POLITEKNIK MALAYSIA
SULTAN SALAHUDDIN ABDUL AZIZ SHAH

FINAL YEAR PROJECT REPORT

TITLE:

INTELLIGENT LPG GAS LEVEL INDICATOR

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DECLARATION

I hereby declare this final year project book is the authentic record of my own work carried out for the final year project for the award of the Diploma of Electronic Engineering Communication with honours, under the guidance of Ts. NORAZLINA BINTI JAAFAR from week 1 until week 14.

SIGNATURE : Sabrina……

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REGISTRATION NO. : 08DEP20F1036

DATE : 15 December 2022

ENDORSEMENT

I hereby acknowledge that I have read this report and I find that its contents meet the requirements in terms of scope and quality for the award of the Diploma in Electronic Engineering (Communication).

SIGNATURE : ……

NAME : PN. NORAZLINA BINTI JAAFAR

POSITION : PROJECT SUPERVISOR

DATE : 25 December 2022

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First and foremost, I would like to praise and thank Allah the almighty, who has granted countless blessings, knowledge, and opportunity to us, so that I have been finally able to accomplish the final year project book.

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Last but not least, I want to thank and express my appreciation to all the people, family, and friends who were directly or indirectly involved in this study. The project could not have been accomplished without them.

ABSTRACT

Colloquially known as “gas cylinder”, **Liquefied Petroleum Gas (LPG)** is a source of energy used for **cooking** and heating. In the era of information technology, humans tend to develop a better and more convenient lifestyle. Wireless technology has already become an important application which usually integrated into a wide range of devices and other technologies. Nowadays, almost all electronic devices are equipped with wireless technology. This fact shows the necessity and benefits provide by this technology. Therefore, I am intended to develop a system which is called **Intelligent LPG Gas Level Indicator**. People know that Liquefied Petroleum Gas (LPG) is widely used in households. So, the purpose of developing this project is to measure the **gas level** inside the gas cylinder. The main component for this Intelligent LPG Gas Level Indicator is an **Arduino UNO**, an **HX711 Load Cell Amplifier**, and a **Load Cell Sensor**. This project uses the HX711 Load Cell Amplifier to amplify the low-voltage output of the load cell and sends it to the Arduino UNO so that the Arduino UNO eventually calculates the weight from this data. The Arduino UNO will process the collected data and send it wirelessly to mobile application **(Telegram)**. With the help of a load cell sensor, the mobile application will display the percentage of gas left in the cylinder. The percentage of gas remaining in the cylinder is updated continuously in the mobile application that is being used by the user, and when the gas level is partially full or empty, the user will receive an alert in the application.

Keywords: Liquefied Petroleum Gas (LPG), cooking, Intelligent LPG Gas Level Indicator, gas level, Arduino UNO, HX711 Load Cell Amplifier, Load Cell Sensor, Telegram.

ABSTRAK

Dalam bahasa sehari-hari dikenali sebagai "silinder gas", **Gas Petroleum Cecair (LPG)** ialah sumber tenaga yang digunakan untuk **memasak** dan memanas. Dalam era teknologi maklumat, manusia cenderung untuk membangunkan gaya hidup yang lebih baik dan selesa. Teknologi tanpa wayar telah menjadi aplikasi penting yang biasanya disepadukan ke dalam pelbagai perant. Pada masa kini, hampir semua peranti elektronik dilengkapi dengan teknologi tanpa wayar. Fakta ini menunjukkan keperluan dan faedah yang disediakan oleh teknologi ini. Oleh itu, saya berhasrat untuk membangunkan satu sistem yang dipanggil **Intelligent LPG Gas Level Indicator**. Umum mengetahui bahawa Gas Petroleum Cecair (LPG) digunakan secara meluas dalam isi rumah. Jadi, tujuan pembangunan projek ini adalah untuk mengukur **paras gas** di dalam silinder gas. Komponen utama untuk Intelligent LPG Gas Level Indicator ini ialah **Arduino UNO**, **HX711 Load Cell Amplifier** dan **Load Cell Sensor**. Projek ini menggunakan HX711 Load Cell Amplifier untuk menguatkan output voltan rendah sel beban dan menghantarnya ke Arduino UNO supaya Arduino UNO dapat mengira berat daripada data ini. Arduino UNO akan memproses data yang dikumpul dan menghantarnya secara tanpa wayar ke aplikasi mudah alih **(Telegram)**. Dengan bantuan Load Cell Sensor, aplikasi mudah alih akan memaparkan peratusan gas yang tinggal di dalam silinder gas. Peratusan gas yang tinggal dalam silinder dikemas kini secara berterusan dalam aplikasi mudah alih yang digunakan oleh pengguna, dan apabila paras gas separa penuh atau kosong, pengguna akan menerima amaran dalam aplikasi.

Kata kunci: Gas Petroleum Cecair (LPG), memasak, Intelligent LPG Gas Level Indicator, paras gas, Arduino UNO, HX711 Load Cell Amplifier, Load Cell Sensor, Telegram.

LIST OF CONTENTS

CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

Liquefied petroleum gas is a mixture of flammable hydrocarbon gases, usually propane, butane and propylene. However, the latter two usually consist of 5% or less of the mixture. LPG is used as a fuel gas in heating appliances, cooking appliances, and vehicles. In developing countries, LPG is mainly used as cooking fuel. The users are predominately middle to high-income households in regions with a supply network (mostly urban and peri-urban areas). Domestic gas cylinders will have their tare (empty) weight engraved on them and gas agencies should fill them with 14 kg LPG. The gross weight of the cylinder should be arrived at by adding tare weight and the amount of 14 kg of LPG. For example, if the tare weight printed on the cylinder is 16.5 kg, a full cylinder with 14.5 kg LPG should have a gross weight of 30.5 kg. LPG emits lower greenhouse gas emissions than alternatives, CO2 emissions are relatively low. Greenhouse gases are reduced by 5-16 times per prepared meal compared to coal. In addition, LPG is easily ignited and provides heat immediately after lighting, especially while cooking. In addition, it is easy to store and transport within the country as well as abroad. But, in case of worn-out equipment or incorrect use, LPG bears the risk of explosion.

In Malaysia, Petroliam Nasional Berhad, or better known as PETRONAS (a Malaysian oil and gas company) is the leading retailer and marketer of LPG for household, commercial and industrial customers. Petronas is given the responsibility by the Malaysian government to expand and add value to these petroleum resources, not only to the country but to the whole world. Their business is supported by the nation's largest LPG supply and distribution network comprising eight terminals and bottling facilities as well as LPG Channel Members consisting of premier dealers, dealers, and bulk dealers.

1.2 PROJECT BACKGROUND

To begin with, liquefied petroleum gas, or known as LPG is used on gas stoves, cooktops, ovens, and heaters are all popular in-home gas appliances. This LPG can often be found in many people's kitchens. In restaurants or for food vendors, it is the most important thing since it is the first thing needed when cooking. In the present day, a user can only determine how much gas is left in a gas cylinder by looking at the changes in the colour of the flame. It is very difficult for consumers who are not capable of observing flame colour changes to use this method. Thus, consumers will be better prepared when it comes to changing a new gas cylinder with this Intelligent LPG Gas Level Indicator. By using this system, the user will know the remaining gas in the gas cylinder by looking at the green LED which indicates the gas cylinder is still full, while the yellow LED shows the gas cylinder is partially full, and the red LED specifies the gas cylinder is empty.

Many people cannot visualize the period of time when technology begins to develop incredibly fast day by day. However, it is expected to revolutionize our lives in the age of the Internet of Things (IoT). IoT is now a growing industry. With this Intelligent LPG Gas Level Indicator system, users will receive information via Telegram about the remaining gas in the gas cylinder. Users will receive a notification as soon as the system is turned on. Therefore, it is very convenient for the user to know how much gas remains in the gas cylinder because the information is at your fingertips.

1.3 PROBLEM STATEMENT

From the research that I have done, there are several problems that might face by the consumers where I have interested to solve their problems.

Firstly, sudden run out of gas during cooking. This causes users take a long time to change a new gas cylinder. Especially when this happens to food vendors, as well as chefs in restaurants who regularly use cooking gas. This also results in customers having to queue for a long time because workers are not ready to change a new gas cylinder. Indirectly, this also causes chaos in the kitchen.

Secondly, users do not have the ability to measure the volume of the gas inside the gas cylinders. Because the volume of the gas is usually measured with a gas syringe or an upside-down measuring cylinder. And usually, only people who specialize in this field are able to measure the volume of the gas in a gas cylinder, so it is very dangerous if we try to open the gas cylinder by ourselves without any knowledge about it. A gas cylinder may explode if we attempt to open it without any knowledge about it.

Lastly, the consumer does not know whether the volume of the gas inside the gas cylinder is full, partially full, or empty. It is because gas is a substance that cannot be seen with the naked eye. Although the gas cylinder is designed with a translucent cylinder, the gas still cannot be seen because it is colourless and transparent. This causes the user to not be able to identify the volume of gas in the gas cylinder.

1.4 PROJECT OBJECTIVE

This project aims to discover the problems faced by LPG gas consumers. There are some project objectives from this project which are:

- To build a system that can weigh the weight of a gas cylinder by using a load cell sensor.
- To design a system that can alert the user about the gas left inside the gas cylinder through mobile phone application (Telegram).

1.5 PROJECT SCOPE

There are few of project scopes that have been studied for this project. One of them is, the project focuses on consumers who frequently use cooking gas, such as chefs in restaurants as well as food vendors. The reason for this is that chefs and food traders must use cooking gas to prepare food. This also allows them for getting ready to replace a new gas cylinder when the gas cylinder is already empty.

Next, this project is applicable to gas cylinders weighing 16.5 kg to 30.5 kg only. It is common in homes, small restaurants, and food traders to use 14kg gas cylinders. So, consumers who use 10kg and 12kg of gas cylinders cannot use this system. This is because the code that has been programmed in the Arduino IDE software is set from 16.5kg to 30.5kg. A full volume of gas inside a gas cylinder weighs between 20.5kg and 30.5kg. The volume of gas is partially full if the weight of the gas cylinder is 18.5kg to 20.4kg. Lastly, when the weight of the gas cylinder is 16.5kg to 18.4kg, the volume of gas inside a gas cylinder is empty.

Lastly, the gas cylinders that is suitable for this project is for cooking only. As we know, the use of LPG gas is very widespread in any use. It can also be used for refrigerators and air conditioning. But, for this project, the gas cylinders used for purposes other than cooking are not suitable. Because this project has been designed according to its suitability in the kitchen.

1.6 PROJECT SIGNIFICANCE

Firstly, this Intelligent LPG Gas Level Indicator is using a wireless network system. It will update the remaining gas in the gas cylinder by sending a notification through Telegram to alert the user about the remaining gas in the gas cylinder.

Furthermore, this Intelligent LPG Gas Level Indicator is a life saver for those who regularly use cooking gas. Consumers will be able to prepare in advance for a switch to a new gas cylinder. That way, they won't have to worry about running out of gas in the middle of cooking.

Additionally, this project has been built of wheeled plates and uses small components. Therefore, it is simple to move it to any place due to its lightweightness and does not require assistance from others to handle.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

LPG products are made up of a group of flammable hydrocarbon gases that are liquefied through pressurization and commonly used as fuel. LPG is frequently used for fuel as LPG heating gases, cooking, hot water, and vehicles, as well as for refrigerants, aerosol propellants, and petrochemical feedstock. But in this project, the focus is on LPG for cooking purposes. In modern times, technology is getting better and better to replace the traditional system by introducing the computerized system. Before I start this Intelligent LPG Gas Level Indicator project, I have to analyse and think of the need of the project such as the program and circuits that are suitable for this project. Moreover, the physical prototype must also be tested before I can make the final product. The purpose of this is to ensure the project will work as intended.

Additionally, this chapter discusses how can users get better prepared if the occurrence of a sudden running out of gas while cooking. In order to prevent this problem from getting worse, this project is designed to help users be more aware of the gas levels in gas cylinders.

2.2 LITERATURE REVIEW TOPIC 1

Almost exclusively, LPG is used as cooking fuel. The users are predominantly middle- to high-income households in regions with a supply network (primarily urban and peri-urban areas). Global LPG production capacity has been growing faster than demand since 2007: In 2012, there were 9.7 million tons of excess LPG. As a result, the gap has been widening. Accordingly, consumption rose by 2% in 2012, while production increased by 3%. In terms of liquefied petroleum gas (LPG) production, Malaysia produced nearly 2.7 million metric tons in 2021. The production of LPG in the country has been increasing since 2013 when 2.53 million metric tons were produced.

2.3 LITERATURE REVIEW TOPIC 2

There are lots of projects that I have learned from others and they are a starting point for my ideas. Among the thoughtful projects I have studied are from the authors named Manuel Taning, Nurul Rodziah Abdul Ghafar, and Zuhanis Mansor (2021)[1]. Their project is called Development of Smart Monitoring and Gas Leakage Detector for LPG Gas. The main objective of their project is to measure the weight of the LPG tank, then notify the user through NodeMCU. This smart monitoring of LPG Gas consists of the load sensor to measure the weight of LPG Gas, which is the force pressure applied on the load sensor. Because of the low and feeble signal strength, the HX711 Load Cell Amplifier will increase and amplify the signal strength. Next, the NodeMCU must configure all the input sensors connected to it and compute the parameters. As result, output will be displayed on the Blynk mobile application for monitoring the measurements that are taken by the sensors.

Then, the project named LPG Gas Usage Indicator (Implementation of Using Cooking Gas) that have been done by Muhammad Fakhrullah Bin Hilman Halim, and Amir Haikal Bin Ahmad (2018)[2]. The objectives of the project are to make sure the system gives a notification if the content is almost empty during cooking. The Arduino UNO function as the main control for this project. It also controls two of the main sensors which is the leakage sensor and the weight sensor which act as an input. The first input is the weight sensor, that used to calculate the volume of gas in the LPG tank. This sensor is then processed by the Arduino UNO to be sent to the outputs which are the LEDs. As an outcome, the GSM module will send the notification and SMS to our handphone. The function of the GMS module is used to establish communication between a computer and a GSM GPRS system. GSM is an architecture used for mobile communication in most countries. This means the GSM function as a communication between the Arduino and our telephone.

Also, I have been doing some research on a project called LPG Gas Monitoring System based on Arduino & Automatic Cylinder booking with Alert System & Leakage Reduced. This project has been done by Polasi Sudhakar, Manda. Ramakrishna, and Yasaswini Katiki from Ramachandra College of Engineering, India (2018)[3]. The objective of the proposed system is to continuously measure the weight of the cylinder and as soon as it reaches the minimum threshold it will automatically send an SMS alert to the user as well as the Authorized LPG agent so that they can act accordingly. In Arduino Based LPG Gas Monitoring & Automatic Cylinder booking with Alert System, MQ-4 gas sensor, LM-35 temperature sensor, 10kg load cell (for prototype) are used as input devices and piezoelectric buzzer, 16x2 LCD display, and GSM Module are used as output devices. The system measures the weight of the cylinder by using a weight sensor. And, it displays the corresponding weight in the LPG display. The proposed system uses the GSM Modem to alert the user about the gas status of automatic cylinder booking. The GSM Module will send SMS to the user's mobile phone for different kinds of input reactions in their project. The message "GAS IS LOW RECHARGE SOON" is sent to the user when the LPG Gas reaches the minimum threshold level, so the user will get ready to book the cylinder to avoid delay in delivering the cylinder. Other than that, the message "GAS IS EMPTY RECHARGE IMMEDIETLY" is sent when the weight of the gas is fully empty.

Not only that but also the authors named Ravindra R. Hiwase, Priya K. Kewate, Sushmita P. Tajane, Jitendra Waghmare, students of the Department of Electronics and Telecommunication from Nagpur Institute of Technology, Nagpur, India (2018)[4] have realised their project which is Automatic LPG Cylinder Booking and Leakage Detection using Arduino UNO. The primary objective of their brilliant project is to measure the gas present in the cylinder when the weight of the cylinder reached below the fixed load. The Arduino UNO is a microcontroller board based on the ATmega328. It uses an ATmega16U2 with faster transfer rates and saves more memory. Arduino can be used to develop stand-alone interactive objects or can be connected to software on your computer. Also, a load cell is a transducer that can translate pressure (force) into an electrical signal. In a strain gauge load cell, the force is sensed by the deformation of a strain gauge on the element. The HX711 load cell amplifier is used to get measurable data out from a load cell and strain gauge.

Then, the GSM module is used to establish communication between a controller and a GSM GPRS system. It requires a SIM card just like mobile phones to activate communication with the network. Also, they have IMEI numbers similar to mobile phones for their identification. In automatic gas cylinder booking, they continuously measure the amount of gas present in the cylinder using a load cell that is interfaced with Arduino UNO and display the weight of the cylinder on the LCD display. When the gas level goes below the set level then a message will be sent to the gas agency and a notification about the same is given to the user by using the GSM Module. So, the user gets the cylinder within time.

Last but not least, I have observed a project done by N. S. Sushmitha, and H. P. Vinod Kumar from the Department of Mechanical Engineering of The National Institute of Engineering, Mysuru, India (2020)[5]. The given name for the project is Design and Implementation of IoT Based Smart Weighing Device for LPG Monitoring and Industrial Applications. The objective of this device is to measure weight in real-time which is further interfaced with a web page and a mobile application for user interface through Wi-Fi. The four load cell sensors are placed at the four equidistant places of the base plate on which it exerts equal forces on all the four sensors. These four load cell sensors are further connected to the HX711 amplifier which reads the values from load cells to measure weight. The output of the HX711 amplifier is connected to the ESP8266 module for further data processing. Then the ESP8266 establishes connection with available Wi-Fi and sends the data to the database which will be further utilized for user interface development. Later on, by using the acquired data, actions like cylinder refill booking and complaints registration can be done by the users. It is a handheld device that can be easy for the user to bring as it is transportable.

2.4 SUMMARY

The goal of this chapter is to explain the sensor perspective used in previous research or projects, as well as to categorise how much this project is related to those research and theory. This chapter also demonstrates the theory and concepts used to solve problems. Theoretical is essential as a guideline when conducting any type of research. As a result of this chapter, I've decided to use a load cell sensor to detect the weight of the gas cylinder. Because of its low power requirements, it is appropriate for most electronic devices such as laptops and mobile phones. Aside from that, the best part about this sensor is that it can be found at any online or physical electronic store. Plus, the price is very cheap.

CHAPTER 3: METHODOLOGY

3.1 INTRODUCTION

A methodology is described as a system of practises, techniques, procedures, and norms followed by persons who work in a discipline by the Project Management Institute (PMI). A set of guiding concepts and procedures called project management techniques are used to plan, manage, and carry out projects. The method of project management you select will affect how tasks are prioritised and finished.

Additionally, the goal of project methodology is to make it possible to effectively make decisions and solve problems while also ensuring the effectiveness of particular procedures, methods, techniques, approaches, and technology. Here is a quick explanation of some of the important factors that can influence our decision, including cost and budget, risk-taking capacity, and adaptability.

The utilisation of the materials to carry out the project is described in greater detail in methodology. This covers both the project's operating procedures and the manner in which the project will be carried out. Every project that is implemented or an existing project that is being improved in the market needs to follow this process.

3.2 PROJECT DESIGN AND OVERVIEW

3.2.1 BLOCK DIAGRAM OF THE PROJECT

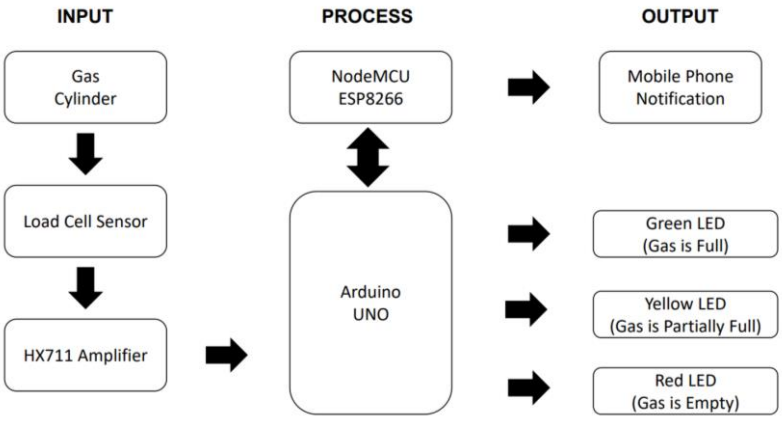

Figure 3.1: Block Diagram

3.2.2 FLOWCHART OF THE PROJECT

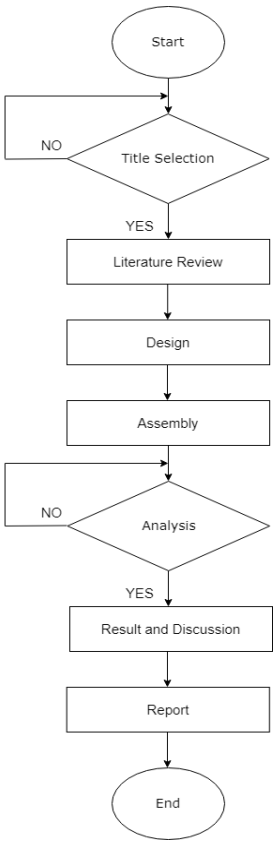

Figure 3.2: Flowchart of the Project

3.2.3 PROJECT DESCRIPTION

This Intelligent LPG Gas Level Indicator has its own ways to be completed and succeed in this project. The project is actually a measure of how much gas remains inside the gas cylinder by weighing the gas cylinder. Firstly, the gas cylinder will be placed on top of the load cell sensor. As soon as the load cell sensor detected a weight, the hardware system is working where a green LED will light up to indicate the gas is still full. But, if the yellow LED lights up, it means the gas is partially full. Next, the red LED will light up to show that the gas has run out. Last but not least, all the data received at the NodeMCU will be sent to Telegram on the user's mobile phone.

3.3 PROJECT HARDWARE

3.3.1 SCHEMATIC CIRCUIT

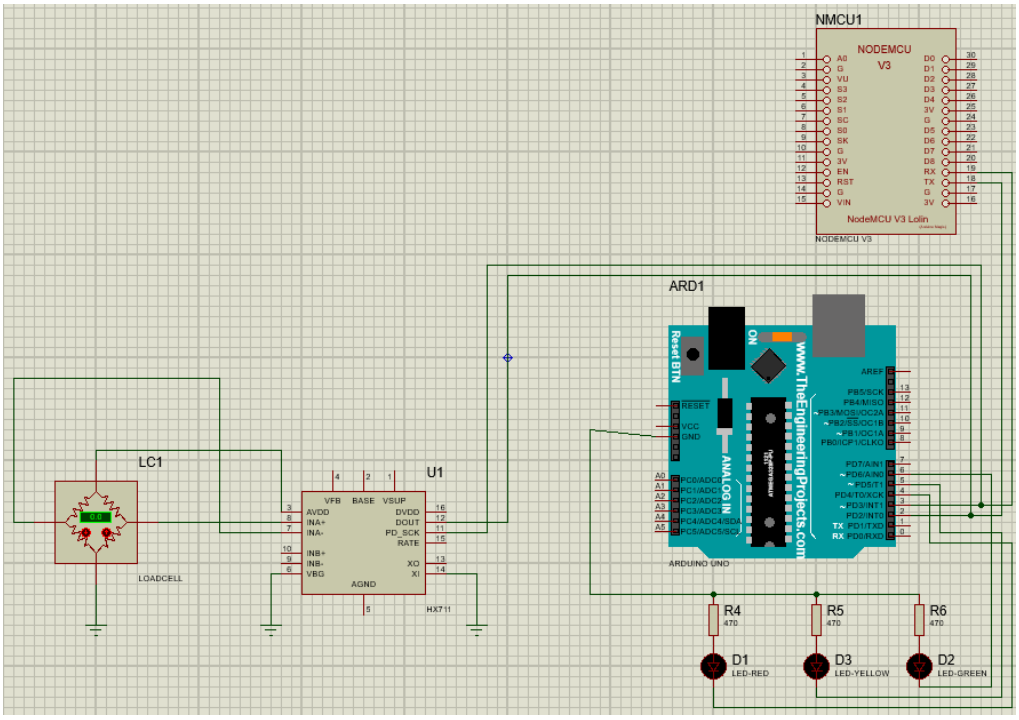

Figure 3.3: Schematic Circuit on Proteus

3.3.2 DESCRIPTION OF MAIN COMPONENT

3.3.2.1 ARDUINO UNO

Arduino is a free and open-source electronics platform with simple hardware and software. Arduino boards can read inputs and convert them into outputs like activating a motor, turning on an LED, or publishing something online. You can instruct your board by sending a set of instructions to the board's microcontroller. Arduino Uno is a popular Arduino due to its smaller size and compatibility with software and hardware in the system. Because it is small in size, it is easily fit with any development board, and designers can easily carry it around the boarding system.

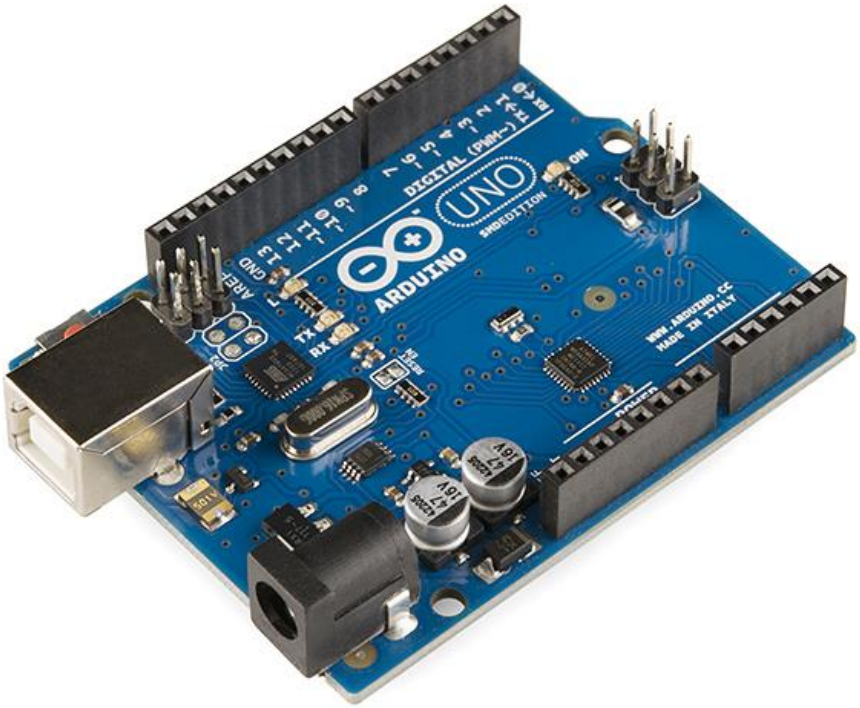

Figure 3.4: Arduino UNO

3.3.2.2 NODEMCU ESP8266

NodeMCU is an open-source platform based on the ESP8266 that can connect objects and transfer data over the Wi-Fi protocol. Furthermore, by providing some of the most important features of microcontrollers such as GPIO, PWM, and ADC, it is possible to solve many of the project's needs on its own. The ESP8266, designed and manufactured by Espressif Systems, contains the crucial elements of a computer: CPU, RAM, networking (WiFi), and even a modern operating system and SDK. That makes it an excellent choice for Internet of Things (IoT) projects of all kinds.

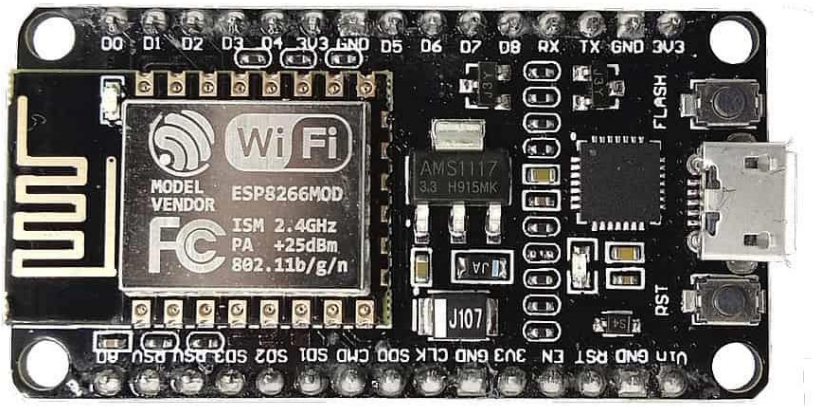

Figure 3.5: NodeMCU ESP8266

3.3.2.3 LOAD CELL SENSOR

A load cell is a type of force transducer. It converts a force, such as tension, compression, pressure, or torque, into a measurable and standardised electrical signal. The electrical signal changes proportionally to the force applied to the load cell. Strain gauges, pneumatic, and hydraulic load cells are the most commonly used types of load cells.

Figure 3.6: Load Cell Sensor

3.3.2.4 HX711 AMPLIFIER

The HX711 is a precision 24-bit analog-to-digital converter (ADC) that is designed to get measurable data out from a load cell and strain gauge. It is specially made for amplifying signals from cells and reporting them to another microcontroller.

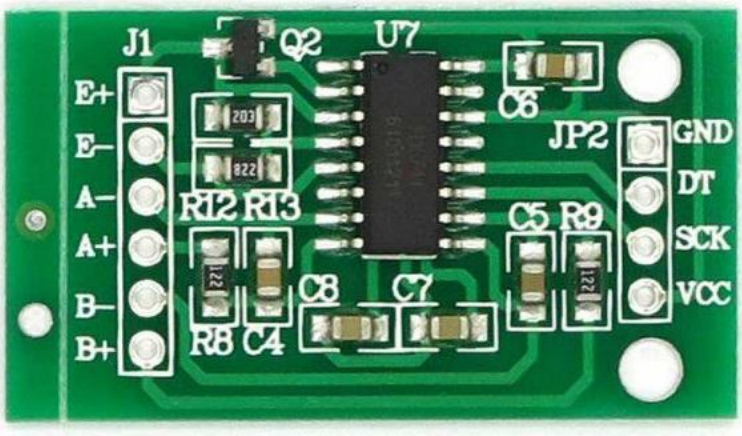

Figure 3.7: HX711 Amplifier

3.3.3 CIRCUIT OPERATION

First of all, through a Micro USB cable, the Arduino UNO microcontroller is connected to a DC power supply, which turns on all the components connected to it. Once the system has already gotten a power supply, the load cell sensor will weigh the gas cylinder and start to get a reading. Then, the HX711 amplifier gets the data out from a load cell and sends it to the Arduino UNO and the NodeMCU ESP8266 to be processed. Once the data has been processed, it is sent to the outputs, LEDs, and Telegram. The green LED will light up to indicate the gas is still full. Then, if the gas is partially full, the yellow LED will turn on. Next, the red LED will light up to show that the gas has run out. Finally, all of the data collected at the NodeMCU will be sent to Telegram on the user's mobile phone.

3.4 PROJECT SOFTWARE

The Arduino Integrated Development Environment (IDE) includes a code editor, a message area, a text console, a toolbar with buttons for common functions, and a series of menus. It communicates with and uploads programmes to the Arduino hardware. Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension.ino. It is possible to cut/paste and search/replace text using the editor. The message area provides feedback while saving and exporting, as well as errors. In addition to error messages and other information, the console displays text output from the Arduino Software (IDE). By clicking the toolbar buttons, you can upload and verify programs, open, save, and open sketches, as well as open the serial monitor.

Figure 3.8: Arduino IDE

3.4.1 FLOWCHART OF THE SYSTEM

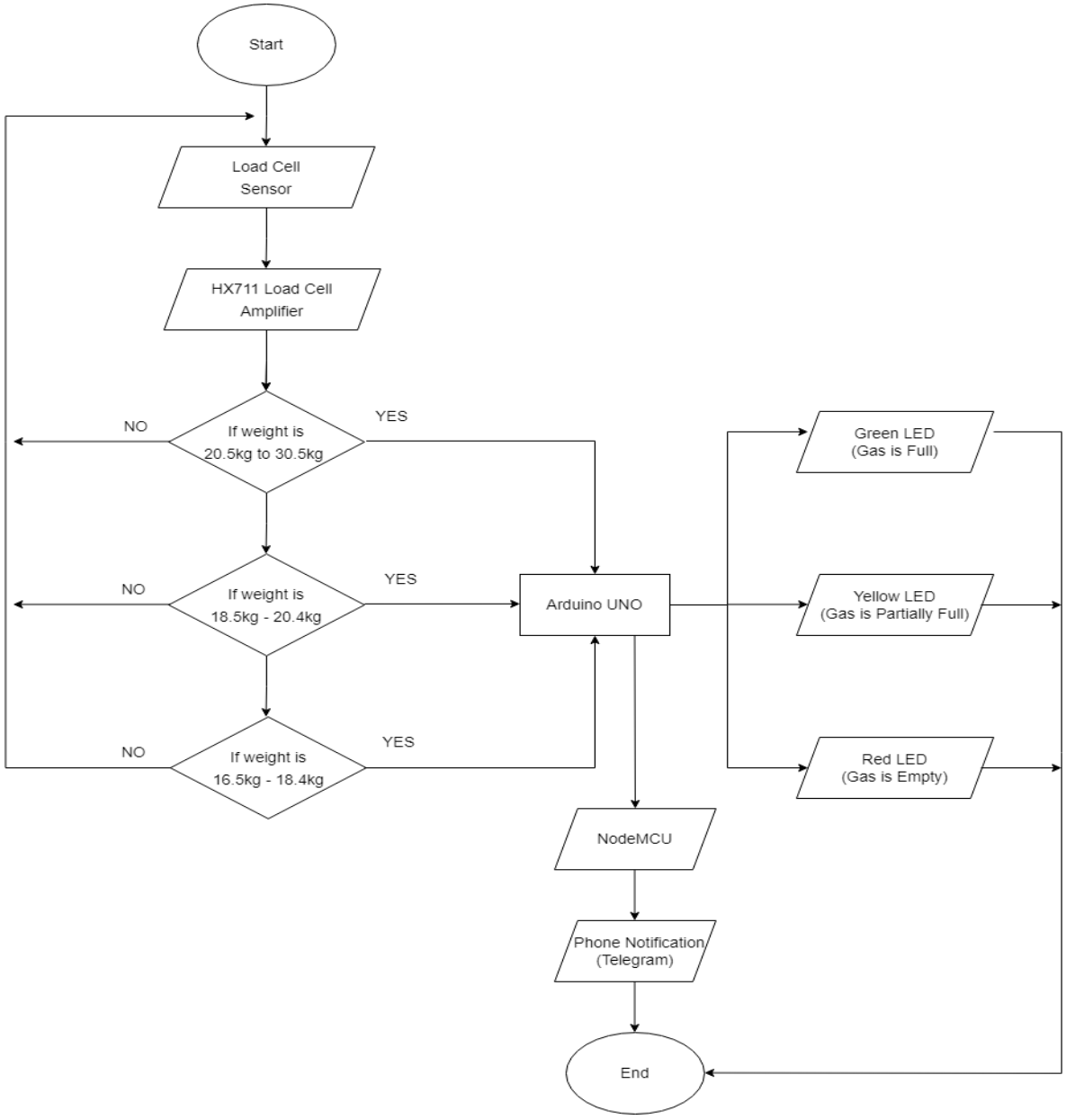

Figure 3.9: Flowchart of the System

3.4.2 DESCRIPTION OF FLOWCHART

Based on the Figure 3.9, the flowchart shows how the hardware and software are working. The system will start if an object is detected on top of the load cell sensor. Once the sensor has sensed an object, its readings are sent to the HX711 amplifier. If the weight is 20.5kg to 30.5kg, it will be sent to the Arduino UNO and NodeMCU. If not, the process will begin again from the start. After that, if the weight is 18.5kg to 20.4kg, the data will be sent to the Arduino UNO and NodeMCU. Otherwise, the process will start over. Next, if the weight is 16.5kg to 18.4kg, the information will be sent to the Arduino UNO and NodeMCU. The Arduino UNO will process the data based on the programming that I have compiled on Arduino IDE software. After the data has been processed, the Arduino UNO will send the information to the LEDs. The green LED will light up to indicate the gas is full. Then, if the gas is partially full, the yellow LED will turn on. Next, the red LED will light up to show that the gas is empty. Moving on to NodeMCU, the received data is then sent to Telegram on the user's mobile phone. Lastly, all of the processes will end.

CHAPTER 4: DATA ANALYSIS

4.1 INTRODUCTION

This chapter covers the explanation of data analysis. There are analysis and collection of data in this chapter. Through this data collection, it can help me to improve this Intelligent LPG Gas Level Indicator with better feature. All the data is recorded in pie chart form.

4.2 ANALYSIS OF QUESTIONNAIRE

Through this part, the questionnaire is conducted among public respondent. Apart from that, all the data in the survey form is tabulated in pie chart form. As overall, there are lots of positive feedback in the development of the Intelligent LPG Gas Level Indicator.

For what we can see at the graph below, 50.1% of respondents often use the kitchen while 40.9% of respondents seldomly use the kitchen. Moreover, question about facing a problem of running out of gas while cooking has also been asked to them, and only 9.1% of respondents said no but 90.9% of respondents have been through with this problem. After that, they have been asked about how do they know if the cooking gas is low. There are 95.5% of respondents observed the colour of the flame while 4.5% of respondents use the Smart Magnetic Sticker LPG Level Indicator that already been in the market. For the next question, there are 77.3% of respondents said this Intelligent LPG Gas Level Indicator will make it easier for them to know the remaining gas in the gas cylinder but 22.7% of respondents did not sure about it. Lastly, there are 68.2% of respondents agreed that they will be more prepared to change the new gas cylinder before the previous gas runs out, and 27.3% of respondents did not sure about it while 4.5% of respondents did not agree if they will be more prepared.

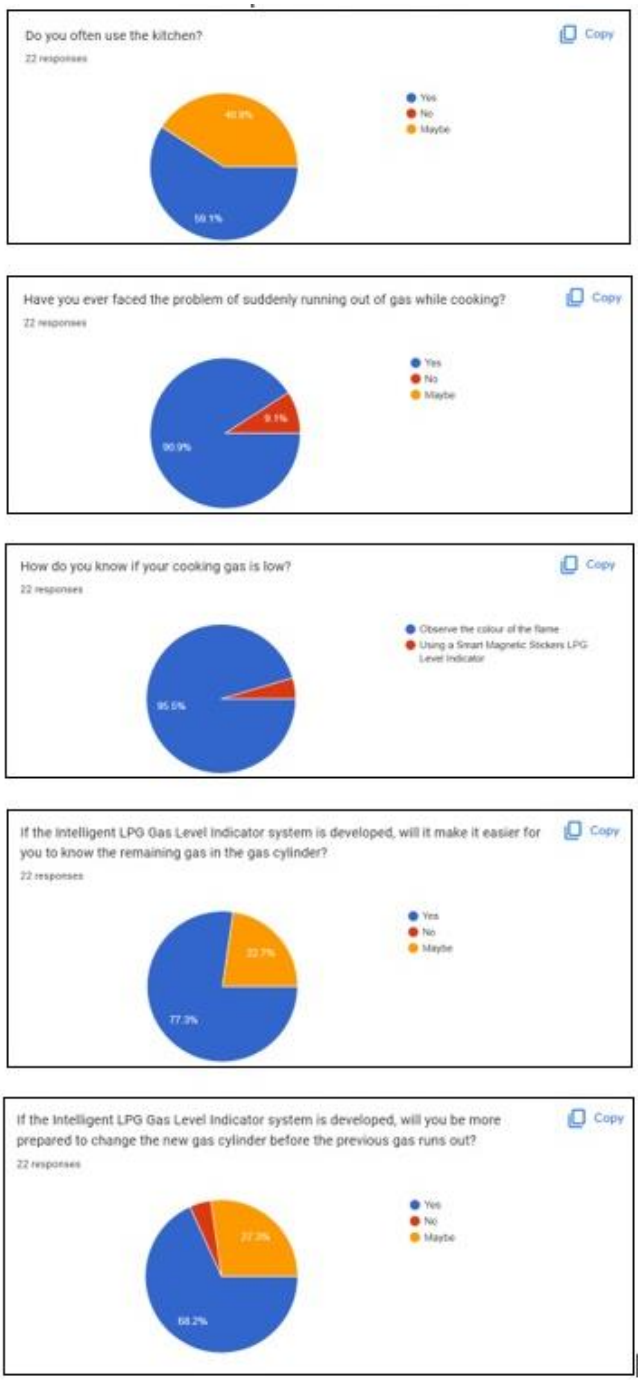

Figure 4.1: The data of the questionnaire

4.3 ANALYSIS OF PROJECT

After the process of designing and programming the Intelligent LPG Gas Level Indicator has been done, all the functions of this project have also been tested. In the first place, I tested the load cell sensor and HX711 amplifier, and both worked as expected. Additionally, I have tested the LEDs and it lit up as the coding which when the weight of the gas cylinder is 16.5kg to 18.4kg (the gas cylinder is empty), the red LED lit up. Other than that, the yellow LED lit up when the weight of the gas cylinder is 18.5kg to 20.4kg (the gas cylinder is partially full), and when the weight of the gas cylinder is 20.5kg to 30.5kg (the gas cylinder is full), the green LED lit up. Unfortunately, the output for the Telegram did not work as expected. When the gas cylinder is placed on top of the load cell sensor, the mobile application (Telegram) could not display the output result.

The Weight of The Gas Cylinder	**LED Output (Expected Result)**	**LED Output (Measured Result)**	**Telegram Output (Expected Result)**	**Telegram Output (Measured Result)**
16.5kg – 18.4kg	Red	Red	“Gas is low”	Unsuccessful
18.5kg – 20.4kg	Yellow	Yellow	“Gas is partially full”	Unsuccessful
20.5kg – 30.5kg	Green	Green	“Gas is full”	Unsuccessful

Table 4.1: The analysis of project

4.4 DISCUSSION

Running out of gas while cooking is a very unpleasant experience because it occurs when we are not prepared to change a gas cylinder. This Intelligent LPG Gas Level Indicator can assist in reminding you of the remaining gas inside the gas cylinder so that we are always prepared. There are already LPG gas level indicators on the market. It is more commonly known as a 'Magnetic Gas Level Indicator,' and it can be attached directly to a gas cylinder. The working principle behind a magnetic level indicator is that the measuring instrument shares the same fluid and the same level as the vessel. The level indicator is attached to the vessel and connects directly with the fluid to be measured. However, it is a basic product that cannot alert the user via a mobile phone. In addition, the display is a little difficult to understand due to the abundance of indicators, bars, and legends. Moreover, lots of reviews said that the 'Magnetic Gas Level Indicator' is not accurate and not functioning. As a result, I came up with the idea of developing this Intelligent LPG Gas Level Indicator, which has a better feature than the one that is currently on the market. It can also be used by anyone, regardless of gender or age. Last but not least, as the project has little display, it is simple to use and comprehend.

CHAPTER 5: CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

In a nutshell, I have discovered how to build a system that can weigh the weight of a gas cylinder by using a load cell sensor. Commonly known, a load cell is a force transducer. It converts a force such as tension, compression, pressure, or torque into an electrical signal that can be measured and standardized. As the force applied to the load cell increases, the electrical signal changes proportionally. Also, the load cell sensor is small but has a precise accuracy, and great sensitivity, so it makes my project able to be trusted by the consumers.

Furthermore, I have observed how to design a system that can alert the user about the remaining gas inside the gas cylinder through a mobile phone application. Since everything is at your fingertips, a mobile phone application is very important in providing information on something regardless of the weather, education or current news, so this system is very useful as it is beneficial for those who often use cooking gas. Because the mobile application is easy to use, the developed system will enable the LPG gas consumers to lead a more systematic life.

5.2 SUGGESTION AND FUTURE WORK

There are several weaknesses in this project that I have identified. Among them is, this project uses Wi-Fi for sending notification via Telegram. So, I suggest to upgrade the system to provide the internet through the sim card for consumers without Wi-Fi.

Other than that, this Intelligent LPG Gas Level Indicator only use Telegram as a medium. In my suggestion, I will create an application that displays more information, so users can see the percentage or a bar that indicates how much gas is left in the gas cylinder.

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APPENDIX 1 (GANTT CHART)

Legend :

Task (Plan)
Task (Actual)

POLITEKNIK MALAYSIA
SULTAN SALAHUDDIN ABDUL AZIZ SHAH

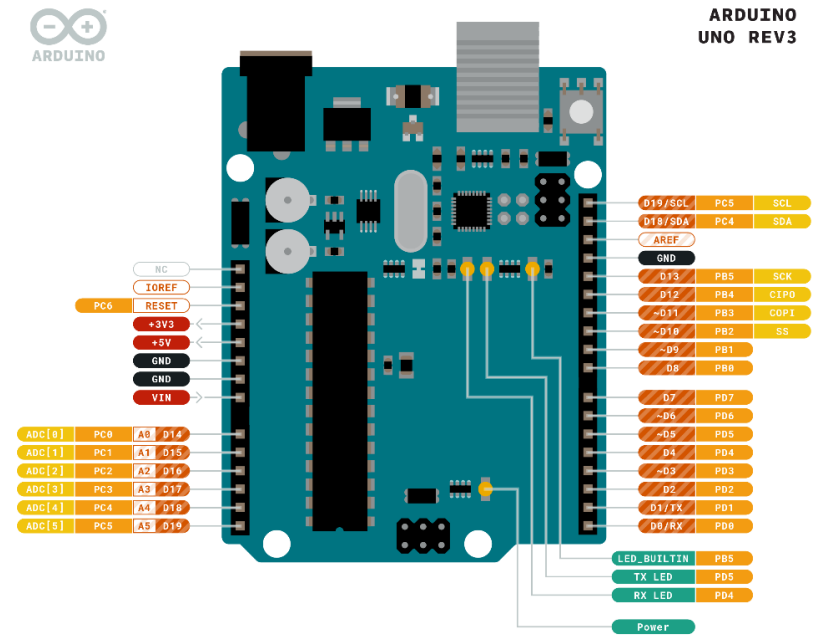
GANTT CHART

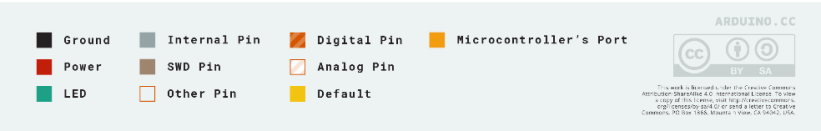
PROJECT TITLE : INTELLIGENT LPG GAS LEVEL INDICATOR

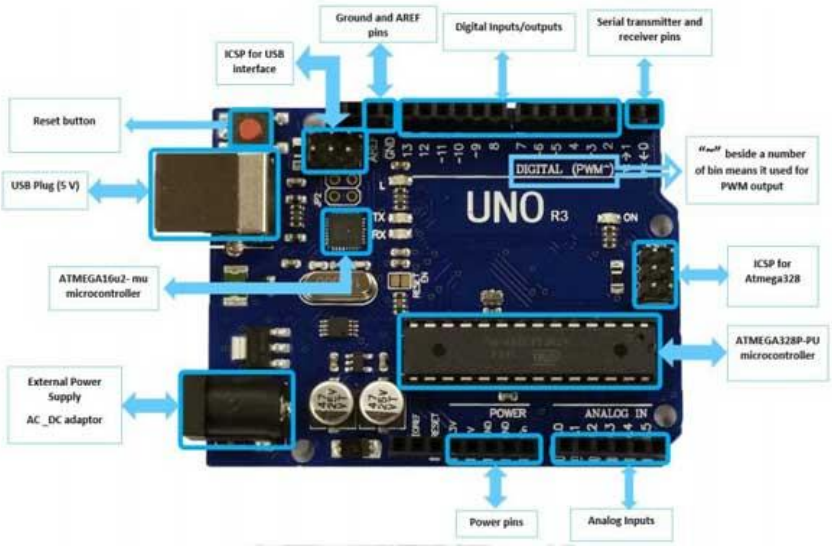
Course	NO	Task Name	Implementation	Week 1 (22.08.2022 - 28.08.2022)	Week 2 (29.08.2022 - 04.09.2022)	Week 3 (05.09.2022 - 11.09.2022)	Week 4 (12.09.2022 - 18.09.2022)	Week 5 (19.09.2022 - 25.09.2022)	Week 6 (26.09.2022 - 02.10.2022)	Week 7 (03.10.2022 - 09.10.2022)	Week 8 (10.10.2022 - 16.10.2022)	Week 9 (17.10.2022 - 23.10.2022)	Week 10 (24.10.2022 - 30.10.2022)	Week 11 (31.10.2022 - 06.11.2022)	Week 12 (07.11.2022 - 13.11.2022)	Week 13 (14.11.2022 - 20.11.2022)	Week 14 (21.11.2022 27.11.2022)
DEE50102 PROJECT 2	1	**INSTALLATION**	Plan														
			Actual														
	2	INSTALLATION OF COMPONENTS ON PCB	Plan														
			Actual														
	3	INSTALLATION OF WIRING	Plan														
			Actual														
	4	INSTALLATION OF SOFTWARE	Plan														
			Actual														
	5	INSTALLATION OF CONTROL CIRCUIT / SYSTEM	Plan														
			Actual														
	6	INSTALLATION OF PROJECT CASING	Plan														
			Actual														
	7	**TESTING**	Plan														
			Actual														
	8	TEST THE ELECTRONIC PART	Plan														
			Actual														
	9	TEST THE MECHANICAL PART	Plan														
			Actual														
	10	TEST THE OVERALL PROCESS / PROJECT	Plan														
			Actual														
	11	**DOCUMENTS**	Plan														
			Actual														
	12	PREPARATION OF SLIDE PRESENTATION	Plan														
			Actual														
	13	PREPARATION OF LOGBOOK	Plan														
			Actual														
	14	PREPARATION OF PROJECT 2 FINAL REPORT	Plan														
			Actual														
	15	PREPARATION OF INSTRUCTION MANUAL	Plan														
			Actual														
	16	END	Plan														
			Actual														

APPENDIX 2 (DATASHEET)

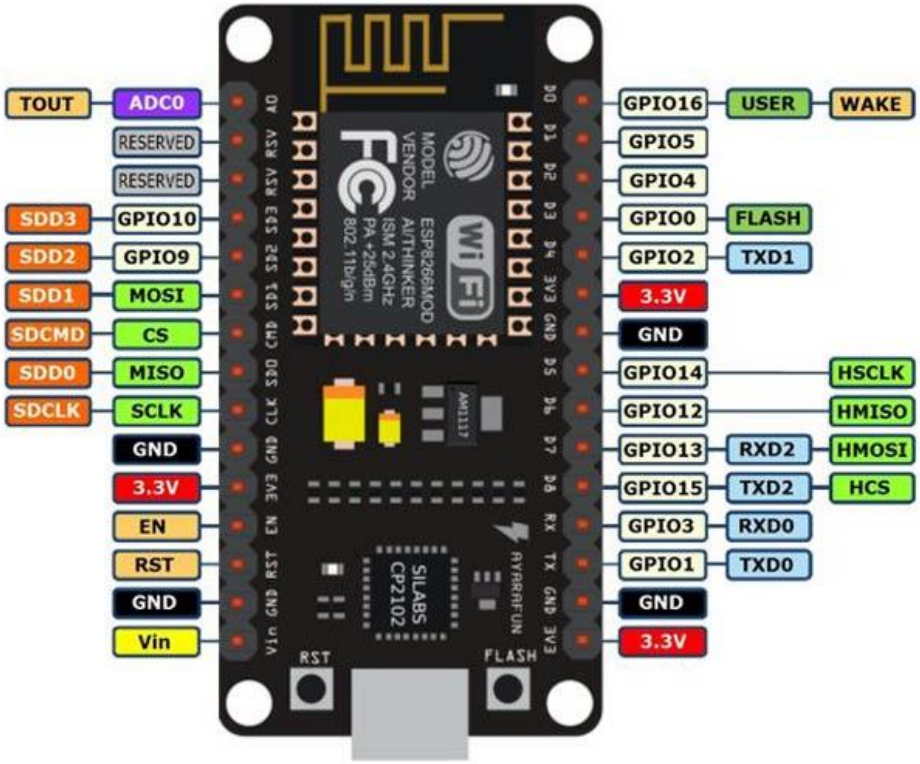
Arduino UNO







NodeMCU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RESERVED
RESERVED
SDD3
GPIO10
SDD2
GPIO9
SDD1
MOSI
SDCMD
CS
SDD0
MISO
SDCLK
SCLK
GND
3.3V
EN
RST
GND
Vin
GPIO16
USER
WAKE
GPIO5
GPIO4
GPIO0
FLASH
GPIO2
TXD1
3.3V
GND
GPIO14
HSCLK
GPIO12
HMISO
GPIO13
RXD2
HMOSI
GPIO15
TXD2
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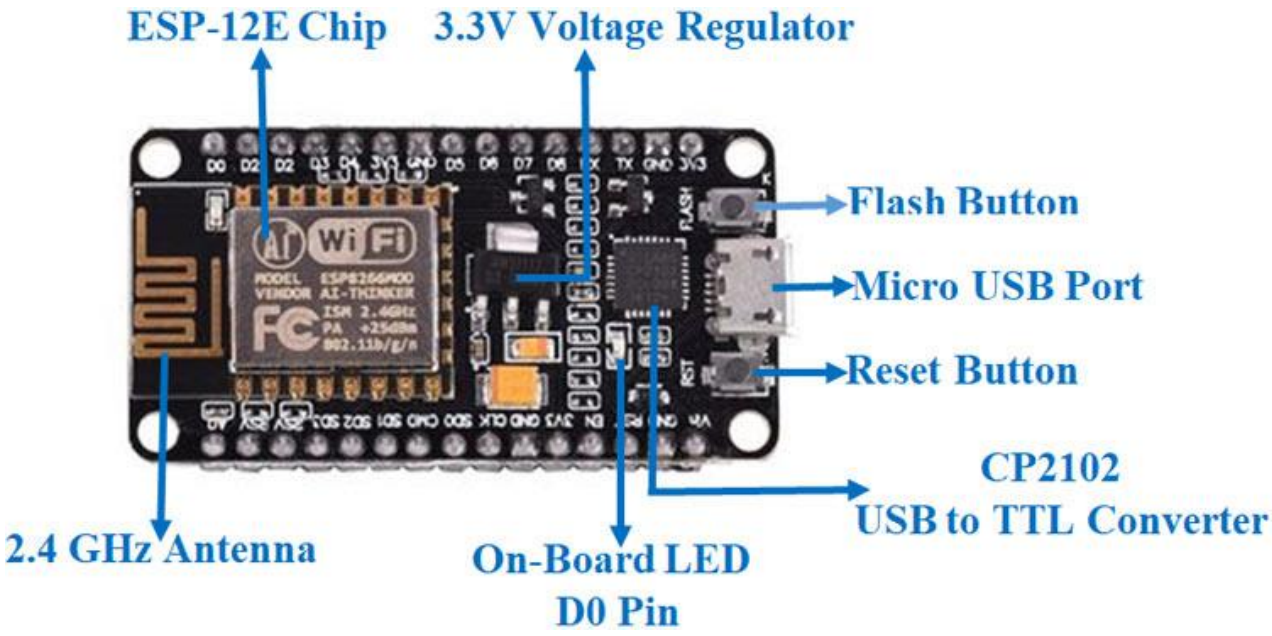
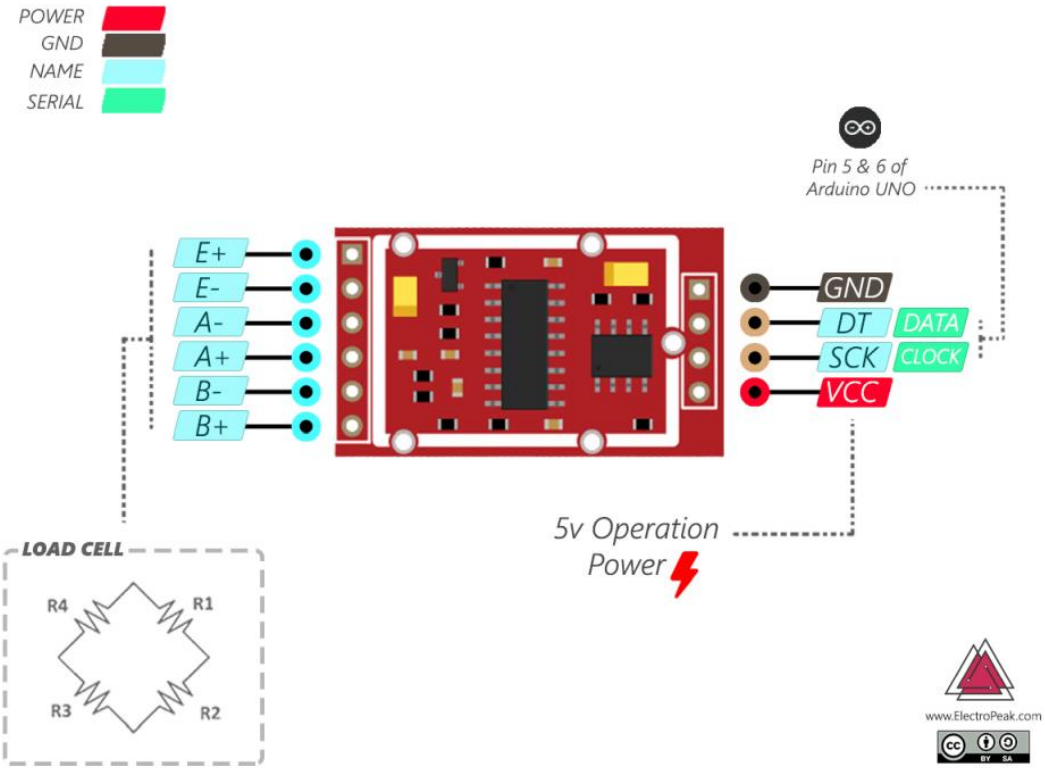
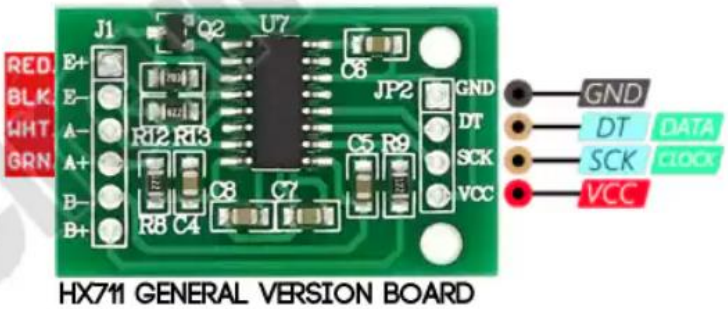
3.3V
RST
FLASH
SILABS
CP2102


ESP-12E Chip
3.3V Voltage Regulator
Flash Button
Micro USB Port
Reset Button
CP2102
USB to TTL Converter
2.4 GHz Antenna
On-Board LED
D0 Pin

HX711 Amplifier



HX711 SPARKFUN BOARD



HX711 GENERAL VERSION BOARD