

POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

**SMART CHILDREN MOVEMENT DETECTOR
(WIFI SENSOR)**

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NURULAIN NADHIRAH
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**REGISTRATION NO
08DEP20F2015**

JABATAN KEJURUTERAAN ELEKTRIK

SESI 2 2022/2023

POLITEKNIK

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SENSOR)**

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This report submitted to the Electrical Engineering Department in fulfillment of the requirement for a Diploma in Electrical Engineering

JABATAN KEJURUTERAAN ELEKTRIK

SESI 2 2022/2023

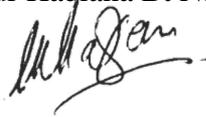
CONFIRMATION OF THE PROJECT

The project report titled " SMART CHILDREN MOVEMENT DETECTOR (WIFI SENSOR) " has been submitted, reviewed and verified as a fulfills the conditions and requirements of the Project Writing as stipulated

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SESSION: SESI 2 2022/2023

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a) Nurulain Nadhirah Shahrurnajib
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) Nurulain Nadhirah
Shahrurnajib

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As a project supervisor, on the date:

ACKNOWLEDGEMENTS

I have taken efforts in this Project. However, it would not have been possible without the kind support and help of many individuals and organizations. I would like to extend my sincere thanks to all of them. I am highly indebted to my supervisor, PN NUR HADIANA BINTI NASRUDDIN for their guidance and constant supervision as well as for providing necessary information regarding the Project & also for their support in completing the Project.

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My thanks and appreciations also go to my colleague in developing the Project and people who have willingly helped me out with their abilities.

ABSTRACT

There are many cases related to the child being trapped inside a locked car with a window and engine closed, such as children being trapped inside the car due to the parents rushing to their workplace. Smart children movement detector is a proposed system that is designed to detect sound or voice and any movement made by the children that had been left behind in a vehicle. The child detector system alerts a parent of the presence of the child when they are alighting their vehicle. In order to save the children from being trapped inside a car, a safety reminder is created by connecting the PIR motion sensor and microcontroller with the mobile phone through an application. This system used the Internet of Things (IoT) which occurs during connecting the system with the phone. Besides, the motion sensor that is included inside the system has the ability to detect human movement inside the car. This system is believed to be useful towards the safety of children efficiently so that the children will live a happy life. When the system detected the movement of a trapped child inside the car, the system will send a notification to the parents through mobile application. There have been numerous cases of a child being left alone and forgotten in a car. Such cases often end in tragedy as the child dies from heatstroke. Smart children movement detector is installed in a car to detect when a child is crying when parents are not inside the car. It can also detect when a child is absence.

ABSTRAK

Terdapat banyak kes berkaitan kanak-kanak terperangkap di dalam kereta berkunci dengan tingkap dan enjin ditutup, seperti kanak-kanak terperangkap di dalam kereta akibat ibu bapa bergegas ke tempat kerja mereka. Pengesanan pergerakan kanak-kanak pintar adalah sistem cadangan yang direka untuk mengesan bunyi atau suara dan sebarang pergerakan yang dibuat oleh kanak-kanak yang telah ditinggalkan di dalam kenderaan. Sistem pengesanan kanak-kanak memberi amaran kepada ibu bapa tentang kehadiran kanak-kanak itu semasa mereka menuruni kenderaan mereka. Untuk menyelamatkan kanak-kanak daripada terperangkap di dalam kereta, peringatan keselamatan dibuat dengan menyambungkan penerima gerakan PIR dan mikropengawal dengan telefon bimbit melalui permohonan. Sistem ini menggunakan Internet of Things (IoT) yang berlaku semasa menyambungkan sistem dengan telefon. Selain itu, sensor gerakan yang disertakan di dalam sistem mempunyai keupayaan untuk mengesan pergerakan manusia di dalam kereta. Sistem ini diyakini berguna ke arah keselamatan kanak-kanak dengan cekap supaya kanak-kanak akan menjalani kehidupan yang bahagia. Apabila sistem mengesan pergerakan kanak-kanak yang terperangkap di dalam kereta, sistem akan menghantar pemberitahuan kepada ibu bapa melalui aplikasi mudah alih. Terdapat banyak kes kanak-kanak ditinggalkan bersendirian dan dilupakan di dalam kereta. Kes sebegini selalunya berakhir dengan tragedi kerana kanak-kanak itu mati akibat strok haba. Pengesanan pergerakan kanak-kanak pintar dipasang di dalam kereta untuk mengesan apabila kanak-kanak menangis apabila ibu bapa tiada di dalam kereta. Ia juga boleh mengesan apabila kanak-kanak tiada.

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CHAPTER 1

1 INTRODUCTION

1.1 Introduction

One of the most recent used in communication system in the present world of technology is Global System for Mobile Communications (GSM). It has become very popular and one of the wireless communication system that is reliable to use. In addition, it is also accessible to be used by people and very user friendly. One of the factors that make this system reliable to use is the cost effective which makes it is affordable to be owned by consumers.

1.2 Background Research

Nowadays, there are several death cases due to babies and children been trapped inside a car. The reason why this can happen is due to the parents that rushed to work and forgot to send their children to nursery nearby. For example, there is a case at Indera Mahkota, Pahang on 14th of August 2020 which the father forgot that his 9-month-old son, who should be sent to a nursery, was still on the car. The father only found out that his son was dead when he wanted to have a lunch. Another similar cases occurred at Sungai Petani, Kedah two months ago which the father forgot that his 4-year-old son is trapped in his car with both car engine and window closed for 10 hours. His son suffered breathing difficulties and found dead around 6:30pm.

1.3 Problem Statement

There are many cases related to the child being trapped inside a locked car with a window and engine closed, such as children being trapped inside the car due to the parents rushing to their workplace. In order to save the children from being trapped inside a car, a safety reminder is created by connecting the PIR motion sensor and microcontroller.

1.4 Research Objectives

There are several objectives that have been outlined in making this system. First, the system need to be developed with several circuit and IoT configuration. Other than that, this project objective is to test the functionality of the system after it is developed.

Lastly, the objective for this system is to verify the performance of the developed system. More specifically the principle objective of this research are:

1. To design and create a system which uses GSM that can communicate with human
2. To implement the design of the model into Smart Children Movement Detector.
3. To develop the mechanical aspects of the detector an iterative design process to use, constructing and testing solutions searching for improvements for a more optimal design.

1.5 Scope of Research

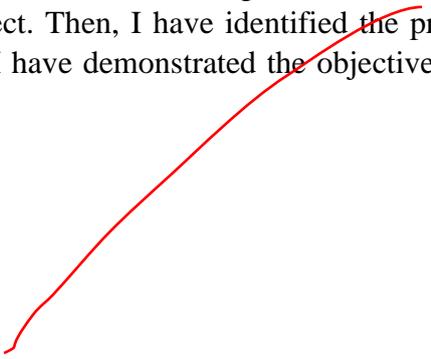
1. This Project is focusing on solving problems parents face when they leave their child on the car.
2. The emphasis is to provide an alarm or notifications if any child is left behind unknowingly in the vehicle
3. The main controller is using Arduino

1.6 Project Significance

Arduino is an open-source physical computing platform which implements the Processing Language on a simple input/output (I/O) board. This technology was initially introduced in Interaction Design Institute, Italy on 2005. The Safety Child Car Alert System is an Arduino-based system. It is a standalone system where the system does not interact with the vehicle's internal system. This system is controlled by Arduino Uno R3, a small microcontroller that turns out to be a control unit. This proposed system has two major parts which are; the detection mechanism and the prevention mechanism connected to the control unit.

1.7 Chapter Summary

In this first chapter, I have described about the background research of the original idea for the beginning of this project. Then, I have identified the problems that are happening nowadays. In addition, I have demonstrated the objectives in this project and the objective study.



CHAPTER 2

2 LITERATURE REVIEW

2.1 Introduction

A literature review is a piece of academic writing demonstrating knowledge and understanding of the academic literature on a specific topic placed in context. A literature review also includes a critical evaluation of the material; this is why it is



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called a literature review rather than a literature report. It is a process of reviewing the literature, as well as a form of writing.

To illustrate the difference between reporting and reviewing, think about television or film review articles. These articles include content such as a brief synopsis or the key points of the film or programme plus the critic's own evaluation. Similarly the two main objectives of a literature review are firstly the content covering existing research, theories and evidence, and secondly your own critical evaluation and discussion of this content.

2.2 Developing of child safety car alert system using Arduino and Ultrasonic sensor (Literature Review Topic 1)

The Child Safety Car Alert System by Arduino is an integrated device that sends alerts to the driver if a child is left unintentionally in the car. The system is developed using the Arduino board which incorporates the integration between sensors and GSM module. This system uses pressure and motion sensors to detect the presence of a child located at the back seat of the vehicles. Meanwhile, the GSM or Global System for Mobile Communication allows the system to send an alert to the driver within a short period. The GSM is chosen due to its ability to lower the energy consumption per bit while providing higher data rates. Two sensors are used; Force Sensitive Resistor (FSR) Sensor and Pressure Infrared (PIR) Sensor. The alert system is triggered when both sensors detect the presence of a child at the back of the car seat which will then notify the parents or a driver immediately through a message sent via a mobile phone. [1]

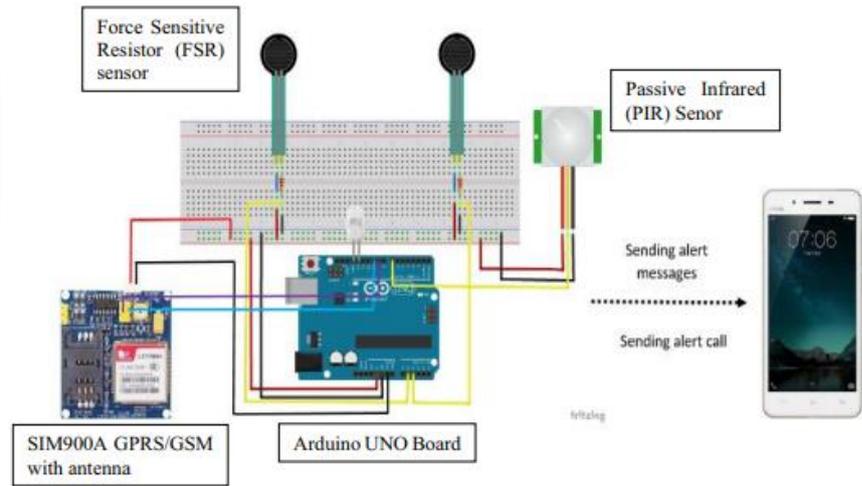


Figure 2.1 : Final module Integration for SCCAS **Error! Reference source not found.**

2.3 Child in car alarm system using various sensors (**Literature Review Topic**

2)

Global System for Mobile Communication (GSM) is one of the most recent used in communication system in the present world. It became popular because it is wireless and reliable to use. In addition, it is also accessible to be used by people and very user friendly. One of the factors that make this system reliable to use is the cost effective which makes it is affordable to be owned by consumers. In addition, it is also accessible to be used by people and very user friendly. One of the factors that make this system reliable to use is the cost effective which makes it is affordable to be owned by consumers. To avoid this kind of bad situations happens; the vehicle must be equipped or provided with a device or system that can be warned owner if there were any unwanted activities when the car owner left the vehicle. Hence, the notification system needs to have access to a long-range phone communication such as GSM (Global System for Mobile Communications). This system needed a technique on how to detect interior's movement or any voice of child that had been left in the car and then send an SMS text message to the parents alerting if any movement or voice occurs. The proposed system will detect any motion or movement and voice from the vehicle's interior and informed the owner by sending an SMS alert message. The proposed system will make parents more alert if they were leaving their children alone in the car and can avoid from unwanted event occurred

2.3.1 Babycare alert system for prevention of child left in a parked vehicle.

Recent developments in Internet of Things (IoT) have led to a renewed interest in child safety division. Busy folks that tend to position their child in the back of the car and could make them overlook that they are carrying their child along. They could possibly go about their routine and leave children secured in the shut window's vehicle. The impacts from work stress related are one of the reason why most of people tend to forgot. This clarifies that individual's day by day life could influence their conduct and contribute to one's decision to leave their child unattended in the vehicle because of distressing and work load.

2.3.2 Child presence detection car alarm system using GSM

Arduino UNO is used to control the system receiving input from key switches and relays then from the load cell detector then instructs buzzer 1 to sound and Global System for Mobile Communication will send a message to the car owner and buzzer 2 will sound if there are still children in the car. Three experts have evaluated this product for possible improvements that can improve the quality of this product to work better and efficiently and also can help to reduce the number of children being left in the cars.

2.3.3 Prevention alert system for a child left in a parked vehicle

This is to discuss the literature reviews on related topics that have been prior to the title. It will start by defining and discussing the current situation around the world, reviewing literature produced by other researchers from journals and related products on the market. Technology is rapidly evolving to replace the traditional system with implementing a computerized system to help better safety and health-related issues. There are a few types of child car seats implemented today, and many studies introduce different methods of implementing a child car seat safety mechanism that researchers have worked on: using a sound sensor, using the seat belt as a sensor, and using a remote sensor, and many more.

2.4 Chapter Summary

The research approach chosen for this project was experimental testing because it is centred on product innovation. When this product is ready to be built, it will be put to the test in order to see how effective it is at solving the problem. Furthermore, this literature review aids in the development of a theoretical framework consisting of research concepts and hypotheses whose success can be evaluated, as well as providing information for research relevance and coherence.

CHAPTER 3

3 RESEARCH METHODOLOGY

3.1 Introduction

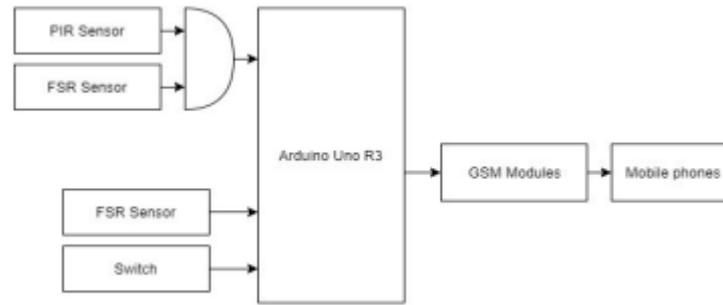
This section will present the methodology used to develop IoT Child-in-Car Safety Reminder. The first subsection will focus on materials used in this system, followed by block diagram of the system, flow chart and detail of each mechanism.

3.2 Project Design and Overview.

Arduino is an open-source physical computing platform which implements the Processing Language on a simple input/output (I/O) board. This technology was initially introduced in Interaction Design Institute, Italy on 2005 [3,7]. The Safety Child Car Alert System is an Arduino-based system. It is a standalone system where the system does not interact with the vehicle's internal system. This system is controlled by Arduino Uno R3, a small microcontroller that turns out to be a control unit. This proposed system has two major parts which are; the detection mechanism and the prevention mechanism connected to the control unit.

3.2.1 Block Diagram of the Project

The detection mechanism is used to detect the presence of a child at the back seat. Passive Infrared (PIR) is used to detect the motion based on IR radiation emission produce from the child. For Force Sensitive Resistor (FSR), it is used to detect the force applied on the infant seat based on the average children's weight. Since both sensors are important to detect and confirm the presence of a child, the AND gate is used for this detection mechanism. Force Sensitive Resistor (FSR) is also used to detect the presence of the driver while the switch is used to simulate the car ignition ON/OFF.



3.2.2 Flowchart of the Project 2

Figure 3.1 shows the circuit diagram of the whole system. It is show that to operate the system, a set of hardware components are combined in a circuit and soldered. After that, the code is constructed with integration to a phone application, and later uploaded to a microcontroller by using a software on computer. Lastly, the system need to be tested and troubleshoot if there is a fault in the system. The systems' whole process is explained in the flow chart as seen on Figure 3.2 below.

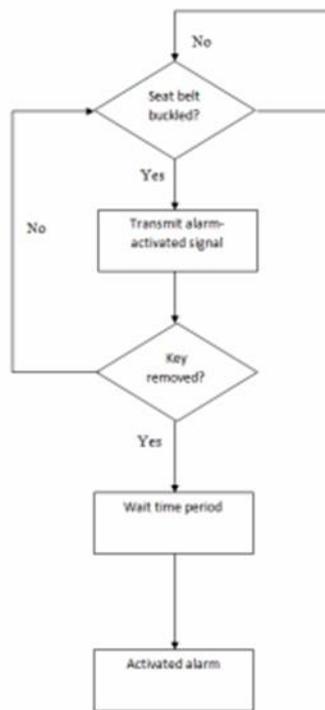


Figure 3.1: Flow chart of operation of the system

*Images may be subject to copyright

3.2.3 Project Description

After designing the circuit, I will proceed to connect every single components by soldering them onto the board. The tools that I will be using is soldering iron. Then, I will construct the programming and put commands to make sure it works.

3.3 Project Hardware

This project involves the cost of purchasing components and materials throughout its implementation. components involving cost are hardware Arduino Uno, , ESP 8266 WiFi Module, Ultrasonic Sensor, Buzzer and other materials.

3.3.1 Schematic Circuit

Figure 3.2 shows the overall circuit diagram of this Project.

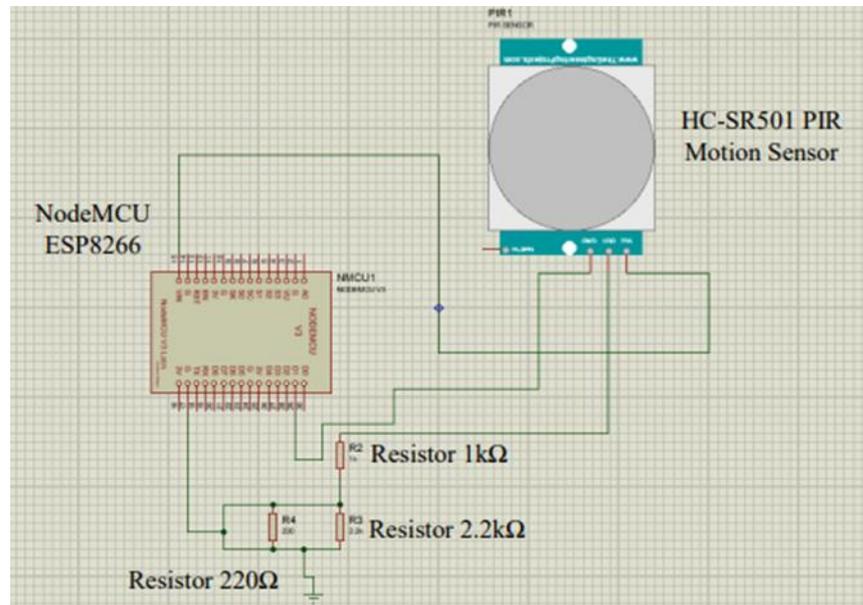
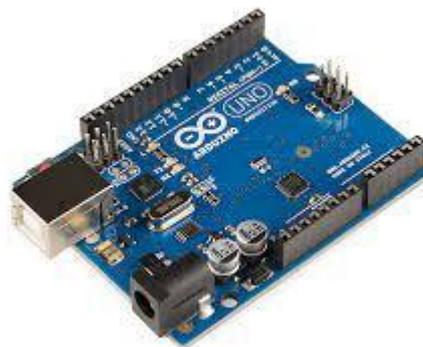


Figure 3.2: Circuit Diagram

3.3.2 Description of Main Component



Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button.

3.3.2.1 Component 1



An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity.

3.3.2.2 Component 2



The ESP8266 WiFi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

3.3.2.3 Component 3



A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

3.3.3 Circuit Operation

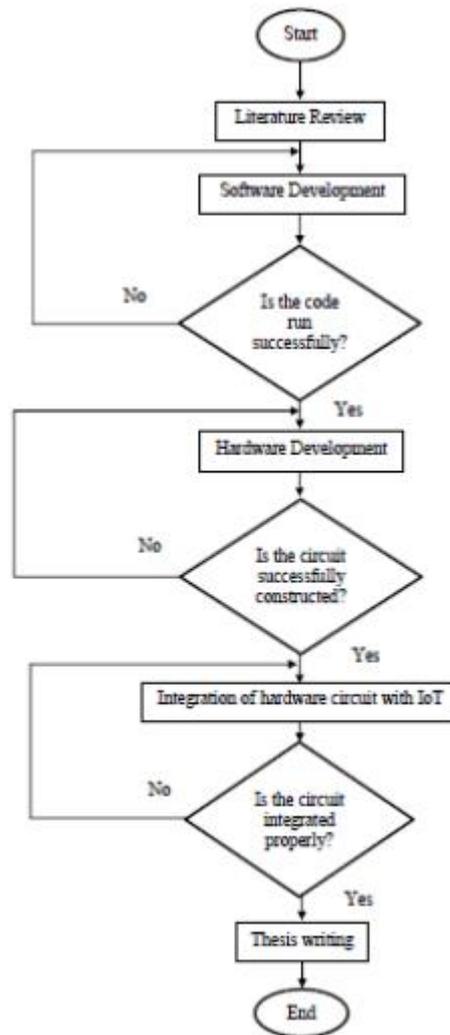
Figure 3.3 shows the circuit connection of Smart Children Movement Detector. The connection will revolve around the microcontroller of the system, which is NodeMCU ESP8266. In this figure, the connection of the system that have been constructed via Proteus software. This system consists of resistors, NodeMCU ESP8266 microcontroller and HC-SR501 PIR Motion Sensor.

3.4 Project Software

For the project software, I use Arduino IDE to sketch the programming/coding for the circuit. The Arduino Integrated Development Environment (IDE) is a cross-platform application which is compatible for Windows, macOS, Linux that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards. The Arduino IDE also supplies a software library from the wiring project, which provides many common input and output procedures. There is an IoT-based application that were used in this system, which is Blynk application. Blynk is a widely used IoT-based mobile application and can connect between phone and system through Wifi connection. It

also will notify the user when there is a presence or movement from a child inside the car, that is detected by the motion sensor. It shows the notification that will be send to user after the motion sensor detected any movement inside the car.

3.4.1 Flowchart of the System



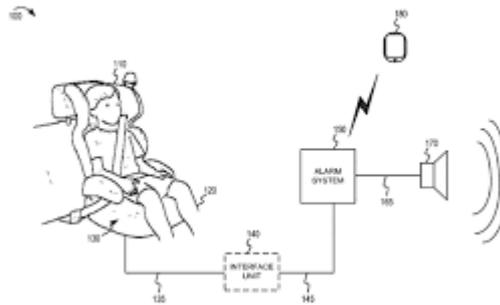
3.4.2 Description of Flowchart

To operate the system, a set of hardware components are combined in a circuit and soldered. After that, the code is constructed with integration to a phone application, and later uploaded to a microcontroller by using a software on computer. Lastly, the system need to be tested and troubleshoot if there is a fault in the system. The systems' whole process is explained in the flow chart as seen on Figure 3.4 below.

3.5 Prototype Development

A prototype model is an early version of a product created to test a concept or process. It's a scaled-down version of the system that's needed.

3.5.1 Mechanical Design/Product Layout



3.6 Sustainability Element in The Design Concept

In this sub-topic student should elaborate on the design criteria of their Project either environmental design criteria, social design criteria use of sustainable design tool or economic design criteria. Also explain contribution to the society of the Project proposed.

3.7 Chapter Summary

Overall, the whole system of IoT Child-in-Car Safety Reminder was able to detect the movement of children inside a closed car. Besides, this system can notify the availability of children inside car by sending data to Blynk application on mobile phone and notify users. However, there is some limitation of the system, which is the motion sensor will not detect human movement who is far from the sensor. The positioning of the system will be very important in order to ensure that the system run properly. Other than that, the system itself can provide a secured system for the safety of children.

CHAPTER 4

4 RESULTS AND DISCUSSION

4.1 Introduction

Results and discussion is about the analysis of the outcome of the project. The outcome may be compared with theory so any errors can be figured out and fixed. This is important because the discussion interprets the meaning of the results, puts them in context, and explains why they matter. In qualitative research, results and discussion are sometimes combined. But in quantitative research, it's considered important to separate the objective results from your interpretation of them.

4.2 Results and Analysis

While testing and doing the project, troubleshoot have also been done. Before doing the troubleshoot, troubleshooting helps identify the symptoms, eliminate the potential cause of the problem, and require confirmation that the solution restores the product or process to its working state. The ESP8266 must do a process and transmit signals to connect with our smartphone via Wi-Fi. In this case, I used my own personal Wi-Fi hotspot to connect. When the ultrasonic sensor detected the distance I have set, the buzzer will be triggered and produce an alarm. Not only that, the range of the distance between the sensor and the object also have been tested.

4.3 Discussion

This IoT Based Child-in-Car Safety Reminder system consist of components such as resistors, NodeMCU ESP8266 microcontroller and Ultrasonic Sensor, which all the components had been combined in a small circuit. Then, this circuit combined with an IoT based mobile application called Blynk so that the application can notify parents when a movement of a child is detected. Overall, this is a low-cost, family friendly system that implement modern IoT application and can be used as a safety measure.

4.4 Chapter Summary

This chapter represents the result and analysis that have been made during the process of the project. Smart Children Movement Detector is a device that help people especially parents to detect and be alert about their children when they are being busy with works and chores.

CHAPTER 5

5 CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The end or close; final part. The last main division of a discourse, usually containing a summing up of the points and a statement of opinion or decisions reached. A result, issue, or outcome; settlement or arrangement: The restitution payment was one of the conclusions of the negotiations.

5.2 Conclusion

In conclusion, I have investigate and design the Smart Children Movement Detector related. This project is easy and flexibe to use. Overall, the whole system of IoT Child-in-Car Safety Reminder was able to detect the movement of children inside a closed car. Besides, this system can notify the availability of children inside car by sending data to Blynk application on mobile phone and notify users. However, there is some limitation of the system, which is the motion sensor will not detect human movement who is far from the sensor. The positioning of the system will be very important in order to ensure that the system run properly. Other than that, the system itself can provide a secured system for the safety of children.

5.3 Suggestion for Future Work

Some suggestions for this project is to make the project more solid to be presented in the future.

5.4 Chapter Summary

This chapter summaries the conclusion for the project which is a success. There are also suggestions for the project which will help it improve and be a much better product in the future.

CHAPTER 6

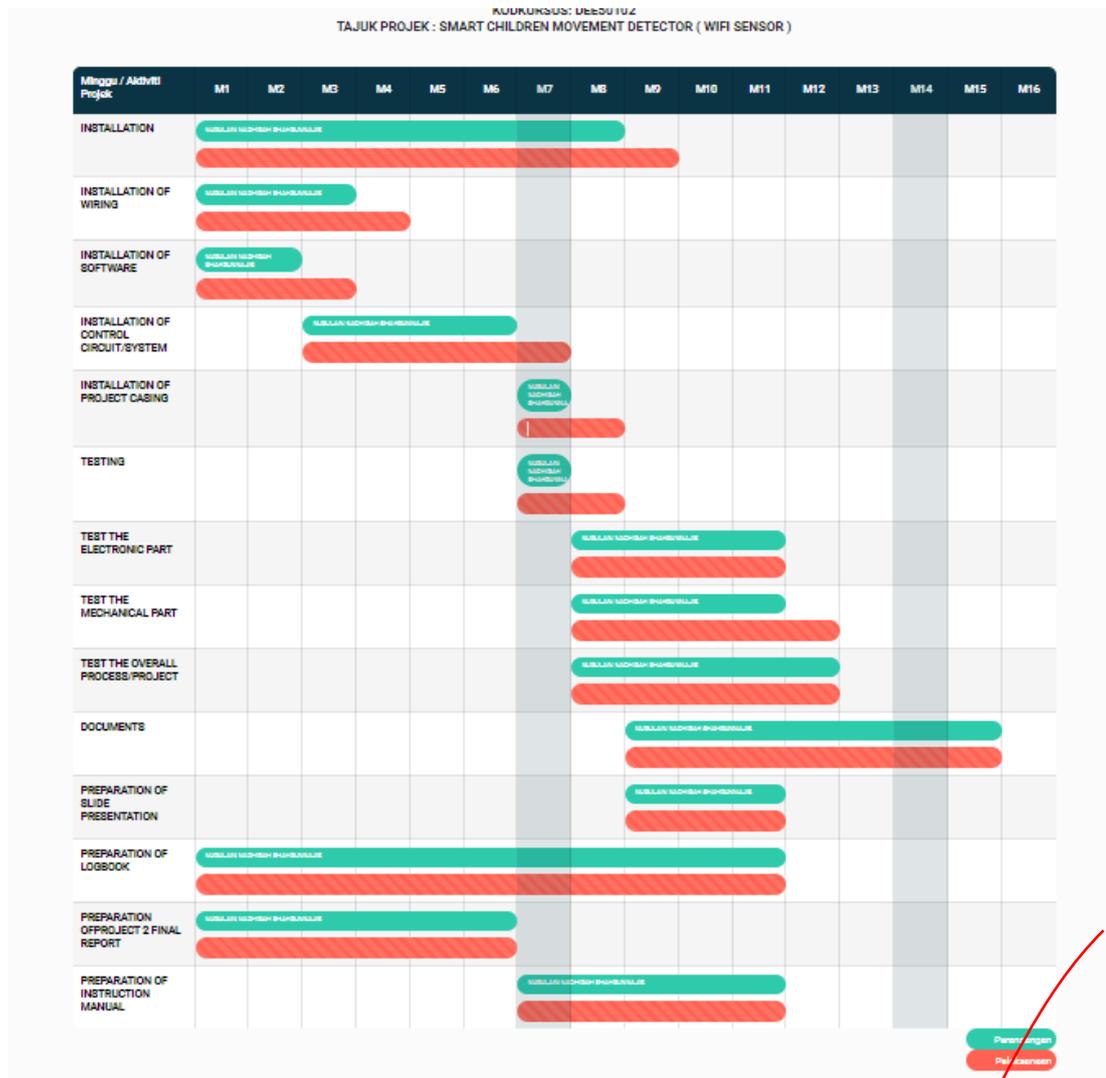
6 PROJECT MANAGEMENT AND COSTING

6.1 Introduction

Cost management is the process of estimating, allocating, and controlling project costs. The cost management process allows a business to predict future expenses to reduce the chances of budget overrun. Projected costs are calculated during the planning phase of a project and must be approved before work begins.

As the project plan is executed, expenses are documented and tracked, so things stay within the cost management plan. Once the project is completed, predicted costs and actual costs are compared, providing benchmarks for future cost management plans and project budgets.

6.2 Gantt Chart and Activities of the Project



6.3 Milestone

6.4 Cost and Budgeting

This project involves the cost of purchasing components and materials throughout its implementation. components involving cost are hardware Arduino, SIM 900AGPRS/GSM with antenna, FSR402 Pressure Force Sensor. HC-SR502 PIR (Passive Infrared Sensor). All of these components are purchased through online purchase methods to make it easier as well as save on costs. The overall gross budget estimate in the implementation of this project is RM 172.00. According to this budget

cost, this project is can be considered as a less costly project compared to other projects that can cost over a thousand ringgit. The cost of the project is also in line with one of the key features of a good project developer that is low cost but have a high-quality project.

6.5 Chapter Summary

In this chapter, I have described and shown a Gant Chart for the course of my project from the beginning until the project was successfully produced. Next, I also describe the cost of expenses that I use to purchase components and items for this project. We can see in detail the price for each component and other costs incurred for this project.

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7 APPENDICES

APPENDIX A- PROGRAMMING

```
int BUZZER = D2;

WidgetLCD LCD(V1);

void setup() {
  Serial.begin(9600);
  pinMode(SENSOR_PIN, INPUT);
  pinMode(BUZZER, OUTPUT);
  Blynk.begin(auth, ssid, pass);
  LCD.print(0, 0, "Please wait....");
  delay(1000);
  LCD.print(0, 0, "System Start...");
  delay(2000);
  LCD.clear();
}

void loop() {
  // Blynk.run();
  int sensorValue = digitalRead(SENSOR_PIN);
  if (sensorValue == HIGH) {
    LCD.print(0, 0, "Motion Detected!!");
    Serial.println("motion detected!!");
    Blynk.logEvent("Alert", "Motion Detected!");
    Blynk.virtualWrite(V0, "Motion Detected!!");
    for (int x = 0; x < 10; x++) {
      digitalWrite(BUZZER, HIGH);
      delay(50);
      digitalWrite(BUZZER, LOW);
      delay(50);
    }
  } else {
    LCD.print(0, 0, "No Motion Detect ");
    Serial.println("not motion detect..");
    Blynk.virtualWrite(V0, "No Motion Detect");
  }
}
```

APPENDIX B- PROJECT MANUAL/PRODUCT CATALOGUE

This user manual is used to explain how the user can operate and use this ultrasonic sensor properly. The user guide is technical documents with a narrow focus. The goal is to assist users in identifying and resolving the problems without the need for expert help. This will also help the user understand the function of this device. Below is the procedure of steps on how to use the project.

1. Place the project on either on top of the babyseat or infront.

2. Turn on WiFi on our smartphones.
3. Connect the project.
4. Open the Blynk IoT app and we will be able to be notified when the buzzer detected any movements.

