POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

IOT Smart Helmet for construction workers

NAME	REGISTRATION NO
NUR FIKRIZAHUSNA BINTI ANIZAM	08DEP20F2017

JABATAN KEJURUTERAAN ELEKTRIK

SESI 2 2022/2023

POLITEKNIK

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NUR FIKRIZAHUSNA BINTI ANIZAM	**08DEP20F2017**

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 IOT Smart Helmet for construction workers

has been submitted, reviewed and verified as a fulfills the conditions and requirements

of the Project Writing as stipulated

Checked by:

Supervisor's name : NUR HADIANA BINTI NASRUDDIN

Supervisor's signature:

Date : 8.06.2023

Verified by:

Project Coordinator name : WAN MOHD ZAMRI B WAN AB RAHMAN

Signature of Coordinator :

Date :

"I acknowledge this work is my own work except the excerpts I have already explained to our source"

1. Signature :  .

Name : **NUR FIKRIZAHUSNA BINTI ANIZAM**

Registration Number : **08DEP20F2017**

Date : 2/6/2023

DECLARATION OF ORIGINALITY AND OWNERSHIP

TITLE : IOT Smart Helmet for construction workers

SESSION: SESI II 2022/2023

1. I, **1. NUR FIKRIZAHUSNA BINTI ANIZAM 08DEP20F2017**

   is a final year student of **Diploma in Electrical Engineering, Department of Electrical, Politeknik Sultan Salahuddin Abdul Aziz Shah**, which is located at **Persiaran Usahawan,40140 Shah Alam Selangor Darul Ehsan**. (Hereinafter referred to as 'the Polytechnic').

2. I acknowledge that 'The Project above' and the intellectual property therein is the result of our original creation /creations without taking or impersonating any intellectual property from the other parties.

3. I agree to release the 'Project' intellectual property to 'The Polytechnics' to meet the requirements for awarding the **Diploma in Electrical Engineering** to me.

Made and in truth that is recognized by;

a) **NUR FIKRIZAHUSNA BINTI ANIZAM** (Identification card No: - 020915101722)

) .HUSNA.
) .....
) **NUR FIKRIZAHUSNA BINTI ANIZAM**

In front of me, **PUAN NUR HADIANA** (Click here to enter text.)
As a project supervisor, on the date:

) .....
) **PUAN NUR HADIANA**

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 Puan Nur Hadiana 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

Before Covid-19 pandemic in Malaysia, the total of accident is the highest which is 326 construction accidents recorded in Malaysia and the number reduced from previous year due to the COVID-19 pandemic. Many reasons that contribute to the accidents such as communication, fails to wear safety gear and time taken to bring the injured worker to hospital for treatment. The goal of this project known as IoT smart construction helmet is to reduce construction sites accidence which can be minor or major causes effect on the whole site as well as work of construction. In Malaysia, the use of helmets is mandatory at construction sites as per the government rules. The Use of a helmet protects the labor head against the impact of the falling object from any height. This project is designed with safety system that can be monitored by supervisor. There was a modification in the ordinary helmet into a smart helmet by adding gas sensor, temperature sensor and light sensor by using ESP32. In this project, the helmets will automatically be updating the work mode ON, if workers wear it because a clamp turns the system ON and information goes to the supervisor. The use of the temperature sensor while on the construction side is essential. for example, when the temperature rises above 38 degrees Celsius, the helmet will detect the high temperature and the data will be sent to the supervisor. therefore, the supervisor can know the state of the worker's environment. the same applies to the use of light sensors and gas sensors in IOT smart helmets. Same as this, there are one push button which indicate the task completion and about the emergency. Using the button, it helps the worker in many ways and manage the tasks and time also. For the IOT System are being used for the functioning of a helmet, Real-time signals will be sending constantly with the help of installed various sensors to monitor. The main objective of this study is to activate the installed components so that the various emergencies can be detected at the supervisor's room and somehow reduce time detect the actual location of the injuries worker and at the same time is the signal is send to the command office of the construction site. It is an Internet of Things (IoT) solution that helps make worksites safer by providing The live. By installing all the components in one construction helmet, the internet of things (IOT), can help to reduce the number of injuries and prevent the injuries to critical stage and it is also enhancing the awareness of the safety of construction workers.

Keywords: IoT Smart Helmet Construction, ESP32, Gas sensor, temperature sensor and light sensor, smart monitoring

ABSTRAK

Sebelum penularan wabak Covid-19 di Malaysia, jumlah kemalangan adalah yang tertinggi iaitu 326 kemalangan pembinaan direkodkan di Malaysia dan jumlah itu berkurangan berbanding tahun sebelumnya akibat pandemik COVID-19. Banyak sebab yang menyumbang kepada kemalangan seperti komunikasi, gagal memakai peralatan keselamatan dan masa yang diambil untuk membawa pekerja yang cedera ke hospital untuk rawatan. Matlamat projek yang dikenali sebagai topi keledar pembinaan pintar IoT adalah untuk mengurangkan kemalangan tapak pembinaan yang boleh menjadi punca kecil atau besar kesan ke atas keseluruhan tapak serta kerja pembinaan. Di Malaysia, penggunaan topi keledar adalah wajib di tapak pembinaan mengikut peraturan kerajaan. Penggunaan topi keledar melindungi kepala buruh daripada kesan objek yang jatuh dari mana-mana ketinggian. Projek ini direka bentuk dengan sistem keselamatan yang boleh dipantau oleh penyelia. Terdapat pengubahsuaian pada topi keledar biasa kepada topi keledar pintar dengan menambah penderia gas, penderia suhu dan penderia cahaya dengan menggunakan ESP32. Dalam projek ini, topi keledar akan mengemas kini mod kerja secara automatik, jika pekerja memakainya kerana pengapit menghidupkan sistem dan maklumat dihantar kepada penyelia. Penggunaan sensor suhu semasa di bahagian pembinaan adalah penting. sebagai contoh, apabila suhu meningkat melebihi 38 darjah Celsius, topi keledar akan mengesan suhu tinggi dan data akan dihantar kepada penyelia. oleh itu, penyelia dapat mengetahui keadaan persekitaran pekerja. perkara yang sama berlaku untuk penggunaan penderia cahaya dan penderia gas dalam topi keledar pintar IOT. Sama seperti ini, terdapat satu butang tekan yang menunjukkan penyelesaian tugas dan mengenai kecemasan. Menggunakan butang, ia membantu pekerja dalam pelbagai cara dan menguruskan tugas dan masa juga. Untuk Sistem IOT sedang digunakan untuk fungsi topi keledar, isyarat masa nyata akan dihantar secara berterusan dengan bantuan pelbagai penderia yang dipasang untuk memantau. Objektif utama kajian ini adalah untuk mengaktifkan komponen yang dipasang supaya pelbagai kecemasan dapat dikesan di bilik penyelia dan entah bagaimana mengurangkan masa mengesan lokasi sebenar pekerja kecederaan dan pada masa yang sama isyarat dihantar ke pejabat arahan. daripada tapak pembinaan. Ia ialah penyelesaian Internet Perkara (IoT) yang membantu menjadikan tapak kerja lebih selamat dengan

menyediakan The live. Dengan memasang semua komponen dalam satu topi keledar pembinaan, internet of things (IOT), boleh membantu mengurangkan jumlah kecederaan dan mengelakkan kecederaan ke peringkat kritikal dan ia juga meningkatkan kesedaran tentang keselamatan pekerja binaan.

Kata kunci: Pembinaan Topi Keledar Pintar IoT, ESP32, Penderia gas, penderia suhu dan penderia cahaya, pemantauan pintar

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CHAPTER 1

1 INTRODUCTION

1.1 Introduction

IoT smart construction helmet reduce construction sites accidence which can be minor or major causes effect on the whole site as well as work of construction. This helmet is for the communication between the supervisor and the labor in case of any emergency. gas sensor, temperature sensor and light sensor were install in the helmet. With the help of ESP32, a developed product which is smart working helmet that can save their lives. Smart helmet is a combination of the ordinary helmet with the latest technology and realtime monitoring as per the requirement of the construction site. The ordinary site helmet is connected with a system so that all the activities are to be supervised in a single computer and further reduce the percentage of accident in construction area.

1.2 Background Research

Workers in other dangerous working areas, are risking their health and life every day. construction site is one of the most dangerous trades in the world. They deal every day with dangerous gases and high temperature levels in a dark environment. With the help of ESP32 we designed and developed a Smart Working Helmet that can save their lives. Smart Helmet is a combination of the ordinary helmet with the latest technology as per the requirement of the construction site. At the Construction site, Helmet is the basic need for labor. For this investigation, an ordinary helmet is taken into consideration and modified it with the latest advancement to fulfill the various requirements at the construction site like detection of various dangerous gases, temperature, If the working environment becomes darker and etc. To fulfil this entire requirement of the construction industry, the Internet of Things (IoT) is introduced in various projects which play an important role. Various components are installed in the ordinary helmet and connect all these with a single computer so that all the activities are to be supervised in a single computer.

1.3 Problem Statement

There are several problems that have been identify in this project.

• The worker is approaching to a dangerous gases

Employees should inform the supervisor or employer immediately if they detect or even Suspect an imminent danger situation in the workplace.

• The environment temperature becomes higher than the worker's body

Working in cold or hot temperatures may lead to an increase in accidents, illnesses, job stress, job dissatisfaction, and a decrease in productivity. We need to keeping the temperature at a comfortable level, sometimes known as thermal comfort. providing clean and fresh air.

1.4 Research Objectives

1. To design a smart helmet for construction workers.
2. To develop an IoT smart helmet that can be remotely monitored by a supervisor.
3. To develop a system that uses temperature sensor, gas sensor and light sensor to ensure workers safety.

1.5 Scope of Research

- This project is focusing on construction workers that using new technology smart helmet.
- The emphasis is to building componies.
- The main controller is ESP32 for IOT.

1.6 Project Significance

The goal of this project is to develop a smart helmet for construction workers. The ability is to alert workers that in dangerous. The Use of a helmet protects the employee comfort and make sure The Occupational Safety and Health Administration (OSHA) is use in work area . There was a modification in the ordinary helmet into a smart helmet by adding gas sensor, temperature sensor and light sensor.

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 serves as the foundation for high-quality medical education research, assisting in the maximization of relevance, originality, generalizability, and impact. A literature review provides context, informs methodology, maximizes innovation, minimizes duplicative research, and guarantees compliance with professional norms. Iterative literature reviews take time and should be conducted throughout the study process. Researchers should make the best use of available resources, such as human resources, search tools, and current literature.

2.2 IOT based smart helmet for mining industry application

Mining Industry can be categories as the most essential application for any developed country. It provides extraction and discovery of the underground materials. From Iron, gold, coal and diamond. Internet of Things is an information and Communication Technology (ICT) used to represent Wireless Sensor Network (WSN) communications, using the defined protocol IEEE 802.14.5 that enables Low Rate- Wide Area Network (LR-WAN) to communicate using specific modulation technique[2].

2.2.1 Previous Research

The main objective of this research is to design and develop a smart helmet system for mining industry application. Where the provided system will keep on monitoring the hazardous events such as temperature, humidity, gas, removal helmet of the miner and obstacle damage to the helmet. The method in this project is helmet section used for Sensor networks connected with RF transceiver modules, Temperature and humidity, IR, Pressure and gas sensor to sense the environmental events and LED indicator to display the danger status of the minor. It is seen that the aim related to the project are successfully achieved by designing Automated system that detects the hazardous gas surrounded by the miner's helmet

2.3 Control System

The signal is sent to be further checked by Node-Red and/or Arduino if it is humidity and greater than or equal to 80%. In addition, if the temperature exceeds 50 C yellow LED on the helmet will be triggered and the LCD will be updated with the reading and sent to Node-red as shown in Figure.

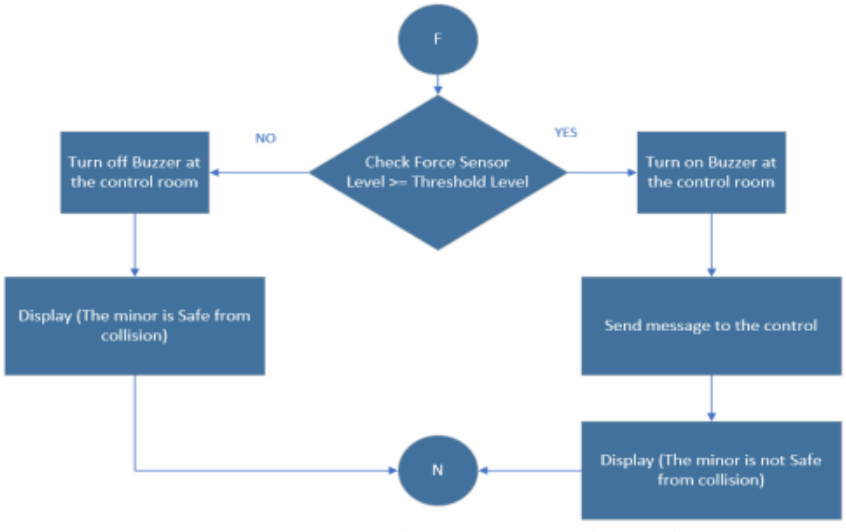


Figure 1 : Force Detection System Flow Chart

2.4 An Internet of Things(IoT) based Smart Helmet for Accident Detection and Notification

This project aims to build an Internet of Things (IoT) application that leverages on ubiquitous connectivity, sensing and data analytics that are the basis of IoT applications. The IoT is comprised of smart machines interacting and communicating with other machines, objects, environments and infrastructures. The huge volumes of data thus generated, is processed into useful actions that can "command and control" things, to make our lives much easier and safer. Integrating sensors with a high-end microcontroller provides rapid accident detection, they are limited in terms of processing and notification capabilities. The TI CC3200 is a Wi-Fi enabled controller, which is used to connect to a data network for accessing cloud services. The smart helmet developed is a smart and reliable piece of technology that is cheap to develop and operate and yet not compromise on safety[3].

2.5 Smart Helmet 5.0 for Industrial Internet of Things Using Artificial Intelligence

The objective of the proposed device is to improve occupational health and safety (OHS), increasing employee performance by reducing the probability of illness, injury, absence or death . There are different methodologies for carrying out research on electronics and system design. Thus, in this section, a description of the hardware and software used for the development of the fifth version of the smart helmet will be presented, and the procedure followed for its subsequent validation through the AI model will be detailed. Its can Detect the different situations to which a worker was subjected[4].

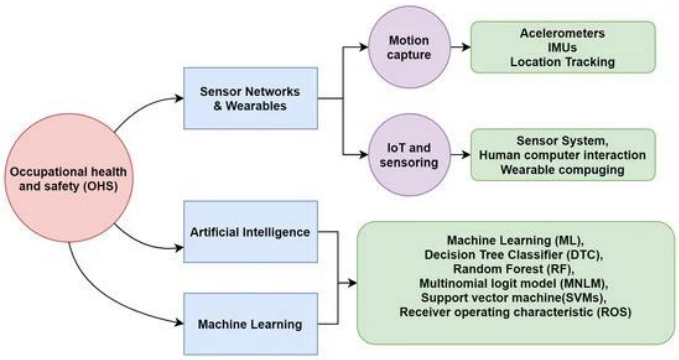


Figure 2 A block diagram of the devices.

2.6 Smart Helmet for Air Quality Used for the Mining Industry

The main objective of this topic is Air pollution and gas explosion are increasing day by day and become foremost crisis in the coal mines and other industries. . A mining helmet needs to be modified to improve miner safety by adding intelligence to the helmet. achieved through the IR sensors. Air quality sensor ,which is used to detect air pollution from coal mines .It is mainly due to emissions of particulate matter and gases include carbon monoxide (CO), Carbon dioxide (CO2). So the conclusion is by using this helmet the miner can easily get alert about the harmful gas. This system can also alert the miner when helmet is removed while mining in the mining industry[5].

2.7 Chapter Summary

The first section of this chapter focuses on the findings on the problem of identifying the smart helmet for workers, with some summary from the research papers regarding the process of development of the project. The second portion reveals information regarding the technical element, including the choice of controller type. This chapter also summarizes the analysis and explanation of the technologies or approaches employed by previous researchers to answer the problem statement. The main controller in this project will be an ESP32.

CHAPTER 3

3 RESEARCH METHODOLOGY

3.1 Introduction

A smart helmet is a combination of the ordinary helmet with the latest technology as per the requirement of the construction site (Safety, Time Management, and Risk). At the Construction site, Helmet is the basic need for labor. For this investigation, an ordinary helmet is taken into consideration and modified it with the latest advancement to fulfill the various requirements at the construction site like managing the time, the safety of labor, supervising the worker's activity, how much work is to be completed, about the activities which are going parallel, detection of various gases, etc. To fulfill this entire requirement of the construction industry, the Internet of Things (IoT) is introduced in various projects which play an important role. Various components are installed in the ordinary helmet and connect all these with a single computer so that all the activities are to be supervised in a single computer.

The practical "how" of any given piece of research is simply referred to as research methodology. It is primarily about how a researcher designs a study in a systematic manner to produce accurate and trustworthy results that address the research aims and objectives. A very complete approach is being undertaken to actualize this project as a ready to-use product with safety characteristics. A step-by-step method is followed to ensure that the Project is completed on schedule. This includes gathering data from various types of smart helmet, designing the part as a transmitter and receiver .also for testing and verifying the circuit design.

3.2 Project Design and Overview.

The helmet is designed to be with three buttons installed in it and various components also like Temperature sensor, light sensor and Gas Detection . The button on top will reflect the safety and emergency symbol whenever a little force will act on the top of the helmet, it will give the information or emergency alert with the location to the supervisor so that the team will reach the labor easily and take necessary actions.

3.2.1 Block Diagram of the Project

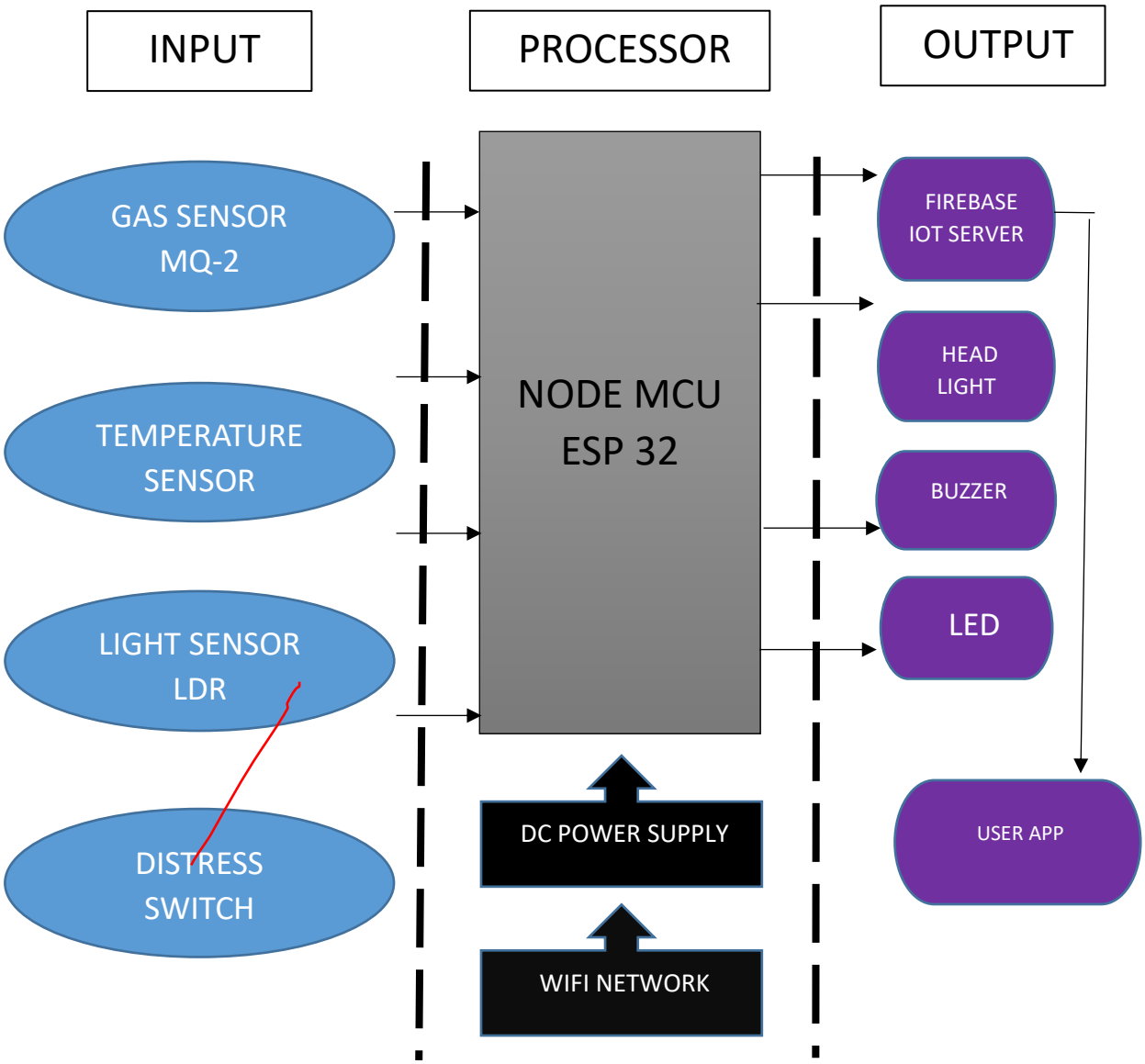
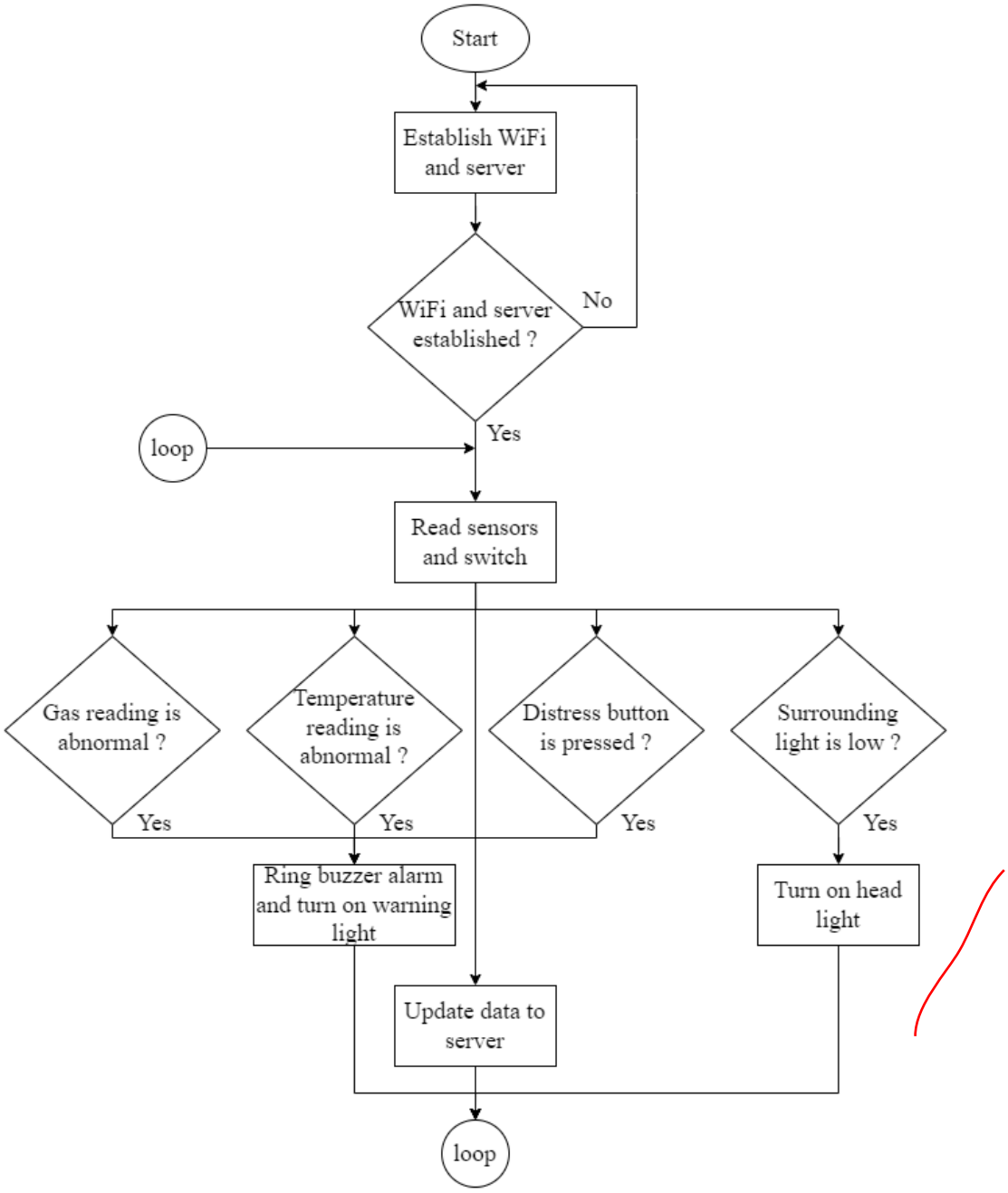


Figure 3 : Block diagram input & output smart helmet for construction workers

3.2.2 Flowchart of the Project 2



re 4: Flow chart of project

3.2.3 Project Description

This project aims to develop smart wearable devices such as helmet using various sensors that will help in monitoring the health and safety of workers IoT sensors to measure and monitoring the environment in which the workers are working.

3.3 Project Hardware

- ESP32
- GAS sensor MQ-2
- Temp sensor DS18B20
- Light sensor module
- Buzzer
- NPN Transistor (e.g. 2222A)
- Resistors: 10k, 120, 4.5K
- Front light (helmet mountable)
- Helmet

3.3.1 Schematic Circuit

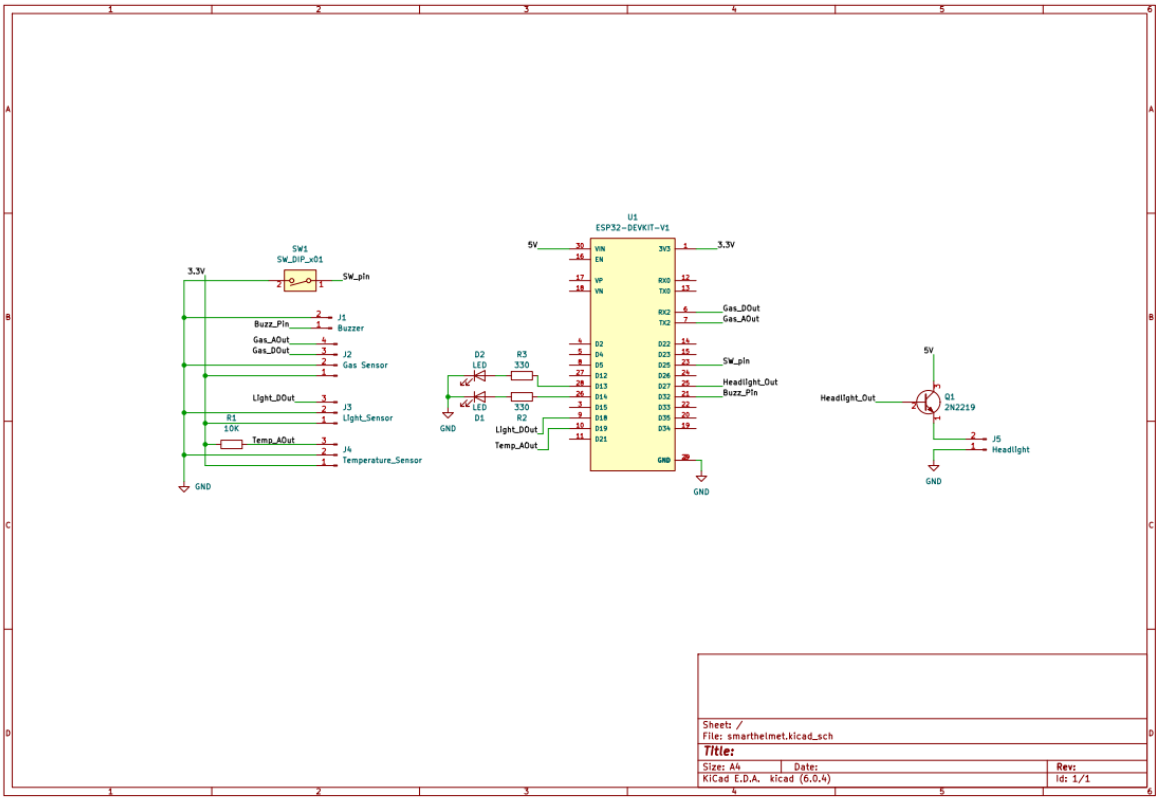


Figure 5 schemetic circuit IoT smart helmet

3.3.2 Description of Main Component

If the worker is approaching to a dangerous gas, the helmet will inform him with a warning sound from the buzzer. If the environment is too noisy, he will know that he is in danger by the red blinking led in the front of the helmet. The warning sound and the red led will repeated faster as he is approaching closer to a dangerous environment. If the environment temperature becomes higher than the worker's body can withstand, the helmet will inform him with a different warning sound from the buzzer. If the working environment becomes darker, the helmet's front light will be turned on.It has a rechargeable battery and can be easily re-programmed to adjust values of the working environment

3.3.2.1 MODULE NODE MCU ESP32

ESP32 is highly-integrated with in-built antenna switches, RF balun, power amplifier, low-noise receive amplifier, filters, and power management modules. ESP32 adds priceless functionality and versatility to your applications with minimal Printed Circuit Board (PCB) requirements. ESP32 is capable of functioning reliably in industrial environments, with an operating temperature ranging from –40°C to +125°C. Powered by advanced calibration circuitries, ESP32 can dynamically remove external circuit imperfections and adapt to changes in external conditions. ESP32 can perform as a complete standalone system or as a slave device to a host MCU, reducing communication stack overhead on the main application processor. ESP32 can interface with other systems to provide Wi-Fi and Bluetooth functionality through its SPI / SDIO or I2C / UART interfaces[6].

Figure 6: ESP 32

3.3.3 Circuit Operation

As a mentioned before , IoT smart helmet for construction workers is a focus on contrction workers helmet with the additional help of light, gas and temperature sensors, ESP 32 becomes the heart of this project. The power supply to help turn on this helmet is a rechargeable battery.

In this project, the reading on the monitor screen will sound when the work environment is not in an unstable temperature, the temperature sensor will detect a warning temperature of 37 degrees Celsius and above. same as the gas sensor, when the reading is high the screen and helmet will also sound a buzzer.

3.4 Project Software

In this project, I am simulating this circuit with the Proteus application. The following software that I use to design the coding of our project is the ESP 32 software. Proteus is capable of creating a circuit design before beginning prototyping. This software can assist us in simulating the circuit and ensuring that current flows into all of the components that I have. This is also to ensure that all of the components work as expected. This program can also help us safeguard our component from overvoltage because it allows us to test it in software before testing it on the prototype. After completing the coding, the ESP 32 program can check the coding for errors before converting it to a hex file for simulation in the Proteus application. This software may examine whether or not all of the components work properly after the coding has been applied to the Arduino in Proteus. This can save time while troubleshooting the problem, whether it's a coding issue or a circuit issue.

Additionally, the Internet of Things (IoT) component of this project uses the Firebase stream application. The users can easily monitor the data in these apps and analyze the received data based on the generated graph. The created graph enables users to easily analyze the data, not just while the device is connected to the internet, but also when the data has been collected for at least 30 minutes and up to two months after the device offline. When a defect is discovered, users will receive both a notification and an email. The users' apps will stay open while the fault is being investigated and cool down for one minute; if the fault is discovered again after that time, a fresh notification and email will be sent to the users.

3.4.1 Monitoring apps of the System using firebase stream

for information, this IoT smart helmet uses its own application designed by myself using firebase stream ESP32.

Figure 7 firebase stream

Figure 8 Apps IoT smart helmet

3.4.2 Description of monitoring apps

Firebase is Google's mobile application development platform that helps you build, improve, and grow your app. It has many services used to manage data from any android, IOS, or web application. This guide will get you started quickly with Firebase using the ESP32 board. Firebase is Google's mobile application development platform that includes many services to manage data from IOS, Android, or web applications. You'll create a Firebase project with a real time database (RTDB), and you'll learn how to store and read values from the database with your ESP32. "Firebase is a toolset to "build, improve, and grow your app", and the tools it gives you cover a large portion of the services that developers would normally have to build themselves but don't really want to build because they'd rather be focusing on the app experience itself. This includes things like analytics, authentication, databases, configuration, file storage, push messaging, and the list goes on. The services are hosted in the cloud and scale with little to no effort on the part of the developer. This paragraph was taken from this article,

and we recommend that you read that article if you want to understand better what firebase is and what it allows you to do. You can use the ESP32 to connect and interact with your Firebase project, and you can create applications to control the ESP32 via Firebase from anywhere in the world. This means that you can have two ESP32 boards in different networks, with one board storing data and the other board reading the most recent data.

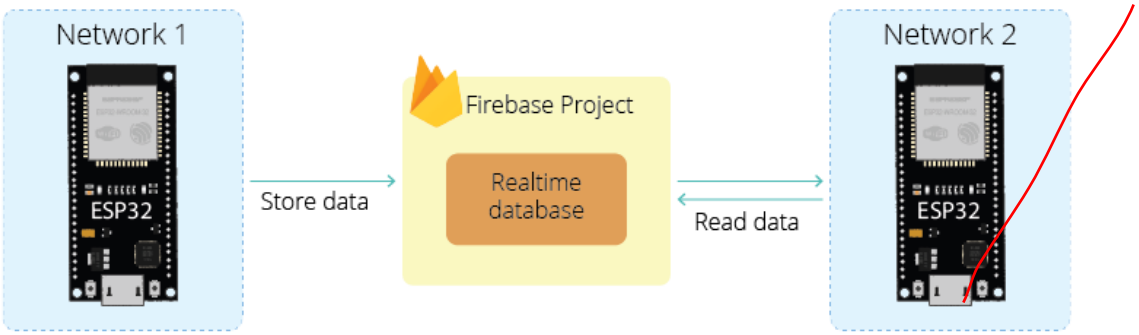
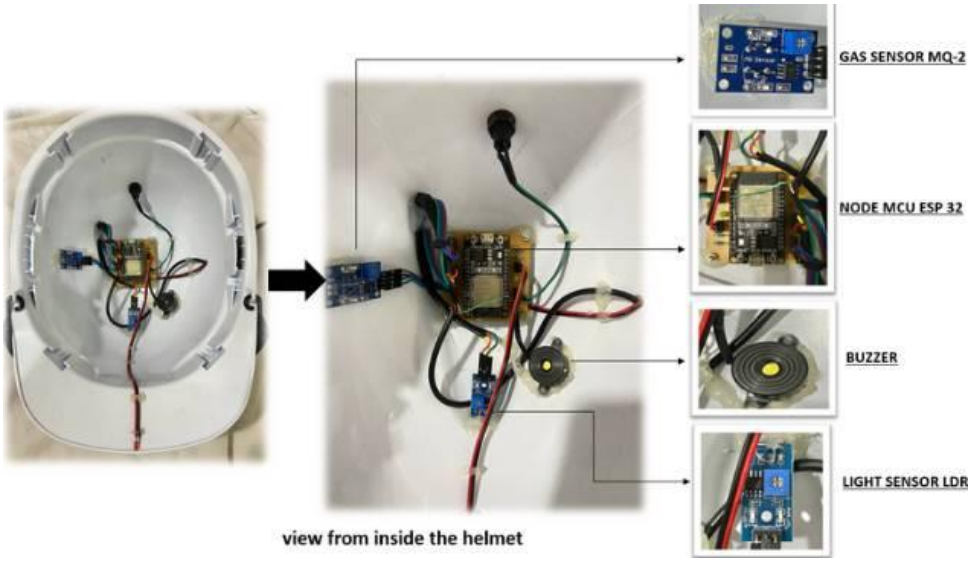


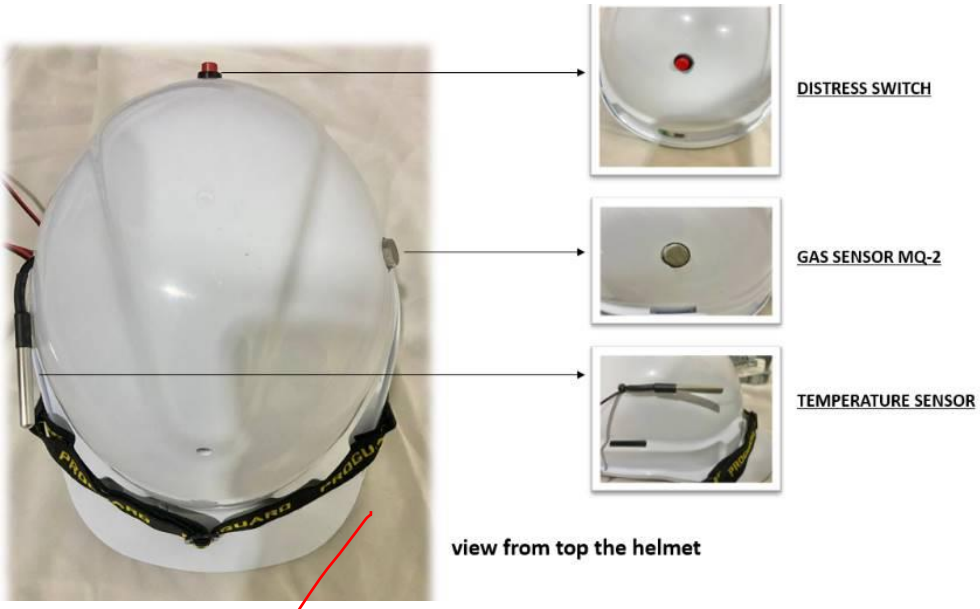
Figure 9 connection firebase stream

3.5 Prototype Development

A prototype is a look-alike or a copy of a part that illustrates the product features and explores all possibilities before investing in the full creation of the part. A prototype might range from a detailed pen and paper drawing to a fully functional version of the product. As a result, prototype development is just a collection of steps used by the manufacturer to create the prototype.

3.5.1 Mechanical Design/Product Layout



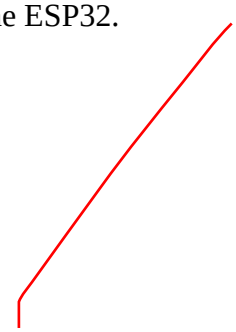


3.6 Sustainability Element in The Design Concept

This helmet is for the communication between the supervisor and the labor in case of any emergency. gas sensor, temperature sensor and light sensor were install in the helmet. With the help of ESP32 , a developed product which is Smart Working Helmet that can save their lives. Smart Helmet is a combination of the ordinary helmet with the latest technology and real time monitoring as per the requirement of the construction site. The ordinary site helmet is connected with a system so that all the activities are to be supervised in a single computer and further reduce the percentage of accident in construction area.

3.7 Chapter Summary

This chapter detailed the project design and overview, including a flowchart of the project and a block diagram of the project. Aside from that, this chapter discusses the component used in this project. The system will have a transmitter and receiver component that will be connected end to end of the helmet and will use the Sensor. We will integrate all of the components from the previous circuit into a single circuit. This project's heart will be the ESP32.



CHAPTER 4

4 RESULTS AND DISCUSSION

4.1 Introduction

Data analysis is the summarization of acquired data. It entails interpreting data acquired using analytical and logical reasoning in order to find patterns, connections, or trends. The outcomes and analysis for this project will be clearly presented and explained in this chapter based on the project's test run progress in 30 minutes. A table detailing the reading temperature sensor, light sensor and gas sensor. I believe that all of the results and discussions contained in this part have met the project objectives outlined previously mentioned.

4.2 Results and Analysis

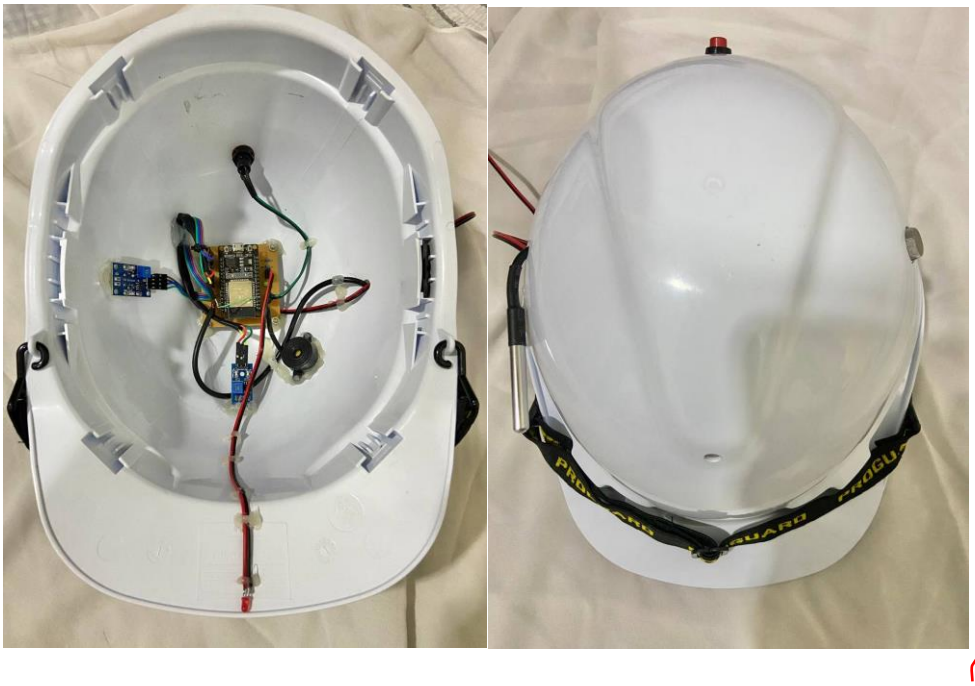


Figure 12 : finalize hardware product

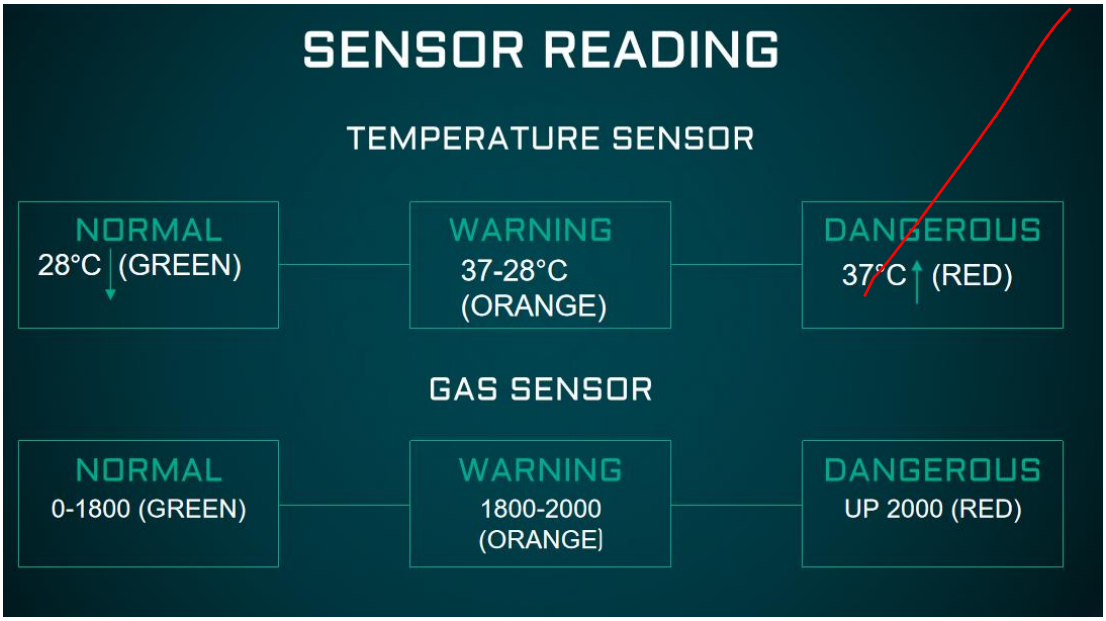


Figure 13 sensor reading

4.3 Discussion

The diagram above shows the results of the IoT smart helmet hardware project divided into the inside and the top. at the top of the helmet has been punched to place the temperature sensor, light sensor and gas sensor. due to the designed design, the sensor detects without other interference and is young enough to be detected by supervisors and workers while wearing it.

Next, the sensor readings have been decoded in the settings. as you can see screen in iot smart helmet application will show normal reading, warning and danger. The value has made research that the temperature or gas at which level has been dangerous for workers. In addition, the light sensor will output a value of 1 if the worker is in the dark and the buzzer sounds. if it is bright, the value 0 will show on the screen.

4.4 Chapter Summary

The outcomes of this project have been linked to this chapter to illustrate that the aims of the project that were previously set have been effectively attained. The discussion has also been provided based on the project results, such as the description and development of the final project, the specification of the helmet is can detect sensor and show the reading to the screen .the supervisor view of the IoT smart helmet Application, and the limitations of this project and its solution. This project's distance between transmitter and receiver has been measured and demonstrated, as indicated in the results section.

CHAPTER 5

5 CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The conclusion in this chapter is based on the results and discussion from the previous chapter. To see the benefits of the project and to build IoT smart helmet for construction workers, the conclusion must be produced to summarize the overall results. This section will also include and discuss suggestions for future work to improve the project's working and operation for another researcher based on the project that has been created and specific in this report. The conclusion also includes the approaches learned throughout the length to create the final product within the time frame given in the Gantt Chart in Chapter 6.

5.2 Conclusion

There was a modification in the ordinary helmet into a IOT smart helmet by adding gas sensor, temperature sensor and light sensor. The good thing is Supervisors can monitor employees remotely. Impact of this project is a The ability of system is to alert workers that in dangerous. To reduce the percentage of accidents at construction site. The use of a helmet protects the employee comfort and make sure the Occupational Safety and Health Administration (OSHA) is use in work area. There was a modification in the ordinary helmet into a IoT smart helmet by adding gas sensor, temperature sensor and light sensor. The good thing is Supervisors can monitor employees remotely.

5.3 Suggestion for Future Work

If there is a chance to improve this product, I plan for them to create a special helmet design that is suitable for placing the connection circuit inside the helmet so that this IoT smart helmet looks more charismatic and advanced.

In addition, adding sensors that are important for construction site workers, for example huminidity sensors that can detect workers' health conditions.

5.4 Chapter Summary

The conclusion was reached based on the previous outcomes and discussions, as well as an examination of the project goals, benefits, and strategies learned during the process of developing this product. The constraints, as well as ideas for future research, have been given, mostly focusing on fiber optic type, characteristics, and metrics that can be examined.

CHAPTER 6

6 PROJECT MANAGEMENT AND COSTING

6.1 Introduction

In the implementation of hardware costs, this endeavor comprises the cost of procuring parts and supplies and receive most of the hardware components through online sources. Some surveys were conducted at multiple online shops to compare pricing, such as on Shopee, before purchasing some elements. This strategy will also make things easier because it will save time and money. The overall gross expenditure estimate for this project's implementation is RM132.80, with additional expenses coming in at RM 156.00.

6.2 Gant Chart and Activities of the Project

The Gantt Chart is used in this project to show the start and end dates of a project's terminal items and summary elements. A Gantt chart is used for project management; it is one of the most popular and useful methods of displaying activities, tasks, or events against time. This Gantt chart depicts the tasks that must be accomplished by the deadline. Every task must provide the number of weeks it will take to complete. Figure below show gantt chart for Project 1 and Project It displays the activities that must be completed each week. This Gantt chart encourages everyone to be more punctual in their work.

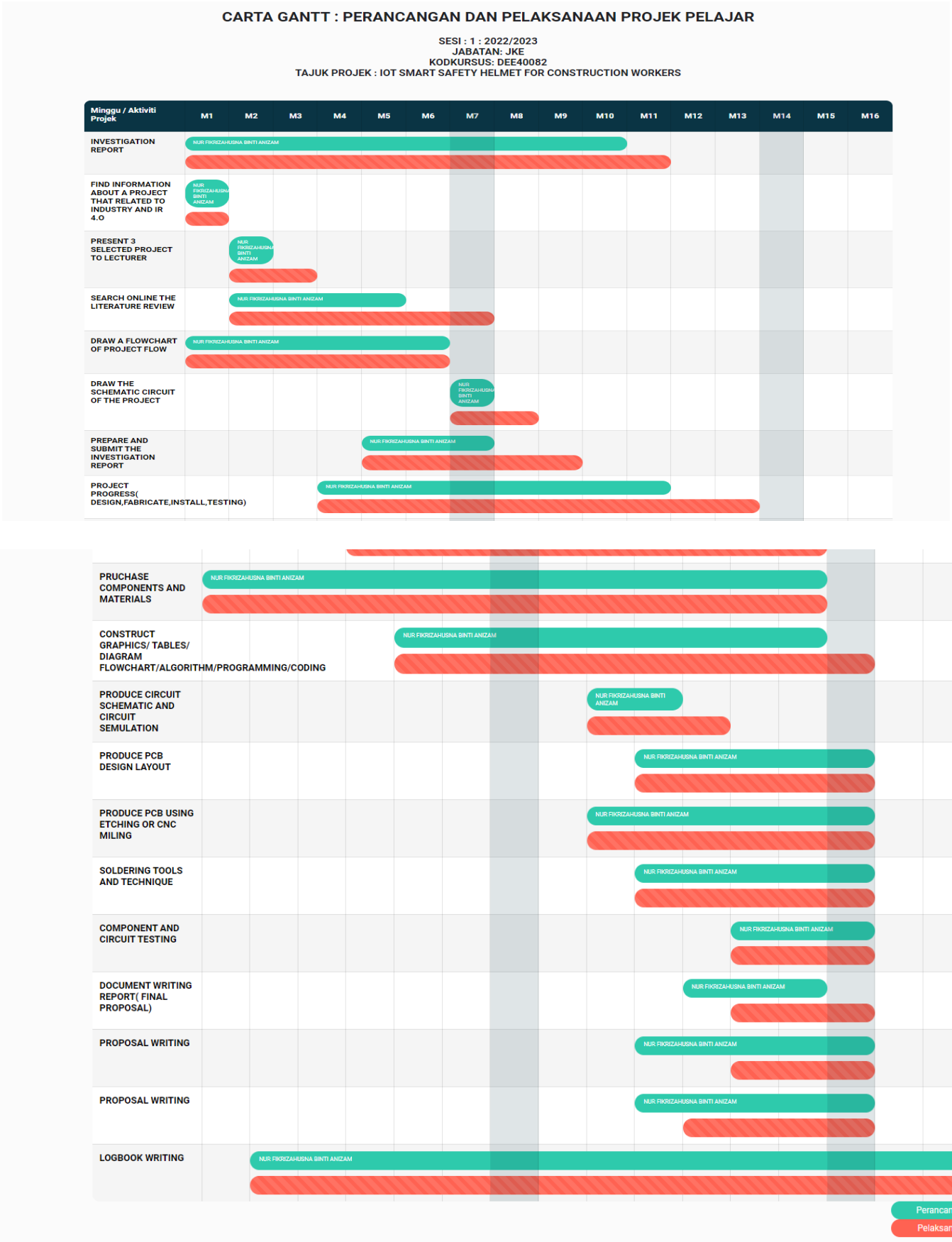


Figure 14 gantt chart project 1

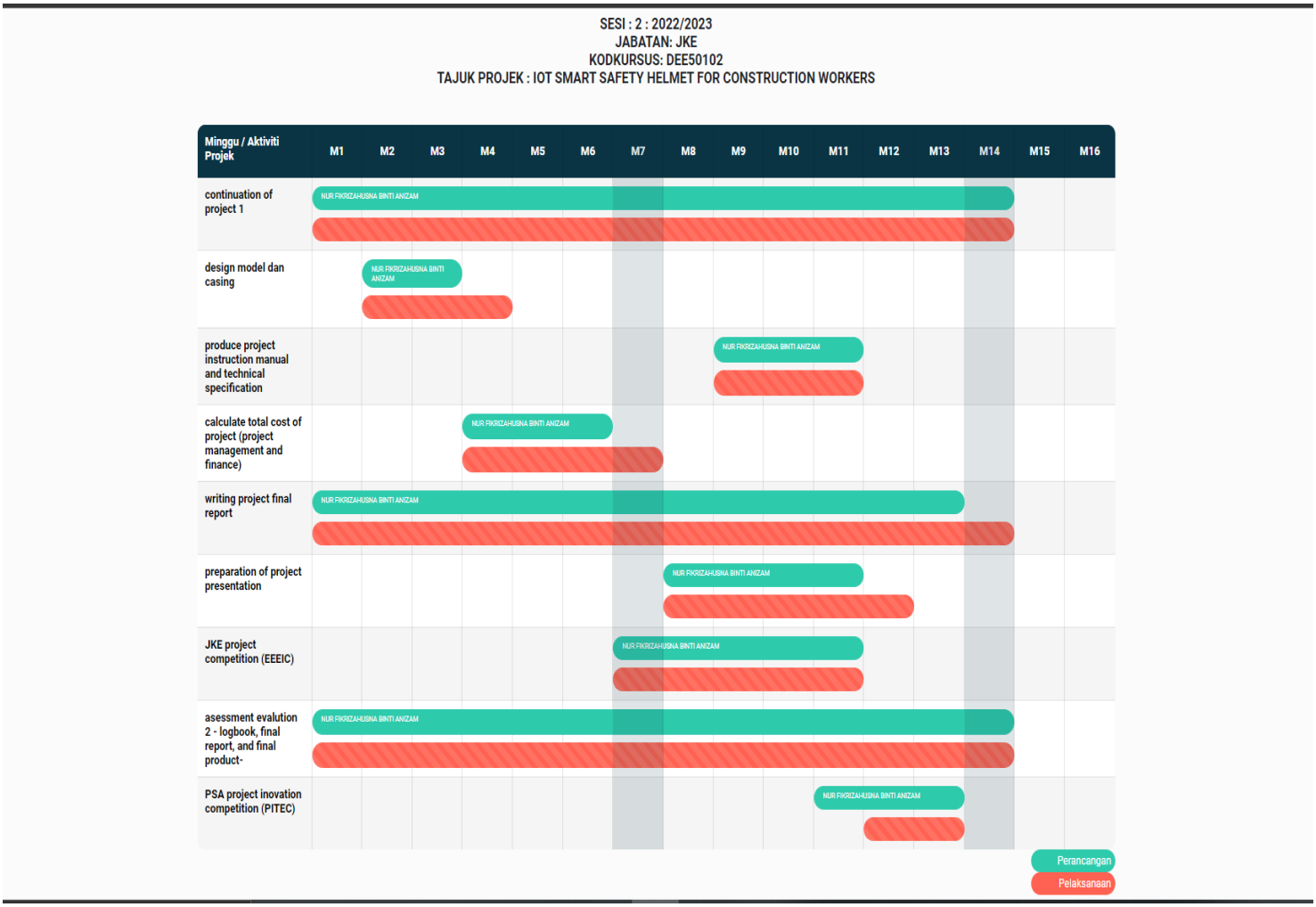


Figure 15 gantt chart project 2

6.3 Milestone

A milestone is a defined moment in a project's life cycle that is used to track progress toward the end goal. Milestones in project management are used to mark the start or end date of a project, external evaluations or input, budget checks, submission of a major deliverable, and so on. A milestone is a reference point inside a project that denotes an important event or a branching decision point. Table below shows the milestone of IoT Smart helmet for construction workers.

Description	Date	Cumulative project completion percentage
Completion of project planning	08.09.2022	15%
Completion of model system	20.10.2022	20%
Completion of project implementation	03.11.2022	35%
Completion of project management and finance	10.11.2022	40%
Completion final proposal report and mini project presentation	01.12.2022	55%
Completion of project programming design	30.03.2023	80%
Completion of project wiring and casing installation	20.04.2023	90%
Completion final report and project presentation	18.05.2023	100%

Table 1 Milestone of IOT Smart helmet for construction work

6.4 Cost and Budgeting

No.	Component and materials	The unit price	Quantity	Total
1	ESP 32 node MCU	RM 23.50	1	RM 23.50
2	Light sensor	RM 3.20	1	RM 3.20
3	Temperature sensor	RM 8.00	1	RM 8.00
4	Gas sensor	RM 7.00	1	RM 7.00
5	Buzzer	RM 2.00	3	RM 6.00
6	Resistors: 10k, 120, 4.5K	RM 2.00	3	RM 6.00
7	NPN Transistor (e.g. 2222A)	RM 2.00	1	RM2.00
8	Front light (helmet mountable)	RM 5.10	1	RM 5.10
9	Construction helmet	RM 11.00	1	RM 11.00
10	3.7 Rechargeable battery	RM 11.00	3	RM 33.00
11	Charger controller board	RM 28.00	-	RM 28.00
			Total :	**RM 132.80**
	List of other costing			
1	Transportation	RM30.00	-	RM 30.00
2	Postage	RM 5.00	4	RM 20.00
3	Ptinting (brochure)	RM 3.20	10	RM 32.00
4	Poster (EEIC & PITEC)	RM 32.00	2	RM 64.00
5	Internet & Application	RM 10.00	-	RM 10.00
	Total :			**RM156.00**
			Overall total	**RM 288.80**

Table 2 List of Components and Materials of IOT

6.5 Chapter Summary

The table above already shows all detail in this chapter about the cost of creating this product. Nowadays, every client is still concerned with cost when purchasing something, so we must create a comparable table to ensure that each of the costs that must be employed does not overburden the project's development. As a result, the goal of this product is to build a profitable, low-cost, high-quality project. The product is quite affordable, costing less than RM 1,000. Last but not least, the concept for this product was created using the most recent design

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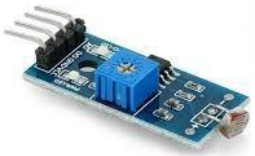
7 APPENDICES

APPENDIX A- DATA SHEET

1) **ESP 32**

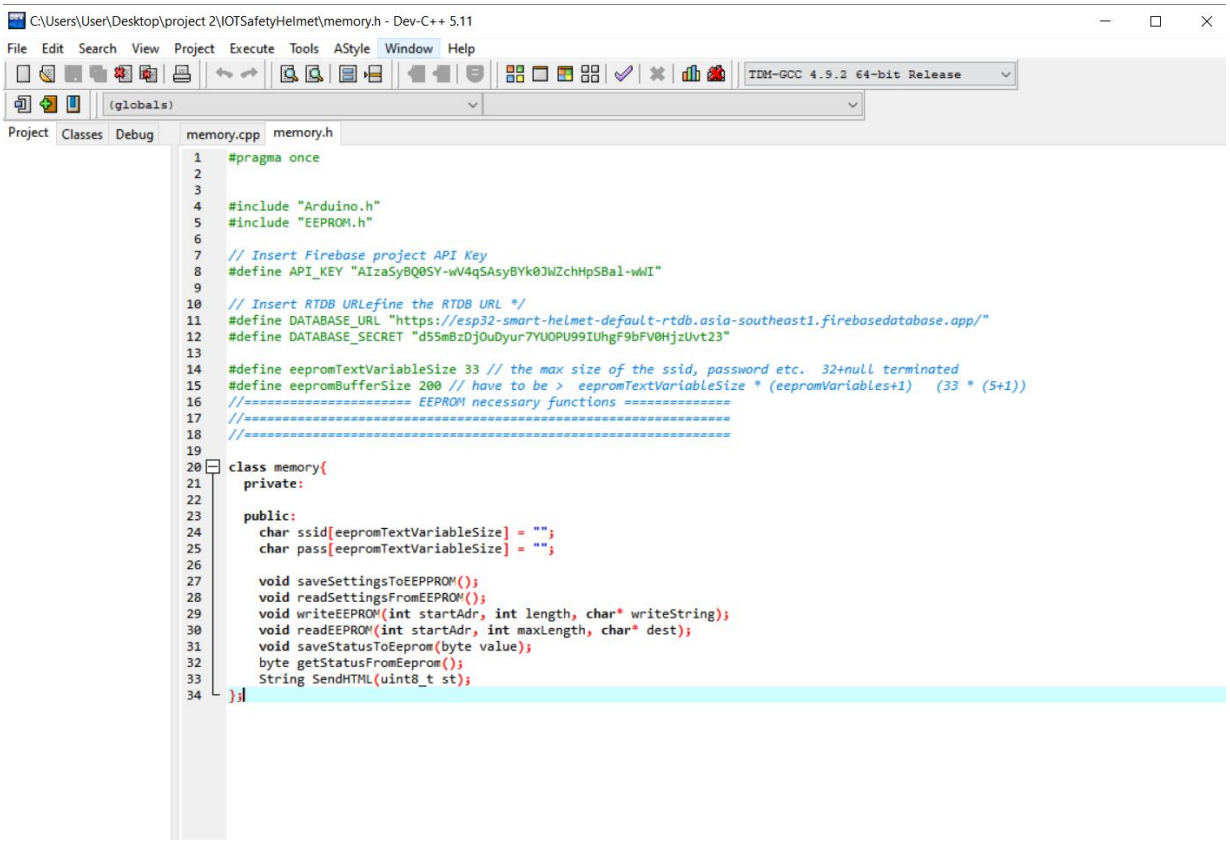
2) **Light sensor**

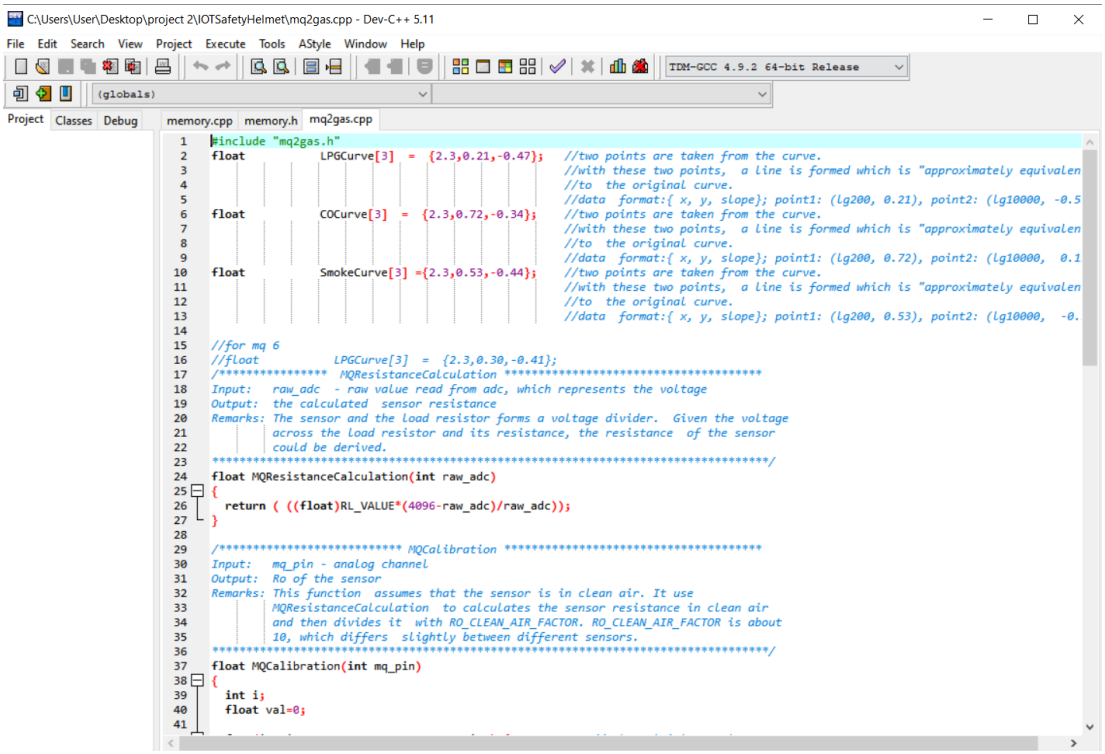


3) **Temperature sensor**

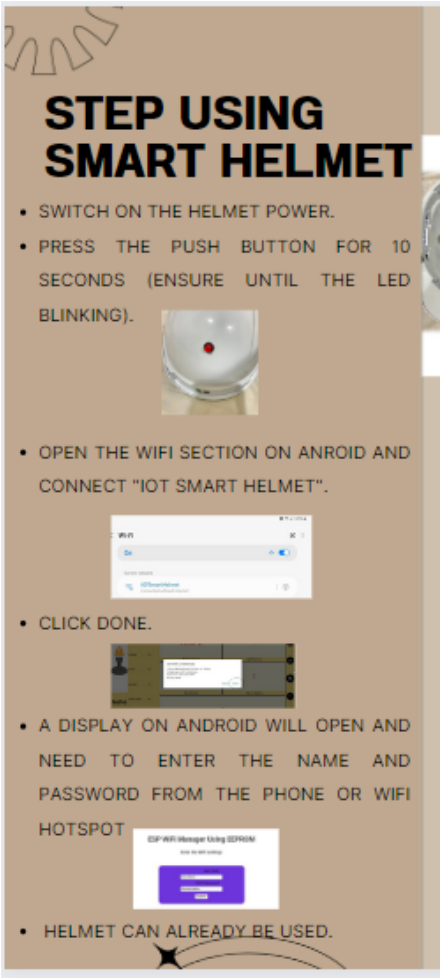
4) **Gas sensor**

APPENDIX B- PROGRAMMING

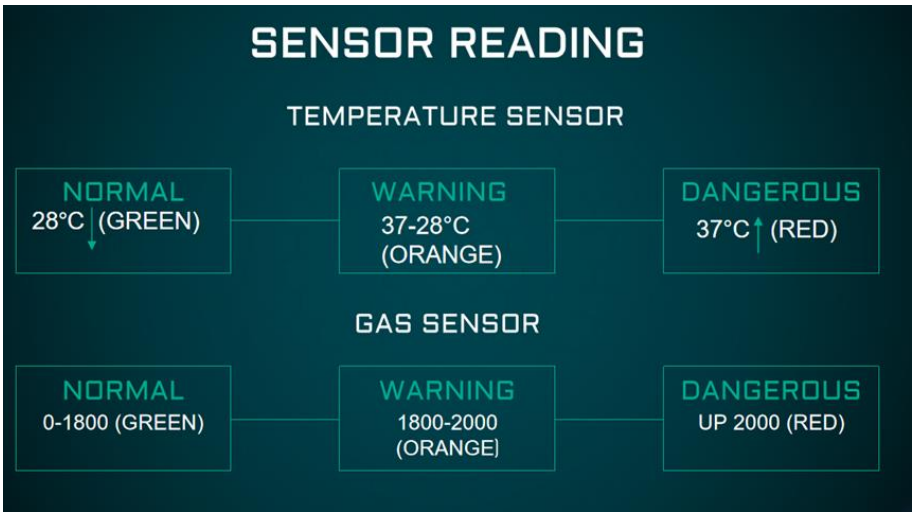




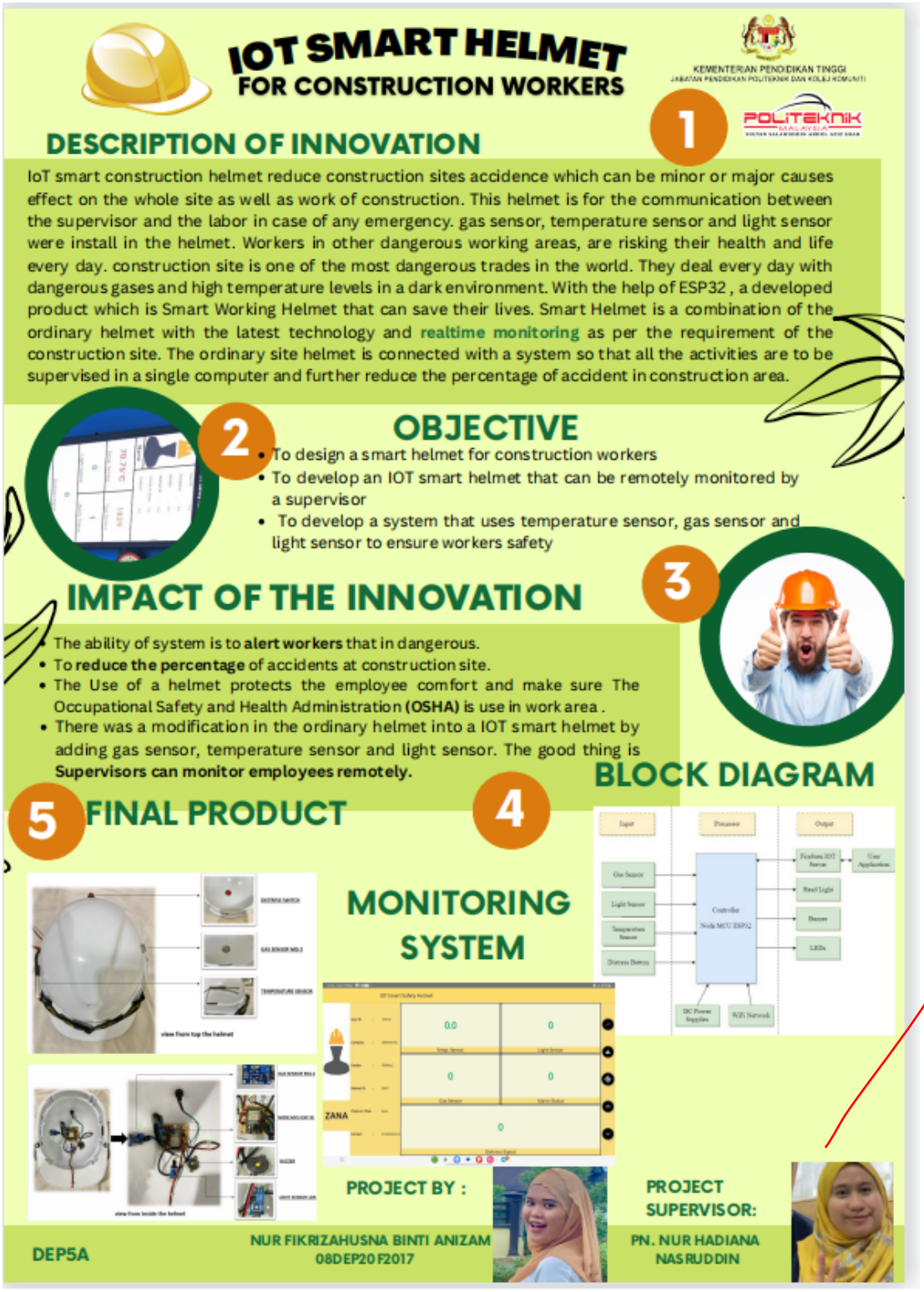
APPENDIX C- PROJECT MANUAL/PRODUCT CATALOGUE

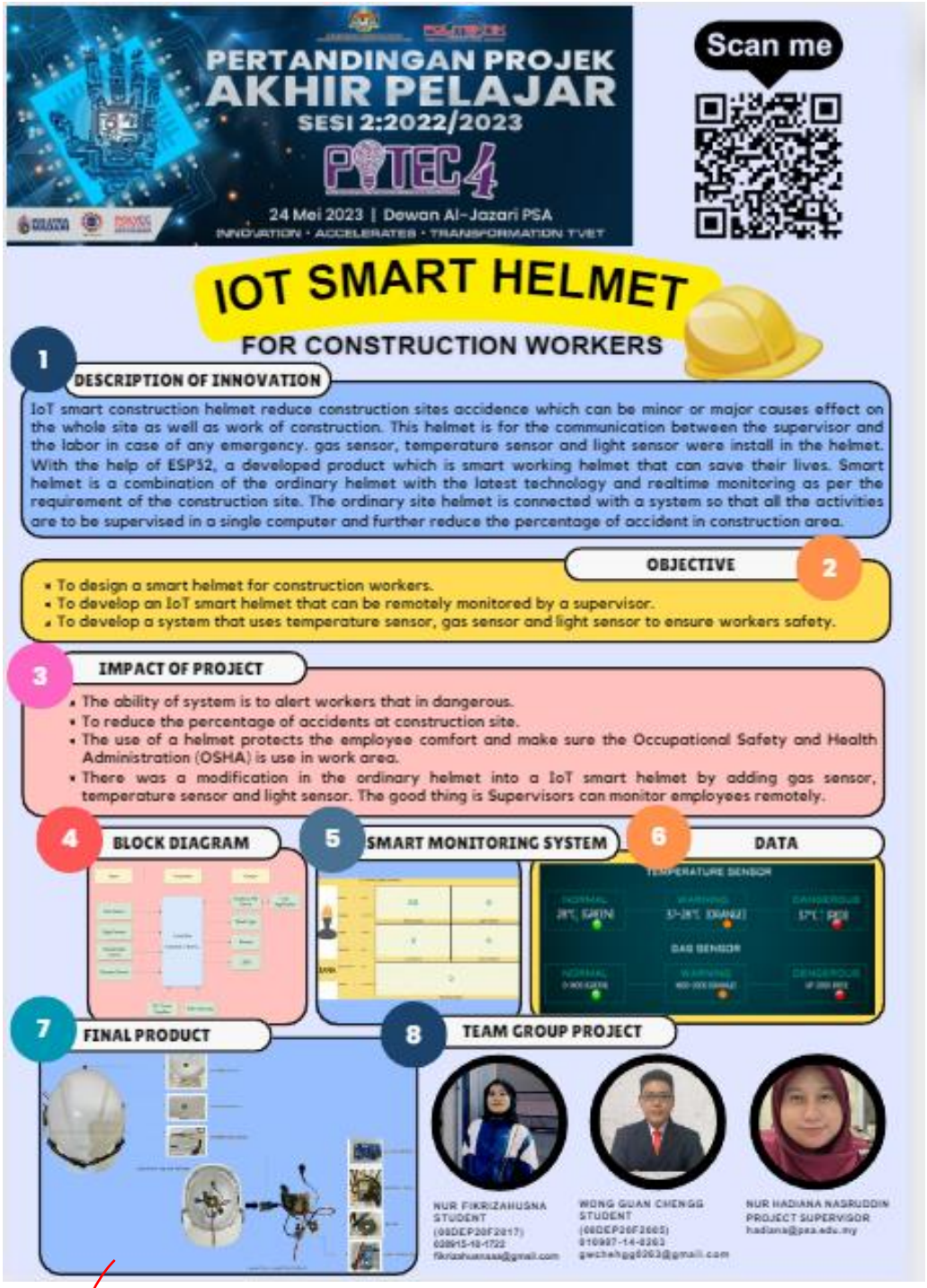


APPENDIX D – CONDITIONAL TABLE



APPENDIX E – EEEiC AND PITEC POSTER AND PARTICIPATION CERTIFICATE

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PTEC 4
24 Mei 2023 | Dewan Al-Jazari PSA
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IOT SMART HELMET
FOR CONSTRUCTION WORKERS
1
DESCRIPTION OF INNOVATION
IoT smart construction helmet reduce construction sites accidence which can be minor or major causes effect on the whole site as well as work of construction. This helmet is for the communication between the supervisor and the labor in case of any emergency. gas sensor, temperature sensor and light sensor were install in the helmet. With the help of ESP32, a developed product which is smart working helmet that can save their lives. Smart helmet is a combination of the ordinary helmet with the latest technology and realtime monitoring as per the requirement of the construction site. The ordinary site helmet is connected with a system so that all the activities are to be supervised in a single computer and further reduce the percentage of accident in construction area.
OBJECTIVE
2
• To design a smart helmet for construction workers.
• To develop an IoT smart helmet that can be remotely monitored by a supervisor.
• To develop a system that uses temperature sensor, gas sensor and light sensor to ensure workers safety.
3
IMPACT OF PROJECT
• The ability of system is to alert workers that in dangerous.
• To reduce the percentage of accidents at construction site.
• The use of a helmet protects the employee comfort and make sure the Occupational Safety and Health Administration (OSHA) is use in work area.
• There was a modification in the ordinary helmet into a IoT smart helmet by adding gas sensor, temperature sensor and light sensor. The good thing is Supervisors can monitor employees remotely.
4
BLOCK DIAGRAM
5
SMART MONITORING SYSTEM
6
DATA
TEMPERATURE SENSOR
GAS SENSOR
7
FINAL PRODUCT
8
TEAM GROUP PROJECT
NUR FIKRIZAHUSNA
STUDENT
WONG GUAN CHENGG
STUDENT
NUR HADIANA NASRUDDIN
PROJECT SUPERVISOR

POLITEKNIK MALAYSIA
SULTAN SALAHUDDIN ABDUL AZIZ SHAH

SIJIL

PENYERTAAN

DIBERIKAN KEPADA

NUR FIKRIZAHUSNA BINTI ANIZAM

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