynk application is a great free IoT platform especially for IoT projects which require to connect with microcontroller. The Blynk application contain graphical widgets, virtual LED, LCD, buttons and value displays. Also, the wide range of devices and connectivity types that the Blynk platform support. This project use Blynk application for interface and notification message in case of unfasten seat belt. The widgets will be use are 2 LED's as an indicator for FSR sensor and Magnetic Switch, an LCD Display to display the status of seat belt and pressure detected and a notify functions will be applied as well.

3.7 Summary

In summary, the project Design of IoT Baby Car Seat with Unfastened Alert can be done if the components needed and the design of the circuit are correct and implemented correctly the project can be success.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

In this chapter the results of design of IoT baby car seat with unfasted alert will be described and analyzed. Moreover, the Arduino IDE will be shown in this chapter for configuring the Node MCU to connect to an android application.

4.2 Configuration

Figure 4.1 connecting Node MCU below shows the results of connecting Node MCU to android application which is Blynk. Two LED has been used to act as indicator for FSR sensor and magnetic switch. In addition, the purpose of this is to test the functionality of Node MCU to connect to android application via Wi-fi. Arduino IDE has been used to configure the Node MCU.

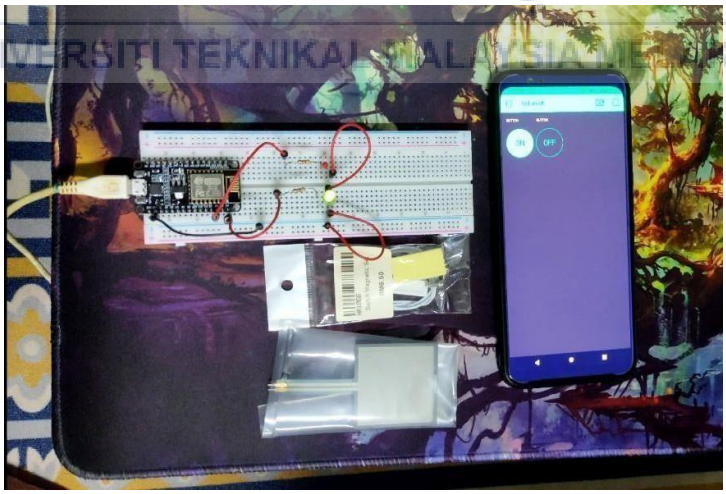

Figure 4.1 Connecting Node MCU

This project uses the Arduino IDE as open source tools to design and develop the operation of this project, which was used to satisfy the aims and also meet the expected result. This software accepts the programming languages C and C++ by using the specific code structure approach. Aside from that, Node MCU ESP 8266 has been programmed using the Arduino IDE. Figure 4.2 below shows the Node MCU configuration.

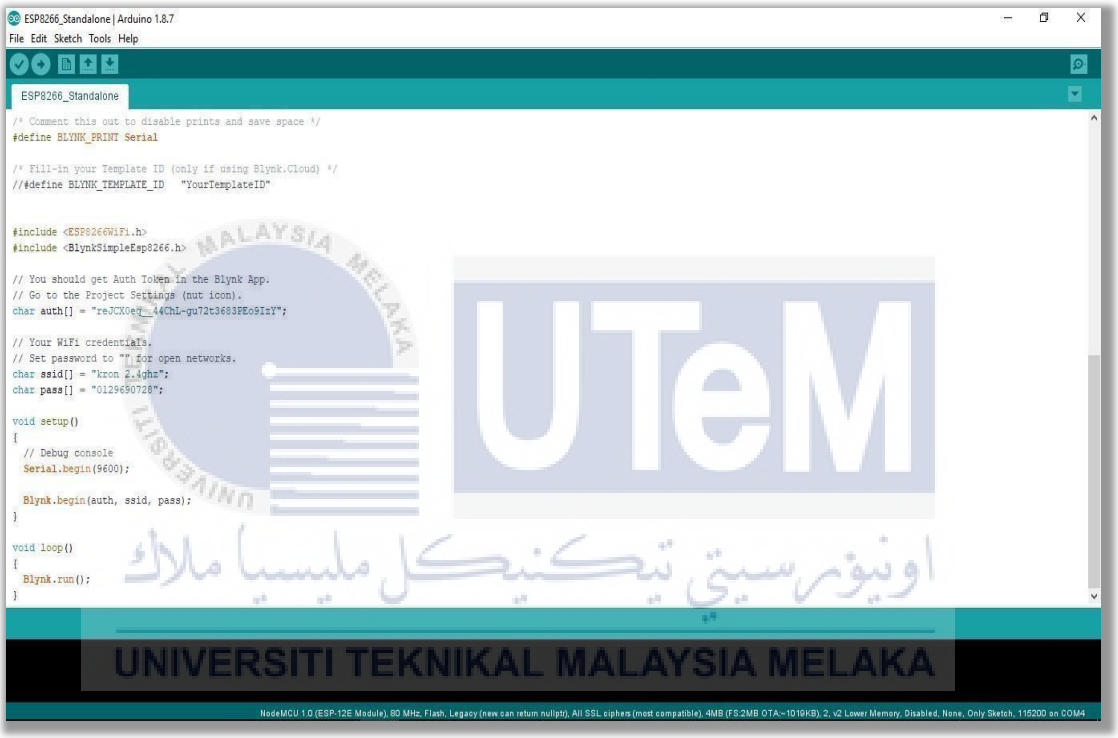

Figure 4.2 Node MCU configuration

4.3 Project Testing

This section explores the Design of IoT Baby Car Seat with Unfastened Alert with IoT project. This project was done successfully and functions great. The system uses 9V battery as power supply which are connected to the circuit with the 5V regulator on board, this is because the LCD display and ISD 1820 voice module only require 5V input while the two sensors only uses 3.3V input. The 3.3V input source for sensors are from the node MCU as shown in the figure 4.3.

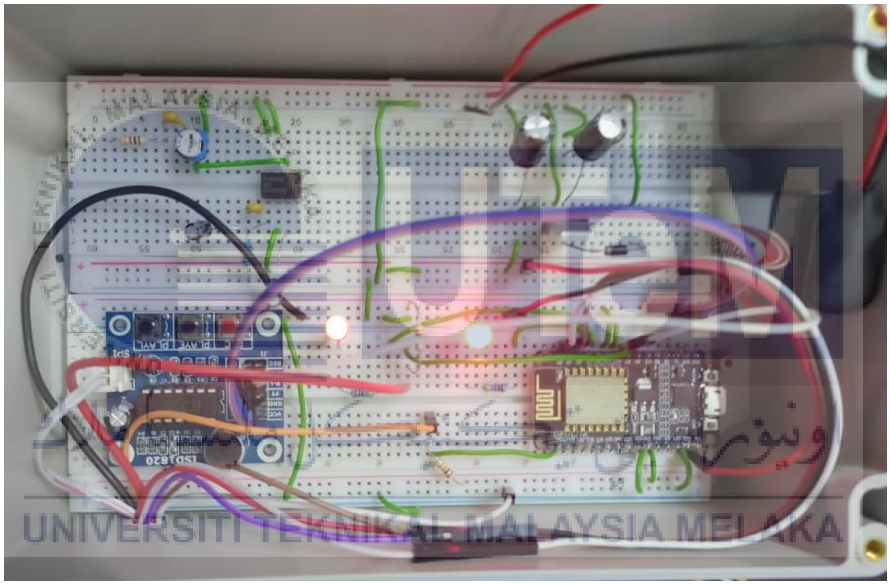

Figure 4.3 Prototype Circuit

As shown below in figure 4.4 is the front view of the project prototype which operate successfully, the FSR sensor and Magnetic switch both functions well and the LCD Display output just as planned, where, whenever the FSR sensor detect pressure the LCD will display "Occupied" and if the status of belt is "Belt Off" the voice alert will triggered at the same time a notification will appear on the Blynk application. However, if the status of seat belt display "Belt On" on LCD then the voice alert will not set off indicating that the baby or toddler is secured and save. Figure 4.5, 4.6, 4.7 shows LCD display.

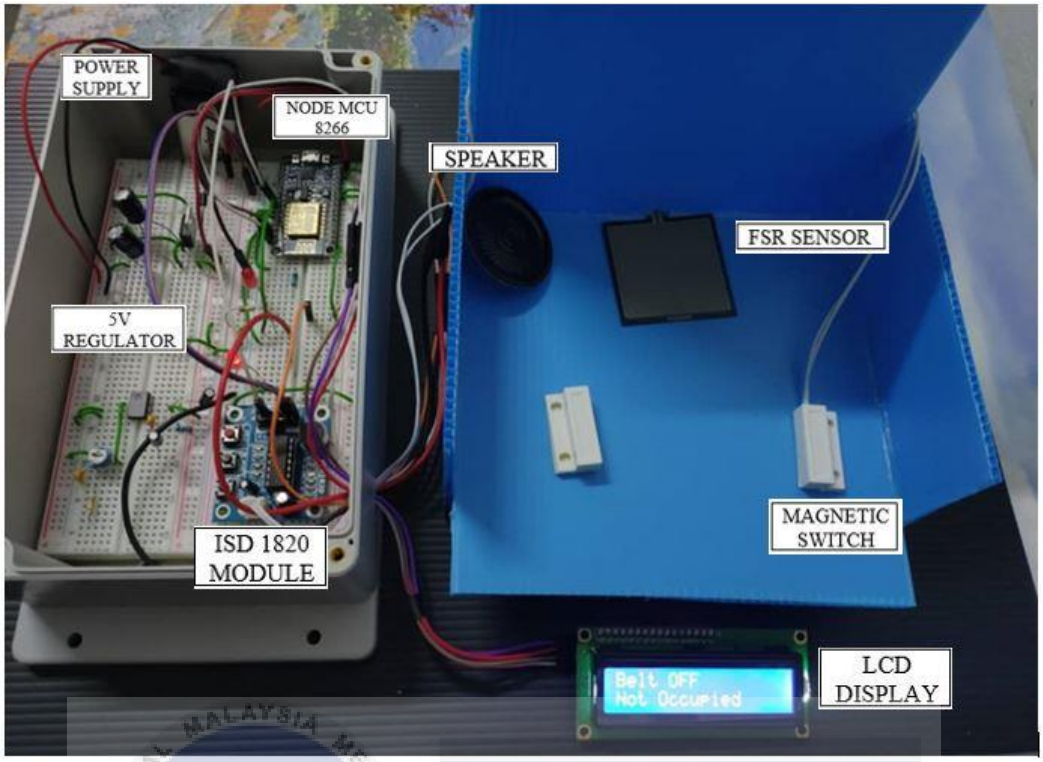

Figure 4.4 Front view of prototype

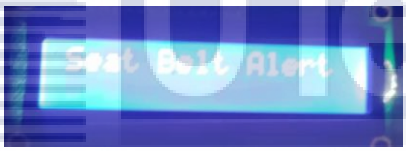

Figure 4.5 Initialized display

Figure 4.6 Belt status display Off

Figure 4.7 Belt status display On

As shown in figure 4.8 below, is the interface of the project by using Blynk application. The interface contains 2 LED as an indicator for two sensors which are FSR and Magnetic switch and LCD display also has been applied along with a notification message in case the seat belt status is unfastened as shown in figure 4.9.

Figure 4.8 Blynk Application Interface

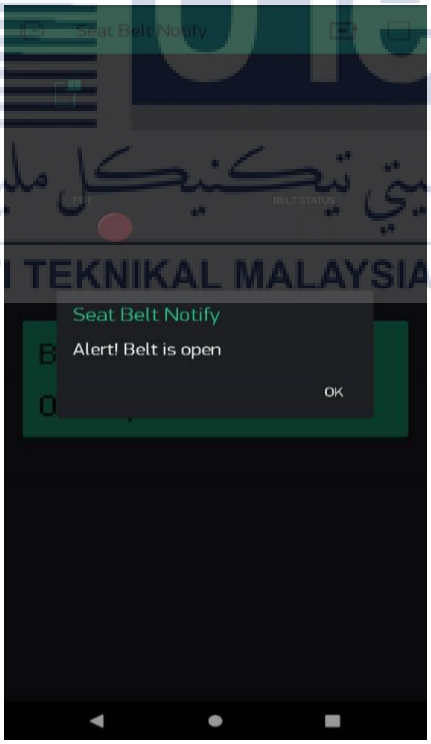

Figure 4.9 Notification Message

4.4 Project Coding

This project uses the Arduino IDE as open source tools to design and develop the operation of this project, which was used to satisfy the aims and also meet the expected results. This software accepts the programming languages C and C++ by applying the specific code structure approach. In addition, the Node MCU ESP 8266 was programmed with the Arduino IDE. Other components associated with the Node MCU ESP 8266 were also detected in programming based on the pinout of the Node MCU ESP 8266 given in following Figure 4.10.

```
#define BLYNK_PRINT Serial

#include <ESP8266WiFi.h>          // Wifi Library
#include <BlynkSimpleEsp8266.h>   // Blynk library for NodeMCU
#include <LiquidCrystal_I2C.h>    // I2C LCD library

#define   magSwitch    D5         // Magnetic Switch input pin
#define   soundPlayer  D6         // Soung player enable input pin
#define   ledON        D3         // Magnetic Switch active LED pin
#define   FSRpin       A0         // FSR input pin
#define   FSRthreshold 400        // FSR reading threshold
```


Figure 4.10 Pinout of Components connected with ESP 8266

Apart from that, the magnetic switch sensor, force sensing resistor (FSR), and speaker have been programmed in line with the project's specifications. These programs were written in C, as shown in Figures 4.11, 4.12, 4.13, and 4.14.

```
// Auth Token in the Blynk App
char auth[] = "reJCX0eq__44ChL-gu72t3683PEo9IzY";

// WiFi credentials
char ssid[] = "kron 2.4ghz";    // Network ID
char pass[] = "password123";    // Password

int FSRvalue;                // ADC measurement of FSR value

LiquidCrystal_I2C lcd(0x27,16,2);    // 16x2 LCD address - 0x27
BlynkTimer timer;              // Blynk Timer object
WidgetLED beltLED(V0);         // Belt fastened status LED
WidgetLED pressLED(V1);        // Pressure Sensor status LED
WidgetLCD lcdB(V2);            // Blynk LCD

// Function to update Blynk with the data ------------------
void timerEvent(){
```

Figure 4.11 Blynk interface pinout

```
// Read pressure sensor status ---------------------
FSRvalue = analogRead(FSRpin);      // Read ADC value of FSR
Serial.print("Analog = ");
Serial.println(FSRvalue);
if(FSRvalue < FSRthreshold){        // Pressure below threshold
  pressLED.on();
  lcdB.print(0,1, "Occupied    "); // Blynk LCD update
  lcd.setCursor(0,1);
  lcd.print("Occupied    ");
  if(!digitalRead(magSwitch)){      // Read belt swich active
    beltLED.on();                   // Belt LED ON in Blynk
    lcdB.print(0,0, "Belt ON ");    // Blynk LCD update
    digitalWrite(ledON, HIGH);
    lcd.setCursor(0,0);
    lcd.print("Belt ON ");
  }else{
    beltLED.off();                  // Belt LED OFF in Blynk
    delay(1000);
    Blynk.notify("Alert! Belt is open");
    digitalWrite(soundPlayer,HIGH);  // Play sound Alert
    lcdB.print(0,0, "Belt OFF");
    digitalWrite(ledON, LOW);
    lcd.setCursor(0,0);
    lcd.print("Belt OFF");
    digitalWrite(soundPlayer,LOW);
  }
```

Figure 4.12 Sensor Coding

```
  }else{
    pressLED.off();                    // Pressure above threshold
    lcdB.print(0,1, "Not Occupied "); // Blynk LCD update
    lcd.setCursor(0,1);
    lcd.print("Not Occupied");
    if(!digitalRead(magSwitch)){
      beltLED.on();                    // Belt LED ON in Blynk
      lcdB.print(0,0, "Belt ON ");     // Blynk LCD update
      digitalWrite(ledON, HIGH);
      lcd.setCursor(0,0);
      lcd.print("Belt ON ");
    }else{
      beltLED.off();                 // Belt LED OFF in Blynk
      lcdB.print(0,0, "Belt OFF");
      digitalWrite(ledON, LOW);
      lcd.setCursor(0,0);
      lcd.print("Belt OFF");
    }
  }
}
```

Figure 4.13 Blynk update

```
void setup() {
  lcd.init();                        // Initialize the lcd
  lcd.backlight();                   // LCD backlight on

  Serial.begin(9600);
  pinMode(magSwitch, INPUT);
  pinMode(ledON, OUTPUT);
  pinMode(FSRpin, INPUT);
  pinMode(soundPlayer, OUTPUT);
  lcd.print("Seat Belt Alert");
  delay(3000);
  lcd.clear();
  Blynk.begin(auth, ssid, pass);  // Log in to network
  // Setup a function to be called every 1 second ---------------
  timer.setInterval(1000L, timerEvent);
}

void loop() {
  Blynk.run();   // Update Blynk
  timer.run();   // Timer enable
}
```

Figure 4.14 Initialize the LCD codes

4.5 Project analysis

The data analysis is calculated and recorded in the tables below in this section. This project has also been analyzed for system detection sensitivity for two sensors implemented in this project, which are magnetic switch sensor and force sensing resistor (FSR).

4.5.1 Detection sensitivity of system for magnetic switch

The data analysis is recorded for magnetic sensitivity detection. The result is shown in Table 3 below.

Table 3 Position versus detection rate of magnet

Distance (cm)	Detection rate of magnet (%)
0.2	100
0.4	100
0.6	100
0.8	100
1.0	100
1.2	100
1.4	100
1.6	100
1.8	100
2.0	0

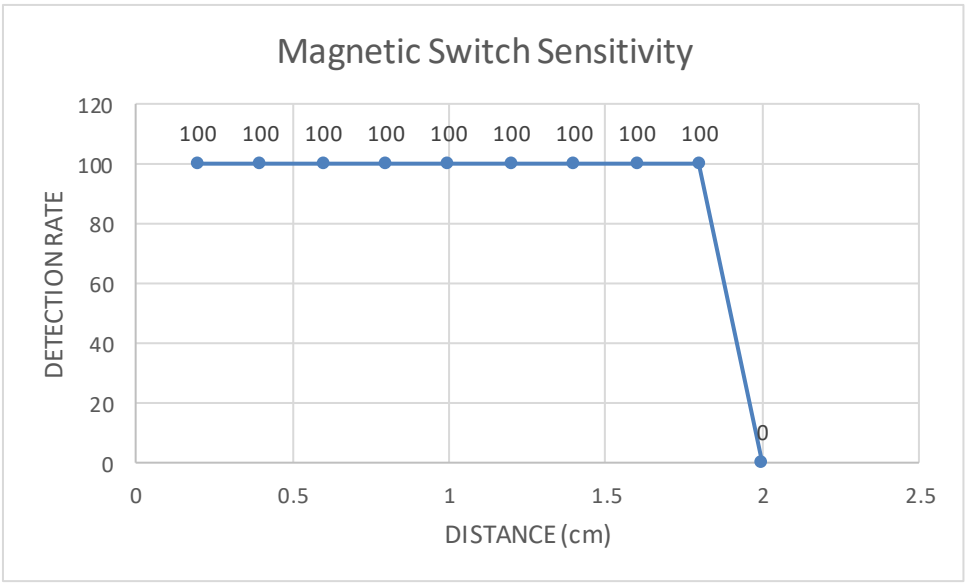

Figure 4.15 Graph detection rate of magnet

The detection sensitivity of the system for reed switch sensor for different positions is listed in Table 3 above. The graph shown in Figure 4.15 was constructed. As a result of this discovery, the graph shows that the detection rate of the magnet on the tongue of the seat belt buckle for the magnetic switch sensor has dropped. As a result, it is reasonable to conclude that the distance for the magnetic switch sensor to achieve voice alert when the seat belt is undone is roughly 1.8 cm, because the detection rate drops to 0% when it reaches 2.0 cm. Finally, the voice alert works well when the magnet on the tongue of the seat belt buckle is between 0 cm to 1.8 cm.

4.5.2 Detection sensitivity of system for FSR sensor

The data analysis is recorded for FSR sensitivity detection. The result is shown in Table 4 below.

Table 4 Weight versus pressure detection rate

Weight (kg)	Pressure detection rate (%)
0.5	60
1	60
1.5	80
2	80
2.5	100
3	100
3.5	100
4	100
4.5	100

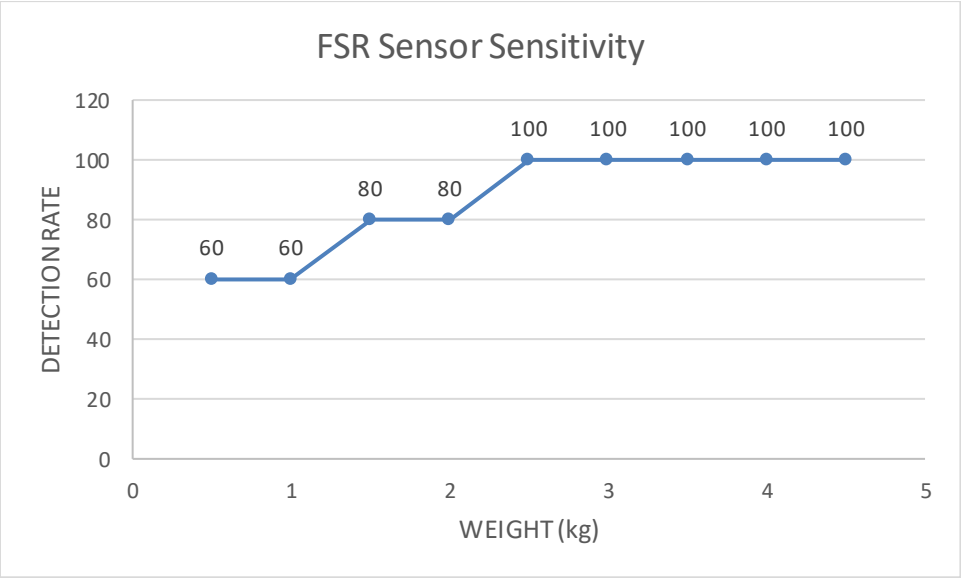

Figure 4.16 Graph of pressure detection rate

The table 4 above shows the detection sensitivity of system for force sensing resistor. Every weight difference of 500 gram were tested 5 times to get the percentage. The graph outcome as shown above in Figure 4.16. The graph represents the detection rate of pressure being applied on force sensing resistor is increase. Thus, it is possible to assume that the minimum pressure being detected for force sensing resistor to attain alert approximately 2.5 kg because the detection rate is 100%.

4.6 Components and Cost

A list of components and its price will be shown here for the Design of IoT baby car seat with unfastened alert. Table 5 below shows the list of components and its cost for this project.

Table 5 List of material

COMPONENTS	COST(RM)
Node MCU – ESP8266	RM30.00
FSR Sensor	RM35.00
Magnetic Switch	RM6.50
Power Supply (9V Battery)	RM20.00
Voice Module	RM40.00
LCD display	RM25.00
LM 386n (voice amplifier)	RM2.50
Total	**159.00**

4.7 Discussion

This section would cover the entire progression of this project, The Design of IoT Baby Car Seat with Unfastened Alert using IoT, as well as any challenges that have arisen. This project's concept is based on the problem of many incidents where children is injured as a result of being hit in the front seat and thrown out of the car due to an accident, even if the child is already in a baby car seat. However, the issue of this problem persists since the belt is genuinely unfastened at times, their child unfastens their own seat belt without understanding it. If their child discovers how to unfasten the baby car seat seatbelt or escape from the car seat, it can be stressful and dangerous if an accident occurs.

As a result, this project is purposefully created with a device and system that can generate an alarm system to their parents when their child unfastens the seat belt of the baby car seat. As a result of examining relevant works, Node MCU was picked as the main controller to employ in this project. The main advantage of this main controller is the fair and lower pricing. In addition, the sensors used in this project include a magnetic switch and

a force sensing resistor. Both sensors serve as the system's input. The magnetic switch sensor will detect if the status of seat belt while force sensing resistor function as to detect the presence of baby.

4.8 Summary

In summary, the findings and implications of "The Design of IoT Baby Car Seat with Unfastened Alert with IoT" have been detailed and addressed in Chapter 4. The project's functionality has been detailed. Furthermore, the project's coding has been discussed and demonstrated using the figures provided in Chapter 4. So. In this project, the coding can be used in each section, which include starting code, secured seat belt code, and unfastened seat belt alert. Aside from that, the project has been tested and successfully completed into a prototype, which functions properly. This project's objectives have been met. Furthermore, the concerns that arose during the course of this project were investigated and resolved.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The project of Design of IoT Baby Car Seat Alert with Unfastened Alert will be concluded in this chapter. Moreover, some recommendations and suggestion of development in the future will be shown here.

5.2 Conclusion

In conclusion, Node MCU able to connect to android application, FSR sensor is used as the alert trigger and magnetic switch is used to identify the status of baby car seat was success. Thus, able to design a system using node MCU to detect the status of seat belt which will help the parent or guardian to receive a notify from android application regarding the status of baby car seat belt which enable to avoid the risk of unfastened seat belt. In addition, the system equipped with voice alert in case the parent did not received the notify due to the bad internet connection.

5.3 Recommendations

There are few recommendations that can be improved for future projects on The Design of IoT baby car seat with unfastened alert with IoT. It is recommended that the seat belt buckle of the baby car seat be designed to automatically fasten when the seat belt is loosened while the baby is already seated in the baby car seat. As a result, the parents do not have to bother stopping the car.

This system can also be proposed by converting it into a portable baby car seat with an unfastened alert system. The system is portable allowing the parents to use it in any baby car seat or any baby seat in their house. As a result, this portable can save parents money by eliminating the need to purchase another baby car seat that is already equipped with an unfastened alert mechanism.

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APPENDICES

Appendix A Gantt Chart PSM I

Project Activity	(PSM I) SEM II 2020/2021														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
PSM Briefing / Title Selection								MIDTERM BREAK							
Title Registration															
Title Research															
Proposal Preparation															
Meeting with Supervisor															
Present Progress															
Report (Chapter 1)															
Report (Chapter 2)															
Report (Chapter 3)															
Report Submission (Draft)															
Report Submission (Final)															

PSM I Presentation														

Appendix B Gantt Chart PSM II

Project Activity	(PSM 2) SEM I 2021/2022														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
PSM2 Briefing								MIDTERM BREAK							
Software Preparation															
Hardware Preparation															
Troubleshoot of Circuit															
Meeting with Supervisor															
Present Progress															
Report (Chapter 4)															
Report (Chapter 5)															
Report Submission (Draft)															
Report Submission (Final)															
PSM II Presentation															