Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF RADIO FREQUENCY IDENTIFICATION TRACKING SYSTEM IN INDUSTRY WAREHOUSE USING DRONE

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Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours

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DEVELOPMENT OF RADIO FREQUENCY IDENTIFICATION TRACKING SYSTEM IN INDUSTRY WAREHOUSE USING DRONE

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

I declare that this project report entitled " Development of Radio Frequency Identification Tracking System in Industry Warehouse using Drone" is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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APPROVAL

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

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Date : 6/2/2022

ABSTRACT

Due any industry's warehouse or sites rely on a wide range of tools, keeping track of their availability is a difficult task. To find materials in large industry and warehouse takes more time and energy. One of the most promising technologies for enabling new smart applications in the context of the internet of things is radio frequency identification (RFID) (IoT). However, from an electromagnetic standpoint, the performance of RFID tags is often linked to the context, thus the selection of the most appropriate tag for the specific application becomes the most important factor. This study presents an affordable yet accurate characterisation approach for the performance evaluation of RFID tags, which is then verified on the IoT-related application of RFID-based interaction with buildings. The widespread use of RFID technology has substantially increased customer convenience in a variety of applications, including smart tags. The systems, on the other hand, were designed using a active RFID system that requires a backup power source to operate. The planning and development of a passive RFID system is the subject of this study. The developed technology is utilised to manage a technology over a specific distance automatically. A prototype of a passive RFID system built in a highly automated environment. The application is being displayed for performance testing. The main component for this project was Radio Frequency Identification tracking system, Arduino, Ultrasonic sensor, and Drone. The RFID is attached to the drone. Drone were move by using ballistic flight which is a flight path on a screen and the drone will automatically fly along specified area. Signal were obtained by RFID sensors were transmitted wireless to microcontroller and input data were given. Arduino microcontroller were programmed to RFID to detect the tag and the drone will moved to the direction. As the safety propose of the system, ultrasonic sensors were used in order to detect and avoided obstacles. An analysis of test the accuracy and efficiency of RFID was done by comparing its distance and delay taken to transmit and receive data.

ABSTRAK

Oleh kerana gudang atau tapak industri bergantung pada pelbagai alat, menjejaki ketersediaannya adalah tugas yang sukar. Untuk mencari bahan dalam industri besar dan gudang memerlukan lebih banyak masa dan tenaga. Salah satu teknologi yang paling menjanjikan untuk mengaktifkan aplikasi pintar baru dalam konteks internet adalah pengenalpastian frekuensi radio (RFID) (IoT). Walau bagaimanapun, dari sudut pandang elektromagnetik, prestasi tag RFID sering dikaitkan dengan konteks, oleh itu pemilihan tag yang paling sesuai untuk aplikasi tertentu menjadi faktor yang paling penting. Kajian ini menyajikan pendekatan pencirian yang berpatutan namun tepat untuk penilaian prestasi tag RFID, yang kemudian disahkan pada aplikasi interaksi berasaskan RFT dengan bangunan yang berkaitan dengan IoT. Penggunaan teknologi RFID yang meluas telah meningkatkan kemudahan pelanggan dalam pelbagai aplikasi, termasuk tag pintar. Sistem, di sisi lain, dirancang menggunakan sistem RFID aktif yang memerlukan sumber kuasa sandaran untuk beroperasi. Perancangan dan pengembangan sistem RFID pasif adalah subjek kajian ini. Teknologi yang dikembangkan digunakan untuk mengurus teknologi pada jarak tertentu secara automatik. Prototaip sistem RFID pasif yang dibina dalam persekitaran yang sangat automatik. Aplikasi ini dipaparkan untuk ujian prestasi. Komponen utama untuk projek ini adalah sistem pengesanan Frekuensi Radio, Arduino, sensor Ultrasonik, dan Drone. RFID dilekatkan pada drone. Drone bergerak dengan menggunakan penerbangan balistik yang merupakan jalur penerbangan di layar dan drone secara automatik akan terbang di sepanjang kawasan yang ditentukan. Isyarat diperolehi oleh sensor RFID yang dihantar tanpa wayar ke mikrokontroler dan data input diberikan. Mikrokontroler Arduino diprogramkan ke RFID untuk mengesan tag dan drone akan bergerak ke arah. Sebagai cadangan keselamatan sistem, sensor ultrasonik digunakan untuk mengesan dan menghindari rintangan. Analisis menguji ketepatan dan kecekapan RFID dilakukan dengan membandingkan jarak dan kelewatan yang diambil untuk menghantar dan menerima data.

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Initially, I might want to thank and appreciation to God for his direction and gift to finish this Final Year project with effectively. I might want to offer my most profound thanks to my consultant, Puan Saleha binti Mohammad Saleh, for her incredible direction, mindful, persistence, giving me idea, tips and support all through the fruition of this Final Year project. On account of every one of my companions uncommonly, the individuals who are continually able to help and gives their best ideas and energize.

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TABLE OF CONTENT

Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF SYMBOLS

mA	-	Milli Ampere
S	-	Second
Kg	-	Kilogram
A	-	Ampere
V	-	Voltage
C	-	Velocity of Ultrasonic
T	-	Transmitter
L	-	Length

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

RAM	-	Random access memory
ROM	-	Read only memory
DSP	-	Digital signal processor
RFID	-	Radio Frequency Identification
IDE	-	Integrated development environment
LED	-	Light emitting diode
GUI	-	Graphical user interface
IR	-	Infrared radiation
CI	-	Continuous integration
RF	-	Radio Frequency
AC	-	Alternating Current
DC	-	Direct Current
IC	-	Integrated circuit
LIPO	-	Lithium Polymer Battery
MCU	-	Microcontroller Unit
UHF	-	Ultra-High Frequency
SPI	-	Serial Peripheral Interface
MISO	-	Master In Slave Out
MOSI	-	Master Out Slave In
SCK	-	Serial Clock

CHAPTER 1

INTRODUCTION

1.1 Project background

This project is to development of Radio Frequency Identification Tracking System in industries warehouse applications using ultra-sonic sensor and Arduino. Radio Frequency Identification Tracking System has been become worldwide wireless technology innovation developed uses electromagnetic fields to recognise and monitor tags affixed to items automatically for material or human to manage their movements and provide good access and effective environment. RFID is a tiny radio transponder, a radio receiver, and a transmitter make up the system. This RFID is the tag transmits digital data, usually an identifying inventory number, back to the reader when it is triggered by an electromagnetic interrogation pulse from a nearby RFID reader device. A drone is a plane that does not have a human pilot on board. The Drone is operating automatically or under the control of a human operator at a distance which is remotely piloted aircraft. RFID is attached to the drone to sense and detect things around the warehouse. Signals were obtained by RFID sensors were transmitted wirelessly to the microcontroller and send data signal. Arduino microcontroller Drone will be programmed to fly and move to certain direction. Arduino microcontroller will be programmed with RFID to detect, receives and transmitted signal. As a safety propose of the system, ultrasonic sensor has been added as to detect and avoid obstacles. This innovation delivers quicker, smoother, and better control. In this project, Arduino has been used as a microcontroller for this project. The Arduino software is program to control and fulfil requirement of the system has been designed in this project.

1.2 Problem Statement

Since there were many new inventions in assistive technology that being helpful to industries and worldwide, still there are some problems with those inventions. Manually searching is an inability to find and allocate items or materials in short time. Some inventions use more time and energy to do such works such as Automated Guided Vehicle, barcode, etc. Some people feel uncomfortable with these systems where excessive movement brings tiredness to the person.

Managing the availability of assets in industries that rely on a wide range of instruments is a difficult task. To find materials in large industry takes more time and energy. Using drones, an RFID tracking system will be used to track which tools have been seized, which employees have stolen resources, and which resources have not been returned to the tool crib, depending on the amount of intricacy. Also, can be used in any industry warehouse. This system will use drone, Arduino, and several suitable sensors to track the location of material that will save cost, time, and energy consumption to find material. The system will be tested and analysed in term of accuracy of RFID signal and time consumption for material detection.[1]

Thus, factors that said above have brought up development Radio Frequency Identification Tracking system. This project was design of RFID with a drone that fly automatically or control by human which is piloted aircraft that helps finding and tracking items or materials easily. In this project there are several factors that was considered such as accuracy, efficiency, and safety. RFID drone system acquires a suitable speed to ensure the safety of the environment. RFID system needs an accurate wireless connection to transmitting data from transmitter to receiver and it allows the RFID sensor to detect and sending signal to alert. An ultrasonic sensor has been used to detect the obstacles nearby drone to ensure this system is more safety and convenient to use.

1.3 Project Objective

In this study, there are few objectives that will archive.

I. To design hardware of tracking System using RFID and Drone.
II. To develop an algorithm software program of tracking System by using Arduino.
III. To test and analyze the performance of the tracking system in term of accuracy the RFID used.

1.4 Work Scope

In order to archive the objective of the project, there was several important criteria that need to consider:

I. Radio Frequency Identification System is design to track and detect items or resources.
II. Drone will be applied to find material at any specific places in a short time and applicable to cover small to medium area.
III. Arduino UNO will be applied for software system.
IV. Proteus and Fritzing software will be applied to simulate circuit.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This section discusses and summaries overall Radio Frequency Identification Tracking system and drone concept and theory of the project. This chapter's main proposal was explained past research and existing research. This chapter discussed the theory and concept used to solve this project's problem. Journals, articles, and case studies are the main sources of information. These sources have been selected based on the project scope similarity.

2.2 Review of Current Situation

Based on the industries environments, manually searching down goods or assets on project sites is usually more difficult than purchasing a replacement, but replacing those products is usually prohibitively expensive. Kennedy Wire Rope and Sling (KWRS) provides construction organisations with a wide selection of wire rope, rigging hardware, slings, and other lifting equipment. Due to the loss of equipment on their hectic and dangerous building sites, one client contacted KWRS about the regular reordering. KWRS opted to build a solution for preventing loss on these locations because it already provides a variety of post-sale services, such as equipment inspection, repair, testing, certificate storage, and even safety courses. All equipment was supplied with very tough RFID tags from the first client, and equipment certificates and data were uploaded online for clients to work out during interrogation. The technology is now used for equipment planning and asset allocation in addition to loss prevention and inventory tracking. This solution is ready to be implemented at other customer locations throughout the world due to the amount of money saved after implementation.[2]

2.3 Theory

2.3.1 Microcontroller Devices

A microcontroller is a miniature computer that is built into a single integrated circuit. A microcontroller, together with peripherals with memory and configurable input/output, contains one or more CPUs (processor cores). Still frequently included on the chip is memory program which in form of ferroelectric, RAM, NOR flash, or ROM. Microcontroller were created for embedded systems expect for microprocessors used for the laptop or any general-purpose implement made up of various discrete chips [3]. Microcontrollers has been used in product and devices automation control. Through limiting the size and cost differenced using separate microprocessor. The memory, input, output, and digital monitoring yet more price-effective devices and methods.

Comprehensive mixed signals are being used which really integrate to controlling non-digital electronic systems requires analogue components. Microcontrollers were famous and economically means of collecting, detecting, and acting on the physical world on the internet of things as edge devices. Several microcontrollers could use four-bit words or even works at ramps up to 4kHz for low power consumption. They typically can process functionality though waiting for press button or other interrupt, to create most of them ideal for long-lasting applications of batteries. Those certain microcontrollers may fulfil performance-critical roles in which they can act similar DSP, with greater clock speeds and larger power consumption. There were many types of microcontrollers in this current are such as Arduino, PIC, Raspberry PI and more.

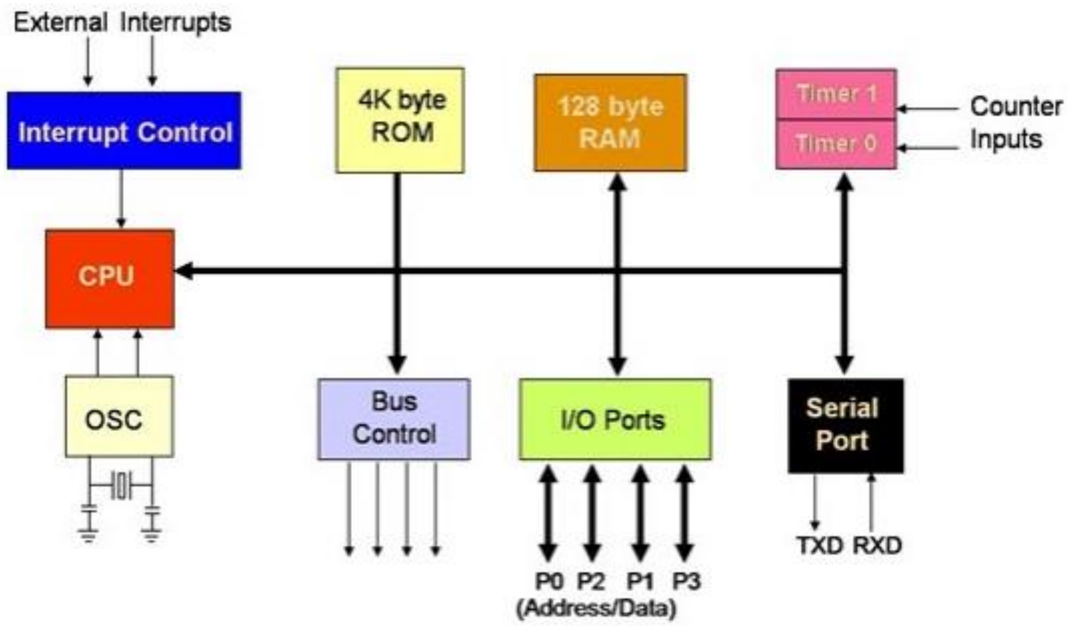

Figure 2.1: Block Diagram of Microcontroller

2.3.1.1 Arduino

Open-source device Arduino were used to develop projects for electrical appliances. Arduino comes in the form of a programmable physical circuit board and software, or even computer-operated IDE which used to compile and transfer computer coding to the circuit board. Arduino marketplace has been famous among people who just beginning with it for a good reason, electrical products. Unlike others Arduino does not require a separate hardware to upload new coding into the board and able to apply a USB cable. In addition, The Arduino IDE employs a very basic C++ version, which makes learning to code much easier.

There are many Arduino board varieties that can be used for various purposes. The one of the most famous Arduino family's boards and great choice for beginners is UNO. Arduino is a hardware and software platform for anyone interested in creating interactive objects or surroundings. Arduino able cooperate with your smartphone or TV with buttons, LEDs, the internet. Combined with this flexibility, Arduino is free, and Because hardware boards are inexpensive, software, and even software and hardware are simple to understand, a big user group has contributed code and approved instructions for an Arduino-based project. [4] There are many types of Arduinos such as Arduino Mini, Arduino Pro, Arduino UNO, Leonardo, Arduino MEGA, Arduino Due Arduino MEGA were commonly used by everyone.

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2.3.1.2. Arduino UNO

Arduino UNO is well known at first choice since it is easy and convenient. It also includes with 14 digital pins for input / output (including 6 for PWM outputs), a USB linking, a power jack, a reset button and much more. It includes all you need to back up the microcontroller by simply connecting it to USB cable laptop or power it to get started battery or analog to digital converter supplies.

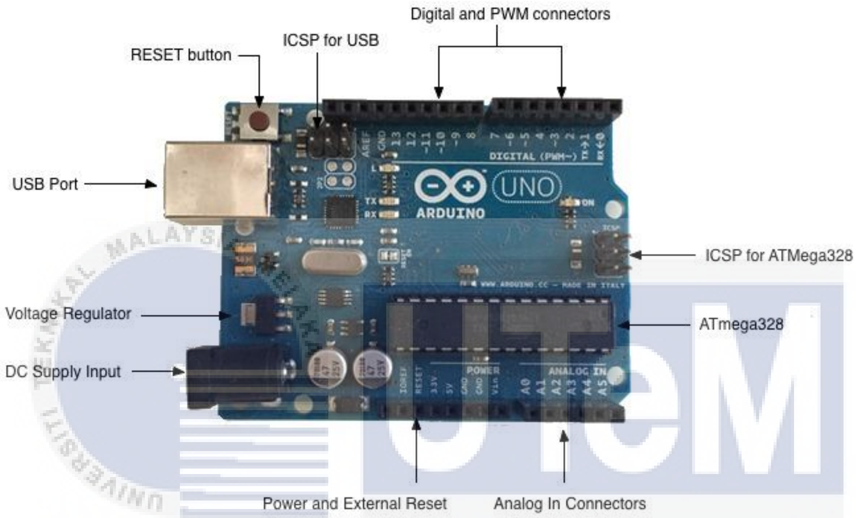

Figure 2.2: Labelled Diagram of Arduino UNO

2.3.1.3 Wi-Fi Node MCU (ESP8266)

The ESP8266 Wi-Fi Module is a self-contained SOC with an integrated TCP/IP protocol stack that allows any microcontroller to connect to your Wi-Fi network. This module can host an application or offload all Wi-Fi networking tasks to a different CPU. The ESP8266 Wi-Fi Module is a self-contained system on chip (SOC) with an integrated TCP/IP protocol stack that lets any microcontroller connect to your Wi-Fi network. This module has enough processing and storage capacity on board to allow it to be connected to sensors and other application-specific devices via its GPIOs with minimal development and load during runtime. [5]

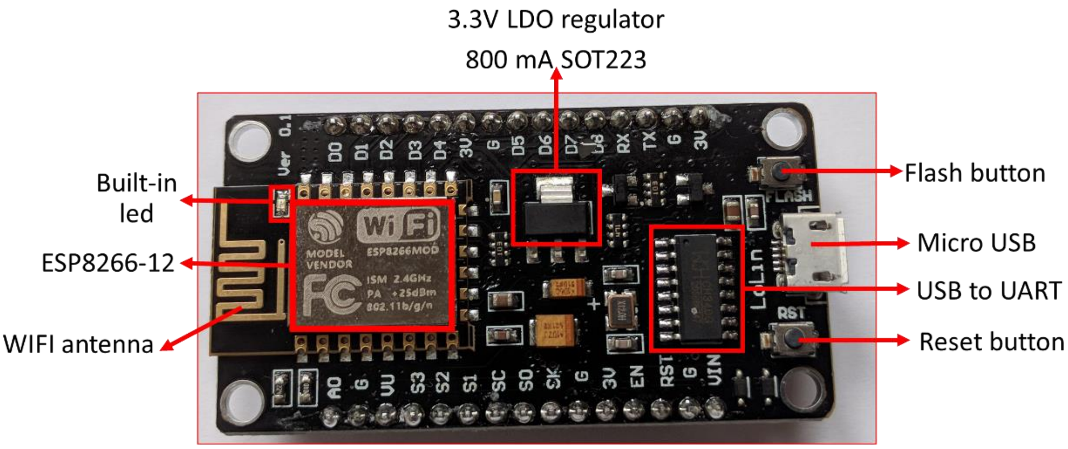

Figure 2.3: Labelled Diagram of ESP8266

2.3.1.4 Comparison of Wi-Fi Node MCU

Table 2.1 shows comparison between ESP8266 and show the characteristics which is used to choose the suitable MCU for Radio Frequency Identification Tracking system.

Table 2.1: Comparison between type of ESP8266

Type Sensor	Bluetooth	Wi-Fi	ESP8266 Wi-Fi Module
Data Rate	**1Mbps**	**11&54Mbps**	**72.2 Mbps**
Distance	**10m**	**50-100m**	**4-70m**
Power consumption	**Medium**	**High**	**High**
Complexity	**High**	**High**	**High**

2.3.2 Sensors

Sensors were electronic component that detect motions, events, or changes in the environment for a suitable output. The factors for using a sensor depending on the applications. Performance, cost, and availability should be considered the feature and benefits depends on specific requirement of an applications. There are several models of sensors been applied in Radio Frequency Identification tracking system such as RFID sensor, ultrasonic sensor.

2.3.2.1 Types of Sensors

A. Radio Frequency Identification System (RFID)

The use of radio waves to read and collect information recorded on a tag connected to an object is known as radio-frequency identification (RFID). To be tracked, a tag can be read from up to several feet away and does not need to be in direct line of sight of the reader.

A tag or label and a reader are the two components of an RFID system. A transmitter and a receiver are incorporated in RFID tags or labels. The RFID component on the tags is made up of two parts: a microchip for storing and processing data and an antenna for receiving and transmitting signals. The tag contains the unique serial number for a single item. A two-way radio transmitter-receiver called an interrogator or reader sends a symbol to the tag using an antenna to read the data recorded on the tag. The data stored in the tag's memory bank is used to react. The read findings will subsequently be sent to an RFID computer programme by the interrogator. RFID tags are available in two types: passive and battery powered. The radio emission energy from the interrogator will be used by a passive RFID tag to communicate its stored information back to the interrogator. A battery-powered RFID tag contains a small low-battery that allows data to be relayed. RFID tags could potentially be applied to articles of apparel in a retail situation. When a listing associate scans a shelf of jeans with a handheld RFID reader, the associate is able to distinguish between two pairs of identical jeans based on the information recorded on the RFID tag. Each pair will be assigned a unique serial number. The associate can not only find a specific pair with a single pass of the hand-held RFID reader, but they can also identify how many of each pair are on the shelf and which pairs need to be restocked. Without needing to scan each object individually, the associate may learn all of this information.[6]

B. RFID Module RC522

The RC522 is a 13.56MHz RFID module based on the MFRC522 controller from NXP Semiconductors. The module comes with an RFID card and a key fob by default, and it supports I2C, SPI, and UART. It is often used in attendance systems and other applications that need to identify people or objects. The RC522 is a radio frequency module with RFID reader, RFID card, and a key chain. Because the module normally runs at 3.3V, it is widely employed in 3.3V designs. It is typically utilised in applications where a certain person or thing needs to be identified by a unique ID.[7]

Figure 2.4: RC522 RFID reader, RFID card and a key chain

C. Ultra-Sonic Sensor

An ultrasonic sensor is a device that uses ultrasonic sound waves to determine the distance to an item. A transducer is used in an ultrasonic sensor to emit and receive ultrasonic pulses that communicate information about the proximity of an item. Ultrasonic sensors use the time between emission and reception to calculate the distance to the target. A transmitter and receiver are used in an optical sensor, but an ultrasonic sensor uses a single ultrasonic element for both emission and reception.

Figure 2.5: Ultrasonic Sensor

D. Comparison of sensor reader and tag type

Table 2.2 shows comparison between reader and tag system and show the characteristics which is used to choose the suitable reader and tag system for Radio Frequency Identification Tracking system.

Table 2.2: Comparison between type of sensor reader and tag

Comparison	RFID	Barcode
Read Rate	10's, 100's or 1000's simultaneously	Only one at time
Read Range	Passive UHF RFID: - Up to 40 feet (fixed readers) - Up to 20 feet (handheld readers) Active RFID: - Up to 100's of feet or more	Several inches up to several feet
Read Speed	Very fast (ms)	Slow
Readable through objects	Yes	No, must be line of sight
Identification	Each item/asset marked can be uniquely identified.	The majority of barcodes just identify the item's type (UPS Code), not its uniqueness.
Advantages	- Collects data automatically, reducing human labour and mistake. - It improves efficiency because it can scan numerous tags at once. - Data may be read from a long-distance using RFID. - Because the tags are wrapped in plastic, they can be reused. - The password is encrypted, and the information is safe	- They are inexpensive. - Extremely accurate. - Technology that is universal. - It eliminates the chance of human error or mistake.
Disadvantages	- Materials such as liquid and metal can reduce the signal's impact. - RFID tags are more expensive than barcode tags because they contain an embedded chip. - RFID implementation takes a long time.	- Scan must be done in a straight line. - It only saves a tiny quantity of information. - In order to scan the barcode, the user must remain close to the product.

2.3.3 Drone

The term "drone" has two unique meanings: the first is a low humming sound that occurs on a regular basis, and the second is a male bee. We all know that the male bee has no work to do; it never goes out on a mission to collect honey; its only purpose in life is to impregnate the bee queen. So, it's not a bad idea to use this word to describe an unmanned aerial vehicle (UAV) that makes sounds like a swarm of bees and appears to be mindless. In today's world, a drone is an unmanned aerial vehicle (UAV) that can be controlled by a human from a remote place or can work autonomously in a predetermined mode. To put it another way, a drone is a type of mini plane. The drone is typically controlled by an obsessive remote unit, and they can manage everything in the air owing to a sophisticated software programme. It has a significant number of onboard functional sensors, such as GPS, that aid in proper flying mode controls.

A. Drone

A drone is a new type of flying machine that may be controlled remotely or run autonomously utilising software-driven flight plans in embedded systems, as well as onboard sensors and GPS. The answers are linked to ongoing technological advancements, particularly the emergence of fast microprocessors, which enable intelligent autonomous operation of multiple systems.

Figure 2.6: Drone

B. Comparison of drone type

Table 2.3 shows comparison between drones and show the characteristics which is used to choose the suitable drone for Radio Frequency Identification Tracking system.

Table 2.3: Comparison between type of drone

Rotory Drone	Size	Range	Equipment	Application
Tricopter	Very small	Consumer	With Camera	- A tricopter has three different types of powerful motors, three controllers, four gyros, and just one servo. - Because it is outfitted with so many traditional sensors and technological components, a tricopter can stay stable on its journey.
Quadcopter	Mini	Prosumer	With FPV	- Brushless DC motors are used to control everything. For such gadgets, a lithium polymer battery is used as the source of power.
Hexacopter	Meduim	Professional	With GPS	- With its 6-motor arrangement, the Hexacopter may be used for a variety of applications. - When compared to quadcopters, these gadgets have more lifting power.
Octocopter	Large	-	With stabilizers	- Octo means eight, thus the octocopter will serve you with its eight powerful motors, which will power eight working propellers. - Octocopters can provide steady film capturing at any altitude.

2.4 Journal Related

A. New Empirical Indoor Path Loss Model using Active UHF-RFID Tags for Localization Purposes [8]

Indoors is one of the most challenging propagation circumstances, depending on the construction of the building. In this research, it presents a combination of two models for active UHF-RFID tags operating at 433 MHz: the Dual One Slope Model (DOSM) and the Dual One Slope with Second Order Polynomial Model (DOSP) (DOSSOM). A comparison with several propagation models is also presented. The purpose of this study is to analyse, evaluate, and enhance the accuracy of two novel route loss models. A number of propagation models are used to determine distance errors. The DOSM had a mean distance error of 56 cm, whereas the DOSSOM had a mean distance error of 51 cm, according to experimental validations. In brief, the distance errors estimated using the two new empirical route loss models (DOSM and DOSSOM) are quite close to the real-world data. Based on the mean distance errors previously attained, the stability of our novel indoor propagation models will be proven.

This paper presents two new empirical indoor localization models. It investigates and compares several empirical propagation models with UHF-RFID for indoor localization. Path loss findings from detailed measurements in a classroom of 8.5 x 7.5 square metres were provided, which served to validate the stability of the proposed models. Furthermore, DOSSOM will increase accuracy, with a mean distance error of less than 1 m. Finally, due to its repeatability and relative simplicity, our suggested model (DOSSOM) is both trustworthy and useful for analysing indoor route loss. The work provided in this study will be completed in future work by analysing the suggested models at various frequencies for common indoor environments such as corridors, halls, and offices.

B. Sensor Integrated RFID Tags Driven by Energy Scavenger for Sustainable Wearable Electronics Applications [9]

The use of radio frequency identification (RFID) technology for the automatic identification and communication of physical parameters with an on-board integrated sensor has numerous applications, including mobile healthcare, logistics, supply chains, robotics, and many more. RFID sensor tags have recently been investigated for use in wearable electronics. However, these devices are still powered by a battery. This study proposes and builds a self-sustaining sensor-integrated RFID tag for wearable electronics applications. To harvest energy from everyday human activities such as arm/finger movements, an integrated dual-gate thin film transistor (TFT) made of polyvinylidene ßuoride (PVDF) was used. Aside from the system design of a sensor integrated chip-based active RFID tag, the numerical analysis and preliminary findings of such an energy harvester were provided.

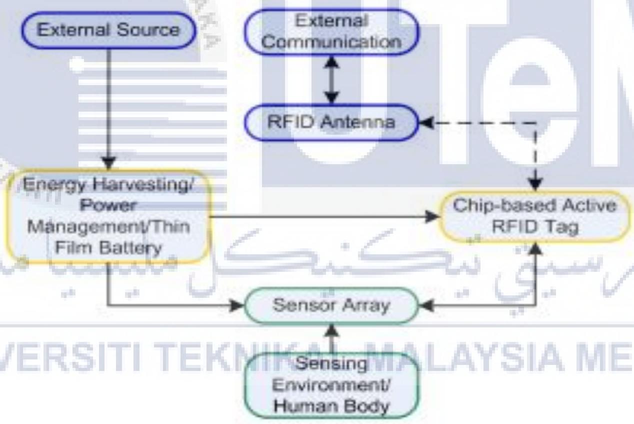

Figure 2.7: System level approach for sensor integrated RFID tag

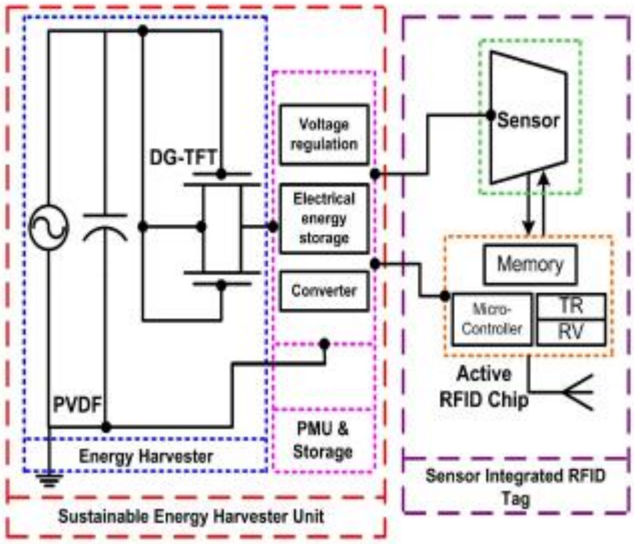

Figure 2.8: Equivalent circuit model consisting of PVDF piezoelectric generator as AC source and a dual-gate TFT as a rectifier.

RFID tags with sensors for wearable electronics can be used for real-time monitoring in medical applications. The article's goal was to demonstrate how a system level approach can be used to fully integrate three separate technologies, namely an energy harvester, a sensor array (heart rate), and a chip-based active RFID tag, as well as their operation as a low-cost, self-powered single system device. The developed energy harvester eliminates the need for a battery source to power the active RFID tag, which is a distinguishing feature of the integrated system approach. In addition to the device construction, device manufacturing, and single-pixel assessment of the energy harvester, simulation results for the developed energy harvester based on the integration of a PVDF film with DG-TFT are presented. According to preliminary research, the sensor-integrated RFID tag with energy harvester will be more effective in biomedical applications and body area networks.

C. Reconfigurable UHF RFID tag with sensing capabilities.[10]

The addition of sensor and computational capabilities to RFID systems has boosted its pervasiveness in application fields formerly reserved for other technologies. The state machine was implemented on a Field Programmable Gate Array (FPGA) board to construct a smart RFID tag based on a custom-made microprocessor capable of wirelessly sending information from a number of integrated sensors and conforming with part of the RFID UHF EPC-Gen2 standard. The suggested technique indicates the potential of producing enhanced RFID tags for a range of applications, including a more secure and regulated food supply chain for perishable commodities, or biomedical sensor data transmitters. The suggested methodology is a realistic solution to build compact, small-size, and low-cost devices for short-range applications, due to the potential of downsizing of the FPGA IC. For high-end features like bi-directional communication, anti-collision, and on-board processing capacity, the FPGA-based solution ensures a low-cost alternative to specialised ASIC design.

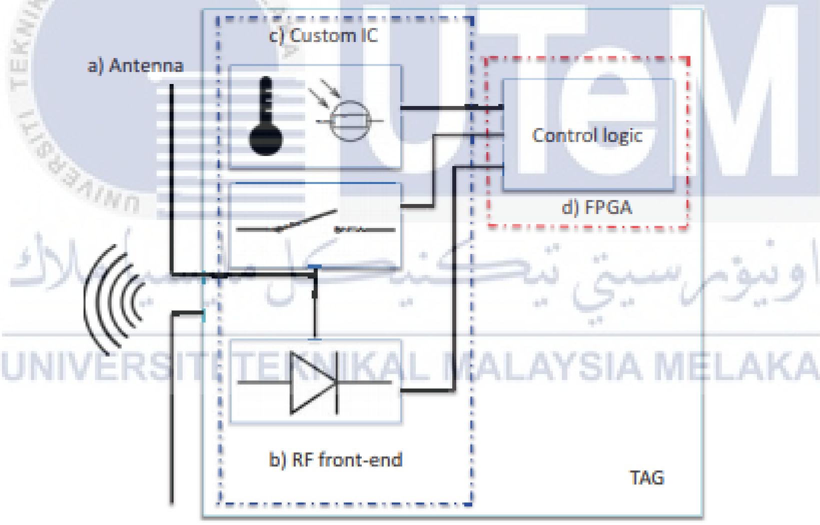

Figure 2.9: Block diagram of the system.

The proposed system illustrates how a single microchip with dimensions of a few mm2 may offer a particular RF section for distant power supply and temperature and illumination data transfer from silicon integrated sensors. A finite state machine on an FPGA platform, described in VHDL, allowing for design by blocks, experimentally proving the machine's functioning while also ensuring the project's absolute compatibility with any digital CMOS technology, making it readily integrable on the same chip. An UHF RFID Reader was employed to realise and describe the implemented prototype (Thing Magic Micro) (Thing Magic Micro). The graphic interface of the URA software, as shown on the PC screen, also confirmed that the Reader and Tag were communicating correctly: a) the Tag's EPC code, which includes sensor data; b) the value of the power received by the Reader as a result of the Tag's backscattering, i.e. the communication's RSSI value in dBm; c) the Tag's number of consecutive readings. At a Reader-Tag distance of roughly 30 cm, the RSSI value was between -20 dBm and -30 dBm. The system operates up to a distance of roughly 70 cm, equivalent to an RSSI value of roughly -60 dBm. The Dickson multiplier was made with individual Schottky diodes in the prototype. The custom CMOS IC has an RF energy collecting section, yet it does not perform well enough to power the complete device. The utilisation of CMOS technology.

D. Integrating ZigBee-Based Mesh Network with Embedded Passive and Active RFID for Production Management Automation [11]

In the electronics business, increased sales and demand require more goods and output from production lines. This occurrence suggests a high level of complexity, as well as a lack of control and insufficient production line management. Manufacturing management challenges develop as a result of an unmanaged system in the manufacturing line. The quantity of output in each production line is an instance of this issue. In production management, output level is a major problem for monitoring, maintaining, and updating information on the condition and position of the production floor. By combining radio frequency identification (RFlD) systems with wireless networks, this study provides several engineering management solutions for real-time monitoring, regulating, and updating information. Under the Wireless Sensor Network (WSN) architecture, a combination of passive and active RFIDs with an embedded controller board was developed according to required capabilities and operational modules. The system's ease of setup offers firms with a wonderful choice for monitoring production and distribution activities swiftly and simply. These integrated modules are employed in automated, wirelessly readable, sensory-based identification methods, as well as Web-based monitoring, to increase reliability and enhance functionality.

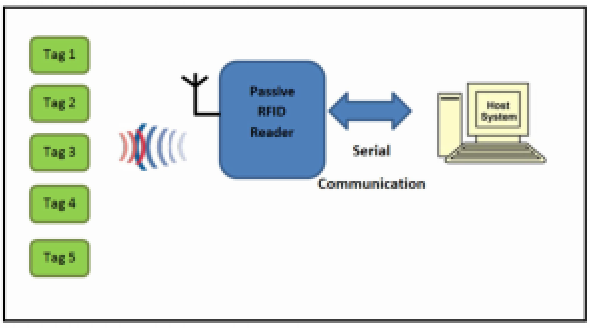

Figure 2.10: Block diagram for the passive RFID system (Conventional usage in production automation)

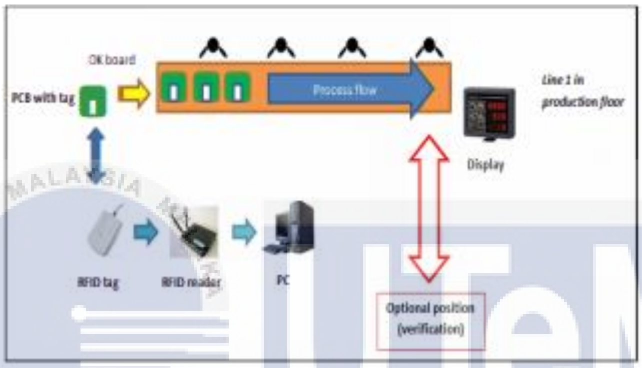

Figure 2.11: Process flow of the RFID system for production management

The RDPMS automation system is a dependable development system that uses RFID, ZigBee, and WSN technologies to increase product quality and demand in the electronics sector. This technology can aid with operational and production management modifications. However, due of the high initial investment cost, high maintenance cost, and insufficient management at the early stage, the adoption of this technology in all areas may not be viable.

Table 2.4: Comparison method between related journals

No.	Author	Year	Title	Method	Results
1	E.Hatem, E., Colin, E., Abou-Chakra, S., El-Hassan, B., & Laheurte, J. M.	2018	New Empirical Indoor Path Loss Model using Active UHF-RFID Tags for Localization Purposes	At 433 MHz, two versions of active UHF RFID tags were used.	- In an indoor environment, the tag can be detected from up to 20 metres away. - To create a hybrid system for tracking mobile objects that is both accurate and efficient.
2	A. Rasheed, E. Iranmanesh, A. S. Andrenko, and K. Wang,	2016	Sensor Integrated RFID Tags Driven By Energy Scavenger for Sustainable Wearable Electronics Applications	RFID and physical parameter communication have been built into a self-sustaining sensor integrated RFID tag for wearable electronics applications.	- Capable of being used in real-time health-care monitoring applications - Three separate technologies are fully integrated.
3	M. Merenda, D. Iero, and F. G. D. Corte,	2019	Reconfigurable UHF RFID tag with sensing capabilities	To transfer information wirelessly, a smart RFID tag based on a custom-built microchip is used.	- RFID tags are beneficial in a variety of applications, including a more secure and managed food supply chain for perishable foods, as well as biomedical sensor data transmitters.
4	Samihah Abdullah*ab, Widad Ismail\ Zaini Abdul Halima, Che Zalina Zulkiflia,	2018	Integrating ZigBee-Based Mesh Network with Embedded Passive and Active RFID for Production Management Automation	Wireless Sensor Network is a mixture of passive and active RFIDs with specified functionalities and operating modules (WSN).	- Low data rates, cheap power consumption, and low cost are required for automation and remote-control applications. - Developed in mesh networks that are larger than Bluetooth's (10m to 75m).

2.5 Conclusion

Based on theories and pass research there are few types of method used to scan and detect the items. The results of those method were listed on comparison table 2.4 above. The most suitable method to scan and detect the items is RFID systems which known as Radio Frequency Identification tracking system. The reason why RFID and drone are selected as a median for this system is because it can link from any location within the range straight to the main controller through signal and transmitter. This project mainly focusses on accuracy and effectiveness tracking material by increasing efficiency, and reducing errors and time taken.

CHAPTER 3

METHODOLOGY

3.1 Introduction

The project flow was detailly discuss in this chapter. A part of this chapter were methods on how this project was carried out around the entire time. This chapter is intended to provide details and confirmation of how this project was conducted. The design and development of Radio Frequency Identification tracking system involve the implement of both hardware and software. These approaches were well implemented so that it produces satisfied outcome of the system which were produce the detection of RFID and drone to receive and transmitted signal.

3.2 Flow chart

To schedule and carry out the project in order to successfully getting the work done, a flow chart was created. A flow chart is chart that shows how the process or system was implemented and its representation of the sequence of path and decisions required for a method to be held out. In a diagram shape, almost every step in the pattern is observed. By connecting lines and directional arrows, steps are linked, and it allows everyone to view the flowchart and follow the instructions logically from start to finish. It also could be used in different methods such as documenting, studying, planning, improving and explaining complex process in very clear and easy ways.

3.2.1 Process explanation

Explanation of the process flow that been carried out. Therefore, figure 3.1 below shows the flow chart of overall project and the ways of this project were done is explained in summary order in detail on the subtopics.

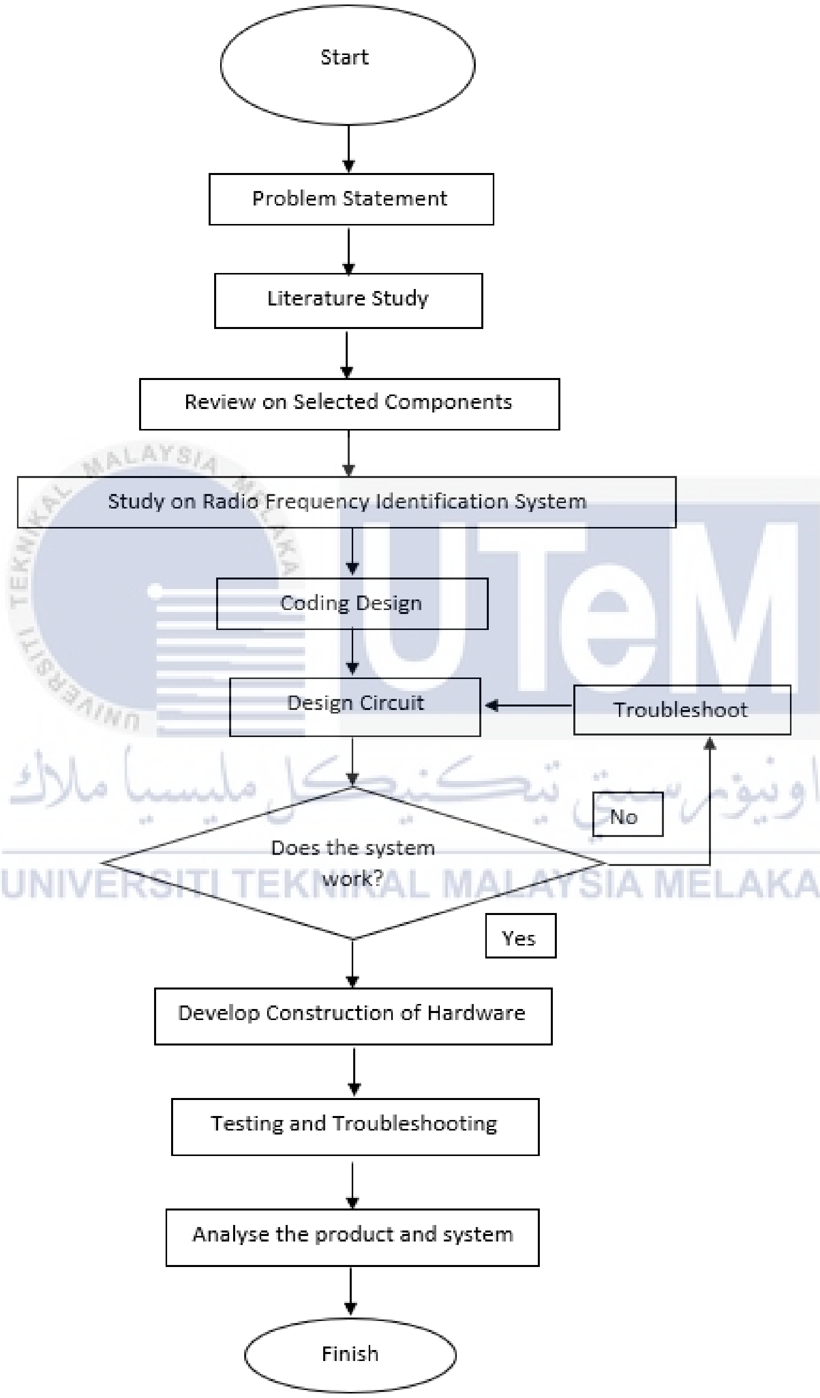

Figure 3.1: Project Flowchart

3.3 Problem Statement

Problem statement is important before choosing the project title because it shows the advantages and good reasons why the project was proposed and the objective that could overcome the problem faced. Manually searching is an inability to find and allocate material or item in a short time. Some inventions use more time and energy to do such work such as using barcode or manually write data. Firstly, Radio Frequency Identification system has been become new wireless support innovation developed for human to manage their time, movements and provide good access and effective environment. The reason why RFID and drone were selected as a median for this system is because it is linked straight from RFID to the data through the signal transmission.

According to that the problem stated that RFID system and drone is more effective and helpful for time management in order move and track and make them more efficient and accurate. The objectives have been achieved at the end of this project. All the hardware requirement details were gathered and analyzed. Therefore, the main idea of Radio Frequency Identification system using RFID sensor and Arduino were proposed to solve the problem faced by industries warehouse.

3.3.1 Literature Study

To gain the idea and knowledge about the development of Radio Frequency Identification tracking system, a literature study was made from previous report and research done by other country or universities. Firstly, sources were gathered by using keywords and those results need to review. According to that if gathered sourced is not related or do not enough those process needs to be redone.

The information from the published journals and articles had been studied to come out with the scopes for this project in order to small down the research scope. There was a lot of information found out through this literature study that helps in designing a RFID system and make sure it come from truth resources. Find the information as much as possible for an example previous journal relevant to title. Figure 3.3 below show flowchart of literature review.

Figure 3.2: Flowchart of Literature Review

3.3.2 Review on selected component

I. Arduino UNO

Based on research microcontroller Arduino UNO was selected for the overall system including the receiving part because it is capable of handling the input voltage used and is ideal for the project. The operating range of the microcontroller is about 6.0V to 12.0V and from the literature study its shows that this microcontrollers price is reasonable. Arduino UNO may run only one program at a time and C++ is the language of programming. Arduino Uno is an ATMega328 based microcontroller board. It is easy to use because it can literally interface it to the computer by using USB cable or battery, or simply power it in the Arduino UNO, six of it can works as PWM outputs. It also includes six analog inputs, power jack, USB connection, 16 MHz ceramic resonator and a reset button. Figure 3.3 below show Arduino UNO.

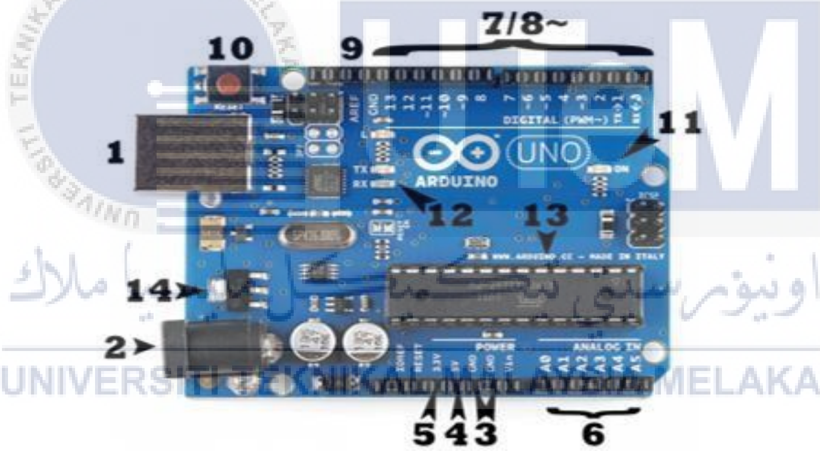

Figure 3.3: Arduino UNO

Table 3.1: Labelled pin function

Pin	Label
1	USB Connection
2	Barrel Jack
3	Ground pin
4	5voltage pin
5	3.3voltage pin
6	Analogue pins
7	Digital input or output
8	Pulse Width Modulation (PWM)
9	Analog Reference (AREF)
10	Reset Button
11	Power LED Indicator
12	Tx & Rx indicator LEDs
13	Integrated Circuit (Main IC)
14	Voltage Regulator

II. Wi-Fi Node MCU (ESP8266)

The ESP8266 Wi-Fi Module is a self-contained SOC with an integrated TCP/IP protocol stack that allows any microcontroller to connect to your Wi-Fi network. The ESP8266 can either run an application or offload all Wi-Fi networking functions to a separate CPU. Using a smartphone, this module will connect to an Android application.

The ESP8266EX is developed for mobile devices, wearable electronics, and IoT applications, and it achieves low power consumption using a combination of unique features. There are three modes of operation in the power-saving architecture: active mode, sleep mode, and deep sleep mode. This enables battery-powered designs to run for extended periods of time. Figure 3.4 below show Wi-Fi Node module of ESP8266.

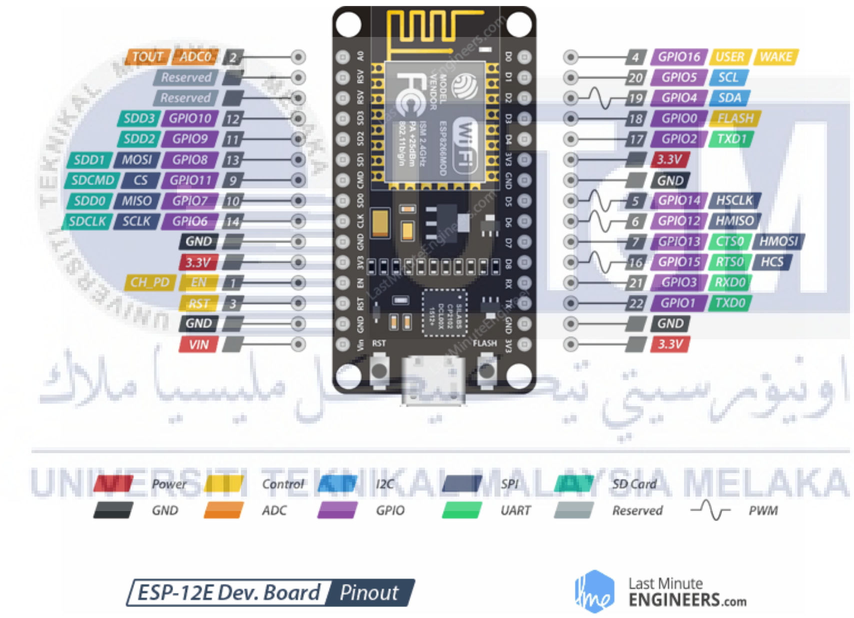

Figure 3.4: Wi-Fi Node MCU ESP8266

III. RFID

RFID were used in this project to utilizes as wireless connection that transmit and receive input and output from a range. RFID module work by sending radio frequency signals and those signals were transmitted to receiver which receive those signals only if it is configured for that frequency. Led/Buzzer monitored when the module is works. The RFID module is a one-way communication between two nodes which is transmission and receiver. The RC522 RFID Reader module creates a 13.56MHz electromagnetic field to connect with RFID tags (ISO 14443A standard tags). A 4-pin Serial Peripheral Interface (SPI) allows the reader to interface with a microcontroller at a maximum data rate of 10Mbps. It also supports the I2C and UART protocols for communication. Figure 3.5 below show RFID RC522 reader.

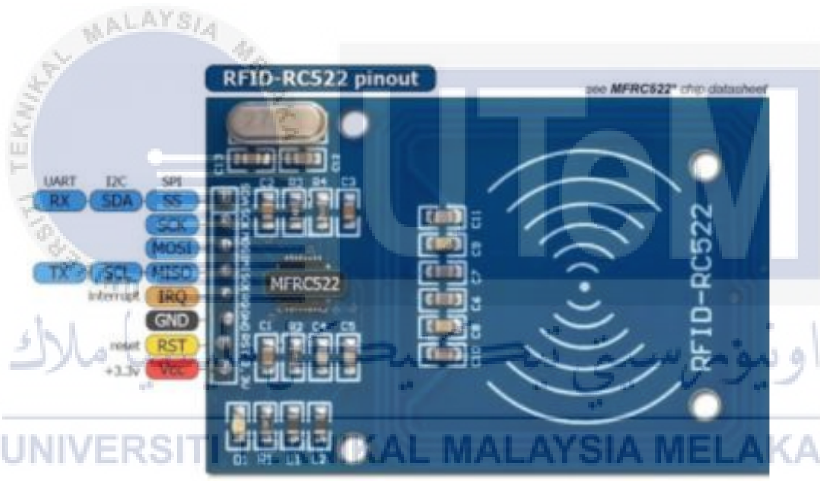

Figure 3.5: RFID RC522

V. 9V Alkaline Battery

The rounded rectangular shape of a 9V - or Nine-volt - battery is distinguishable from the cylindrical design of other typical standard batteries (think AA/AAA/ C/ D, for example). 9V batteries are normally made up of six individual cells that are then wrapped together to make a block. They come in a variety of chemical types, with the most common being carbon-zinc and alkaline or lithium-iron disulphide batteries. A 9V battery can provide the equivalent of six AA cells, however because of its compact size, it may be more practical than utilising many smaller ones. This is particularly true for long-term applications, such as smoke detectors. Figure 3.6 below show 9V Alkaline Battery.

Figure 3.6: 9V Alkaline Battery

VI. Drone

A mini 4K camera drone is used for this project. This drone using 2.4G frequency and have 4 channel. 3.7v 1800mh lithium battery is applied at drone. It can be control from 1m to 100m range distance. This drone is quadrilateral type which is small size 25cm x 20cm x 5.5cm. The drone has a build in wi-fi function to connect to an APP or APK system and take photos and video, as well as transfer photographs in real time through the camera. Ballistic flight function is applied to make the drone fly automatically to specified direction. 2.4GHz technology is used for anti-interference. The quad-rotor fuselage is made of high-strength engineering plastic, which is light and durable. Figure 3.7 below show EIS Stabilization GPS Drone.

Figure 3.7: EIS Stabilization GPS Drone

3.4 Study on Radio Frequency Identification Tracking system

The study mainly focuses on who used the system and why RFID is chosen. Industry warehouse will be able to use a RFID technology to access data and tracking item with easy access and accuracy. This innovation delivers quicker, smoother, and better control. This study is that the initial indicate that the wireless and RFID tracking system outperforms manpower. The RFID system is connected by the microcontroller and Arduino. RFID sensor is attached to a drone to track item to any place within range. A drone is use as a carrier to drive the RFID to the location pointed. The RFID system makes it easier to track and find material or item in warehouse. This topic was more briefed on literature studies.

3.5 Software Development

For the system to be designed and built, several types of software were needed to make the system working successfully. The function of this software is to ensure that the task is going easily with the precaution step so any failures can troubleshoot directly until the system work. The software that going to be utilized in this framework are:

- Arduino (IDE) Software
- Proteus Software
- Fritzing Software

All three-software had different functions for this project. The Arduino IDE software is used to make the process of the desired outcome for the ESP8266 to work in the hardware properly. It is required to write a detailed process of C++ coding language and then compile it to check whether the coding can be work properly or not. Once the coding is succeeded according to the desired outcome, then it can be transferred to the Arduino Mega hardware component. Figure 3.8 shows the flow process of software development on the Arduino IDE.

Besides, the Proteus ISIS Software is used to make a simulation of the hardware project system on the laptop. This software is useful because the outcome of the simulation that was made in the laptop will be the same outcome made for the prototype if it designs correctly. Most of the components can be found in the Proteus Software such as Arduino, RF module, buzzer, LED and sensor. Same as the hardware part, the coding from Arduino IDE software can be upload in this software to test the ESP8266 can be operated or not. If all clear, then the project can proceed to build the hardware part step by step.

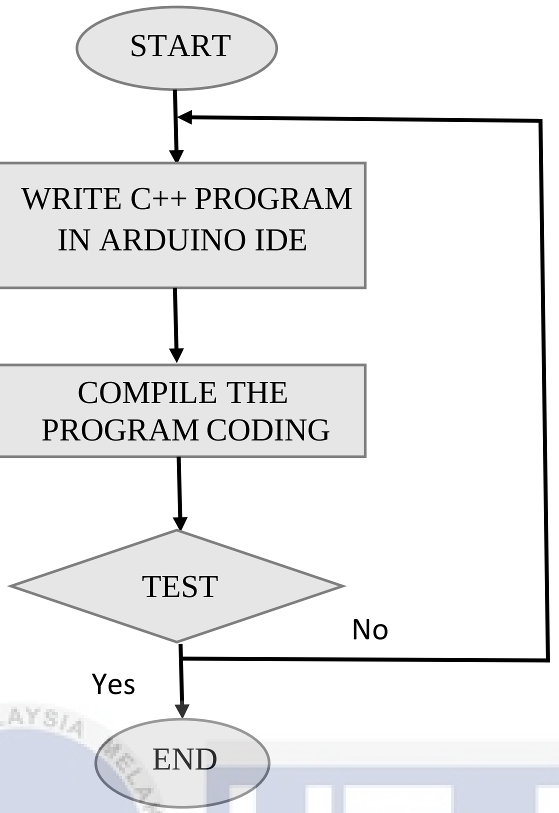

Figure 3.8: Development of the Software Flowchart

3.5.1 Arduino IDE for coding design

The coding of algorithm is needed for this project to make sure radio frequency identification and drone system works as designed. A variety of software can be used including C, C++. A simple program was built and insert into Arduino as a testing of workability and functionality of electrical components. Software part is consisting of computer software called Arduino IDE where its free to download and install. Arduino and ESP32 has been code by using Arduino IDE. Writing and uploading were easy since Arduino is open-source software. IDE Arduino could be used on various types of computers or through different java written software applications and is obtained based on IDE as language of programming as well the wiring of projects. Arduino software will help the coding run smoothly for this project. Figure 3.9 below shows Arduino IDE software.

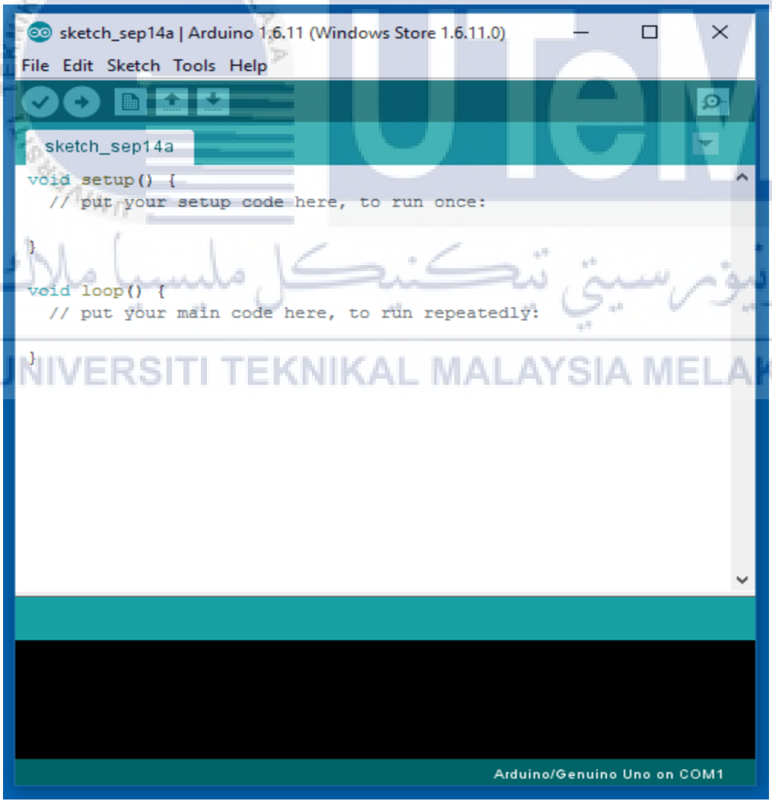

Figure 3.9: Arduino IDE software

3.5.2 Proteus Software for circuit Design

Before starting to construct hardware, electrical circuit should have been and tested in order to achieve this project successfully. It helps to change component and trouble shoot error that will occur during simulation process. Proteus is just a computerized software tool exclusively used for automation of electronic circuit design. This software has been used electronically to develop schematics and electronic drawings. In addition, it is also a schematic design, simulation and PCB layout application. Coding that created can directly download to this software and checkout designed system functionality. The simulation of Proteus will help the project to run successfully and detect the error circuit before hardware configuration. Figure 3.10 below shows Proteus design software.

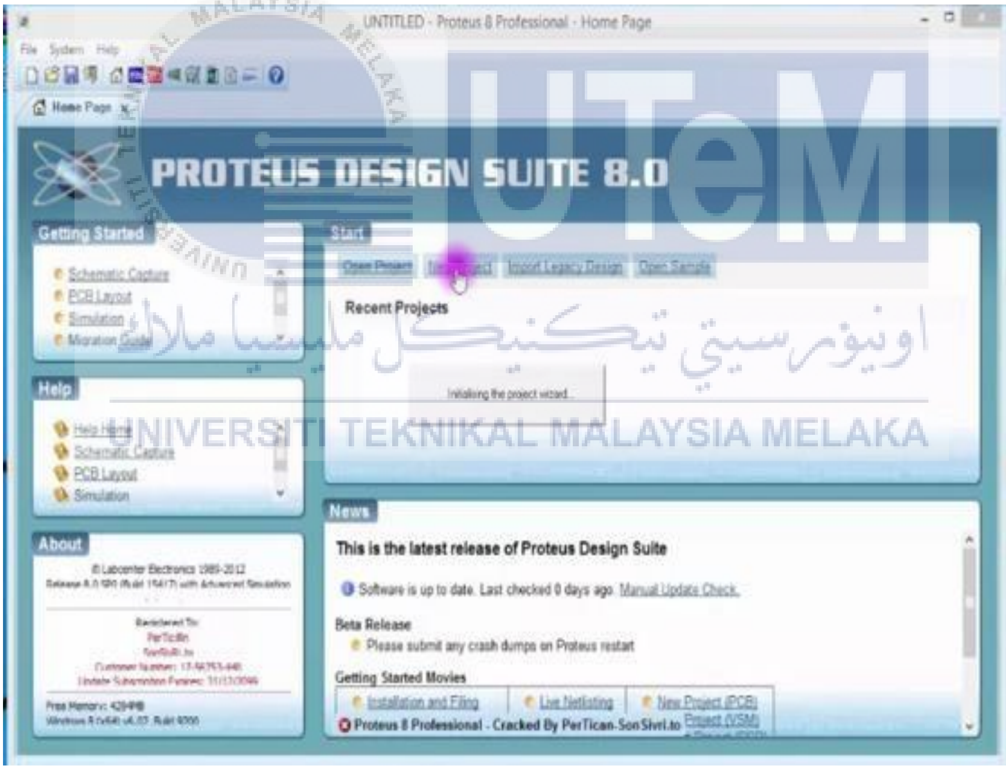

Figure 3.10: Proteus Design software

3.5.2.1 Simulation circuit

Figure 3.11 below shows an electrical circuit simulation that has been conducted for this project by using proteus software. The circuit is design as prototype for this RFID project. Functionally of the system is expected the same as the hardware. RF module TxRx is applied in this simulation circuit.

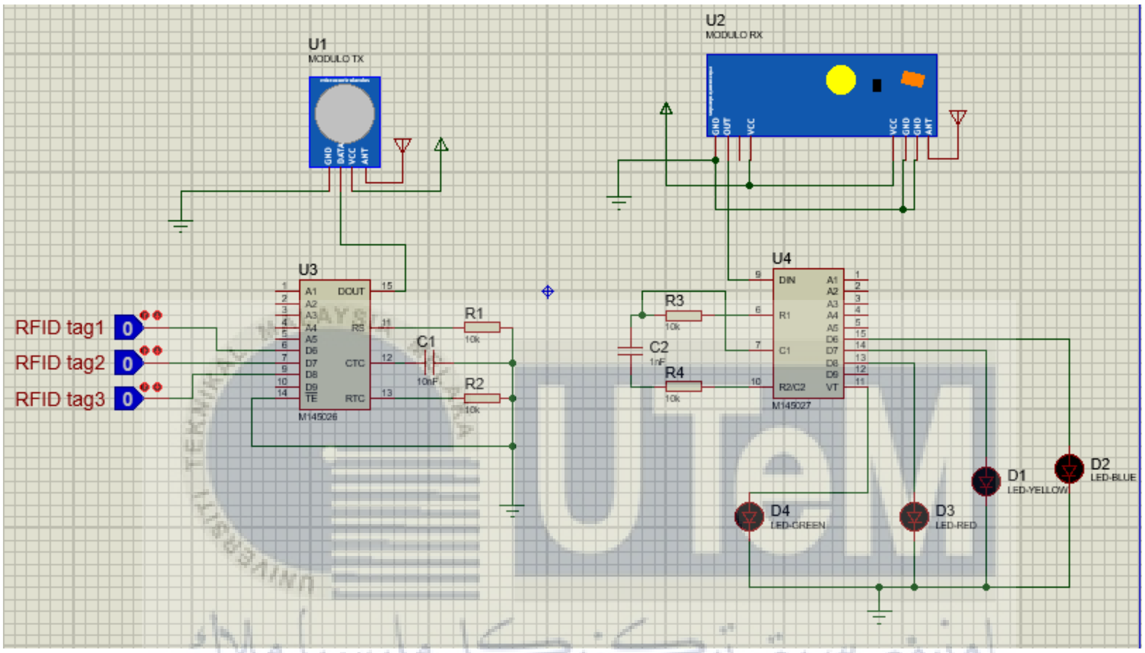

Figure 3.11: Prototype of RF module circuit

3.5.3 Fritzing Software for circuit design

This software also used for this project before starting to construct hardware, electrical circuit should have been and tested in order to achieve this project successfully. Fritzing is an open-source hardware effort that allows to use electronics as a creative medium. In the spirit of Processing and Arduino, it is providing a software tool, a community website, and services that build a creative ecosystem that allows users to document prototypes, share, teach electronics, and layout and build professional pcbs. Fritzing is useful to assist in this project to progress from a prototype to a more permanent circuit. Figure 3.12 below show RFID circuit design in Fritzing software.

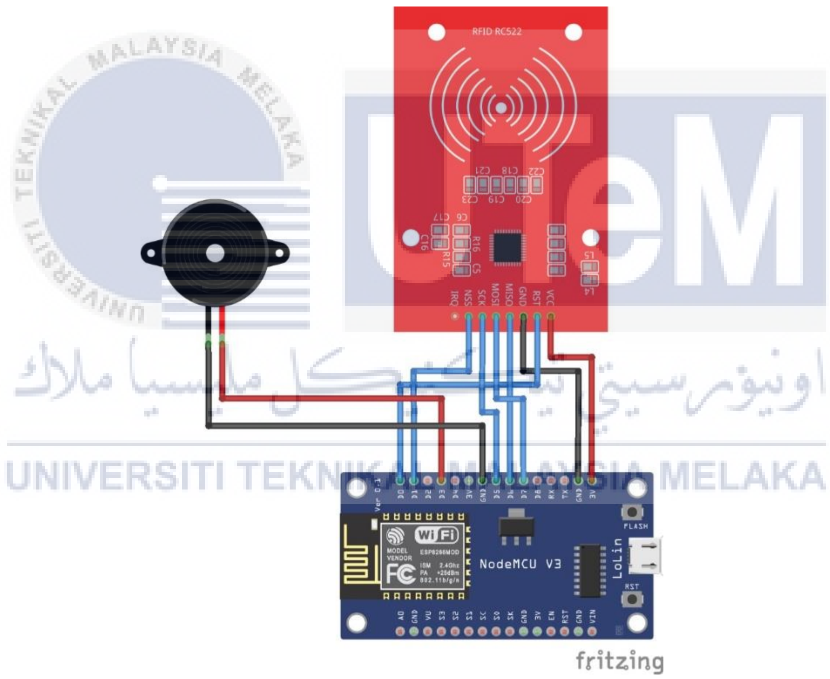

Figure 3.12: RFID Circuit Design in Fritzing software

3.6 Application Software

3.6.1 Blynk

Blynk is an Arduino, Raspberry Pi, and internet system control platform featuring IOS and Android apps. It is a digital dashboard where you may drag and drop widgets to make a project's graphic interface. It can control hardware from a distance, display sensor data, and preserve information. Figure 3.13 below show the android application.

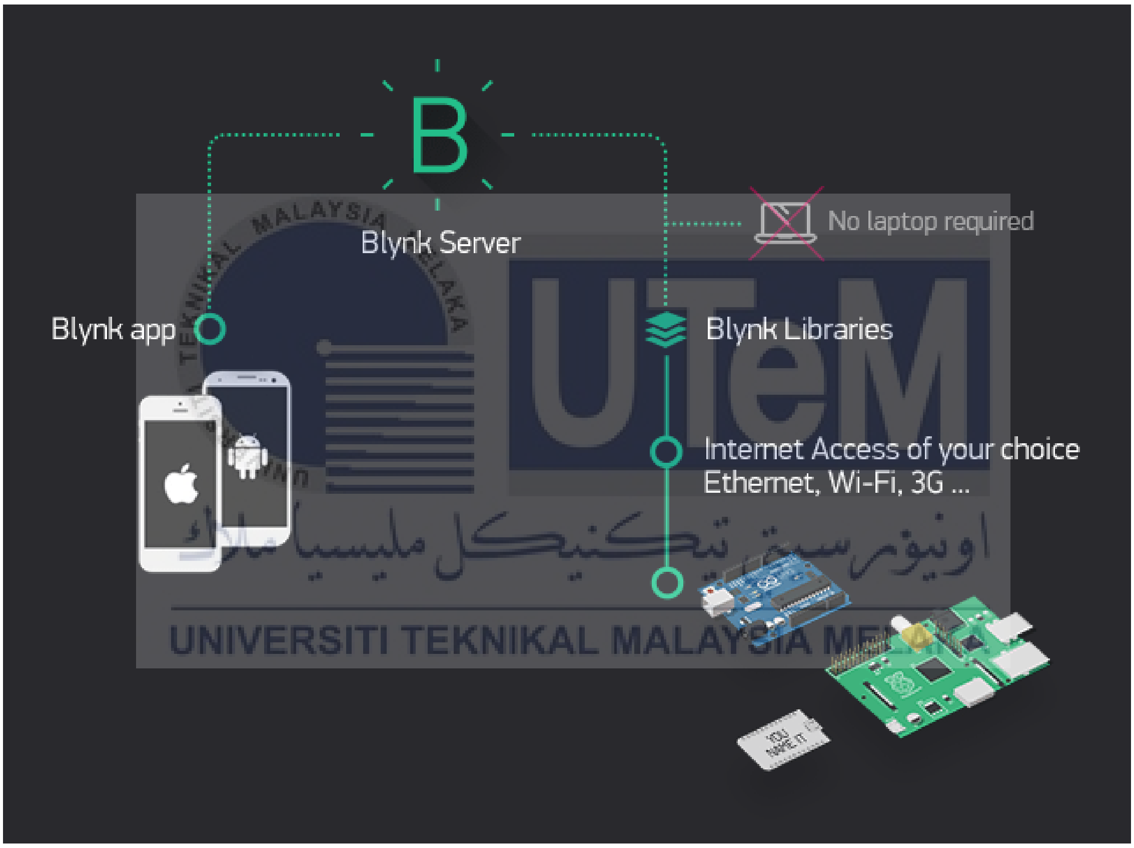

Figure 3.13: Blynk software

CHAPTER 4

RESULTS

4.1 Introduction

This section describes the general analysis and discussion about all the data required to determine the performance and achievement of the project. The results were obtain based on objective and scope that had been mentioned before. Analysis was conduct based on method and result achieved. The data will be evaluated and summaries in two phases. First section is the transmitter and second part of it is obtained on the receiver side.

4.2 Project Development

There were two phases on development of this project which is hardware and software. The hardware consists of implement of RFID and drone were built to transmit data to receiver of RFID reader and tag, and to move into specific area. For the software part there is also two types of coding designed which is for the RFID and the drone. The software and stimulation were done before construction of hardware.

4.2.1 Hardware development

The circuits were designed before the implement of RFID and drone because it helps to design the hardware easier. For the circuit is consist of RFID.

4.2.1.1 Radio Frequency Identification circuit design

The RFID circuit were design by using RC522 sensor which works with 2.5v to 3.3v and it has reader and tag. The ESP8266 is a communication that were used as Wi-Fi, Bluetooth and RF. Arduino Uno were used as microcontroller to interface input data from sensor and transfer it to the received by transmitter. ESP8266 operate with 9v battery for better performance. 433MHz transmitter act as wireless which drive an output by range. Frequency was sent to the receiver to perform the corresponding output. RC522 sensor module consist of 7 pins which is 3.3v, ground, reset, interrupt, MISO pin, SPI input and serial clock pin. The pin of RC522 sensors were connected to D0, D1, D5, D6 and D7 of ESP8266. RC522 VCC and ground were connected to the ESP8266 3V3 and ground. The buzzer pin was connected to pin D3 and GND on the ESP8266. 9v Alkaline battery is applied to supply the circuit. Figure 4.1 and 4.2 below shows the RFID circuit design and RFID schematic circuit design on fritzing.

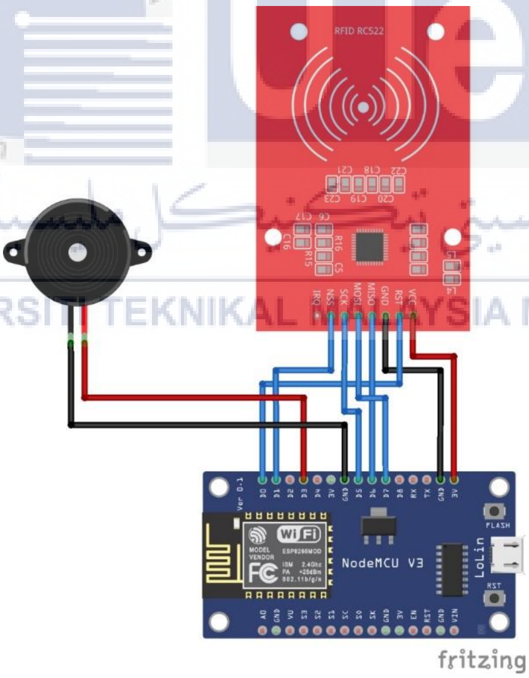

Figure 4.1: RFID circuit

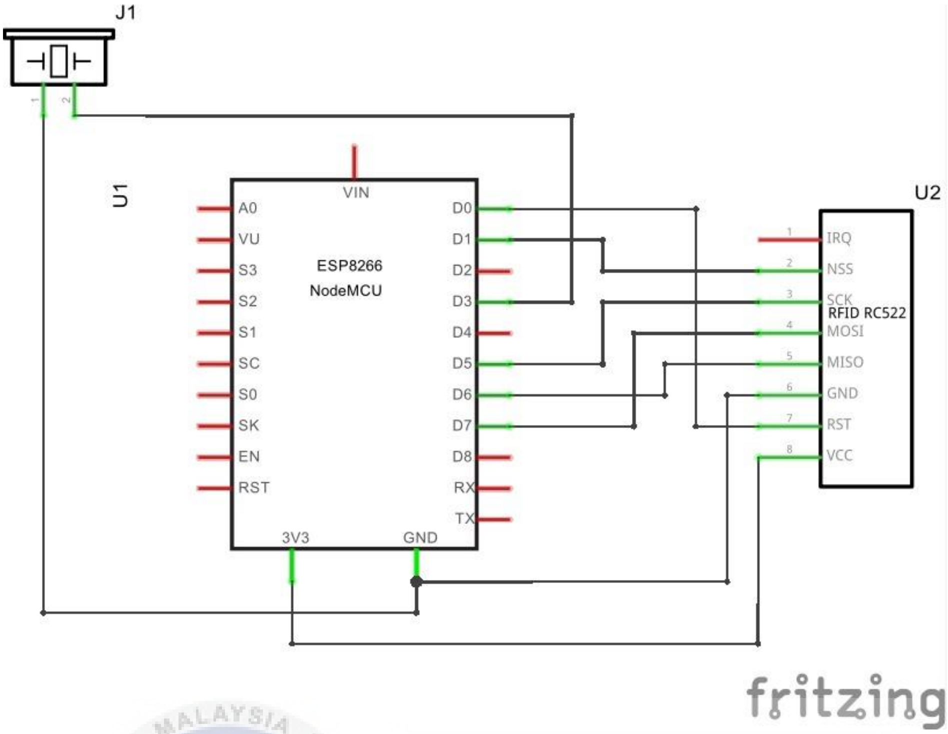

Figure 4.2: RFID schematic circuit

4.2.1.2 Hardware implementation

In hardware implementation, there were two part which are electrical part and mechanical part. This implementation is about how both parts were modified and developed to attached RFID and drone.

RFID

This circuit of RFID was assembled to attach RC522, ESP8266 and LED. Breadboard and wiring process is used to combine the connection from each point for current flow. This method is useful to test the connection of each point and identify the wiring problem. Unfortunately, this method is risky that can cause a short circuit. Figure 4.3 below shows the RFID testing circuit.

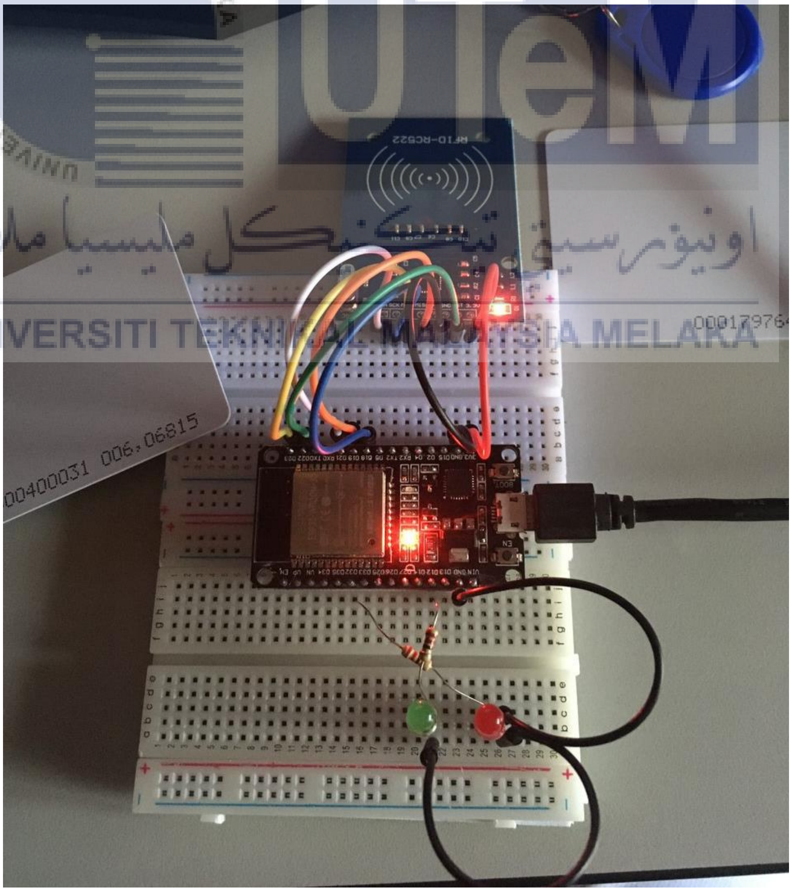

Figure 4.3: RFID Testing circuit

Then the new circuit of RFID was construct and assembled to attach RC522, ESP8266 and buzzer. Soldering process was done to combine the RC522, ESP8266 and buzzer altogether. Most of the wiring were removed as solder is used as connection current flow from point to point. This method is reliable than wiring as it is neater and tidier. Figure 4.4 below shows the design of RFID base circuit.

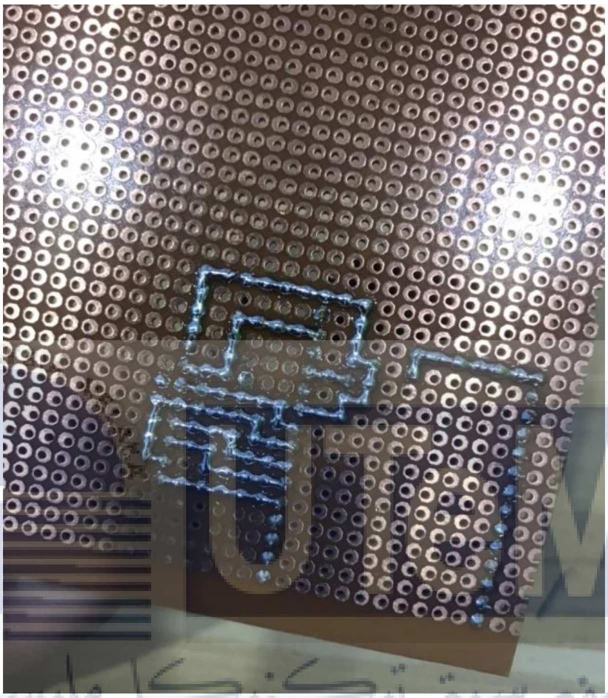

Figure 4.4: RFID base circuit

ON the top of the circuit of RFID terminal block were used to attach every connection of current flows. This will make it neater and easier to connect RFID, ESP module, buzzer and battery pin. Each pin of RC522, ESP8266 and buzzer to the circuit board were connected easily by using terminal block. Figure 4.5 and 4.6 below shows top base of RFID and ESP module, and final connection of RFID and ESP module on circuit.

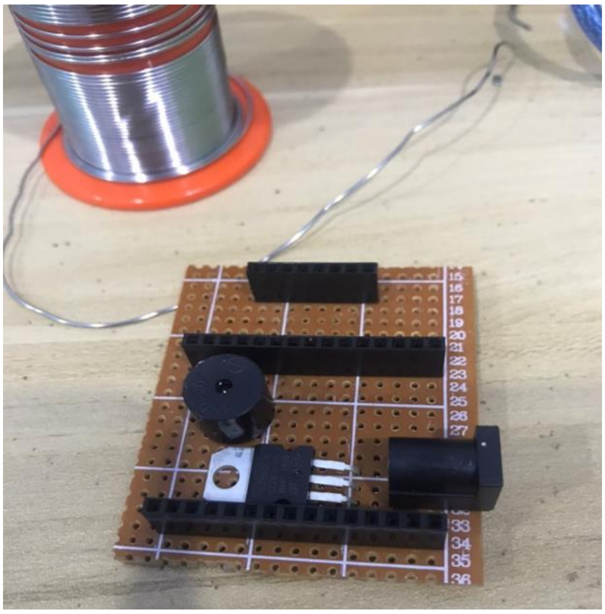

Figure 4.5: Top base of RFID circuit

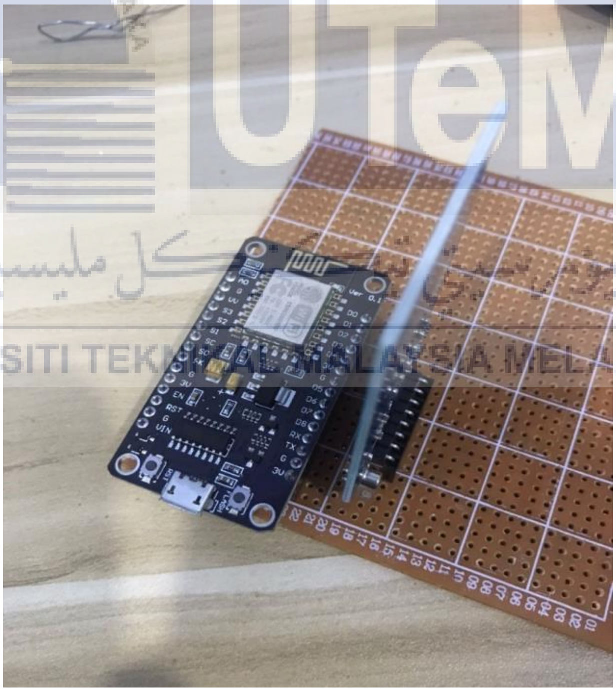

Figure 4.6: RFID and ESP module connection on circuit

4.3 Software & Coding Development

The development of this project is using software and hardware. Software which used to complete this project is Proteus, Fritzing and Arduino IDE. The constructions of circuit are done by using Proteus software and Fritzing software to construct the RFID circuit before it is developed into hardware. Meanwhile Arduino IDE is a platform to develop a coding before it transferred to the Arduino UNO and Blynk apps. The serial monitor was used to observe the real-time result such as the detected item, places, time of RFID.

4.3.1 Internet of Things (IoT) System

The RFID Tracking system will be using an IoT application by connecting to the internet server. This system will be using the ESP8266 Wi-Fi module to connect to the internet server. This will make the RFID Tracking system easy to be monitoring and tracking the appliances by using the smartphone only.

4.3.2 Analysis of ESP8266 Wi-Fi Module

The ESP8266 Wi-Fi module will be used to connect the system to the internet server and Blynk application and when it had connected, the RFID Tracking system can easily track and monitor through the smartphone. The Wi-Fi module will also alert by notify from the Blynk at the smartphone when detected items to the system. The analysis for this module will be how many can the system connect to the internet server. Table 4.1 and figure 4.7 below shows time taken to detect (s) by Wi-Fi range of ESP8266.

Table 4.1: Shows Time Taken to detect (s) by Wi-Fi Range of ESP8266 (m)

WIFI Range of ESP8266 (m)	Time Taken to detect (s)	Detection of WIFI Module ESP8266
2	4.6	YES
4	5	YES
6	5.8	YES
8	8.5	YES
10	0	NO

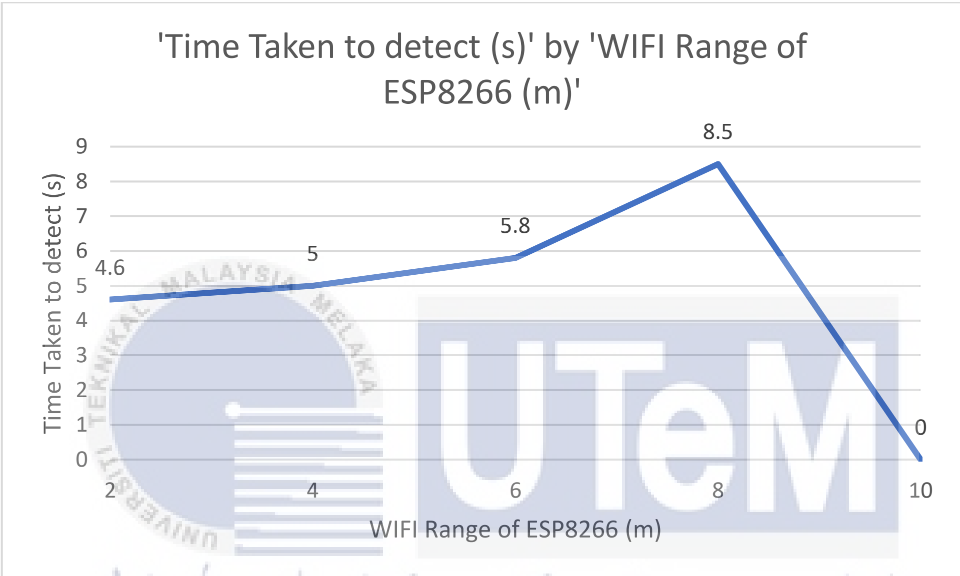

Figure 4.7: Time Taken to detect (s) by Wi-Fi Range of ESP8266 Graph

4.3.3 Connection of ESP8266 Wi-Fi Module with server

By using a Blynk Apps on the smartphone, the system can be monitor and even control the electrical appliances. But the Wi-Fi module will be playing the communication system between the user and the smartphone. The ESP8266 will be connected to the Wi-Fi and make the system goes online. All the data and details will be upload to the server and can be monitor through the smartphone. An analysis was conducted to see the connectivity of the module with the internet server.

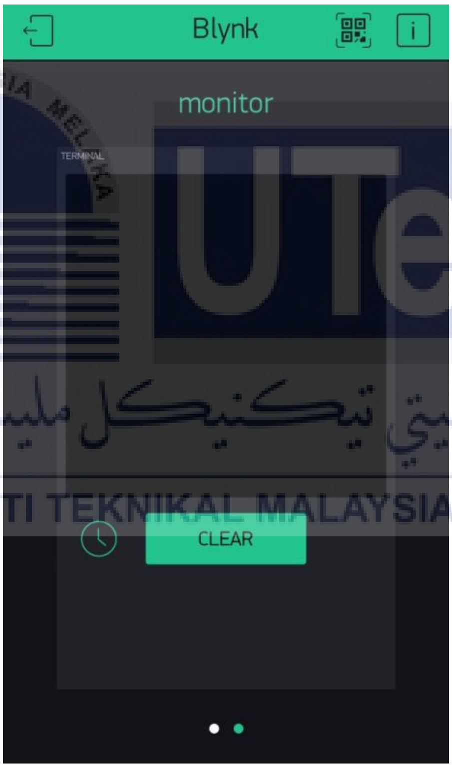

Figure 4.8: Blynk Applications for monitoring RFID data

As shown in Figure 4.8, the ESP8266 will be connected with the Wi-Fi then it is connected direct to Blynk Apps. After that, the system can go online, and electrical appliances can be monitor and controlled via smartphone.

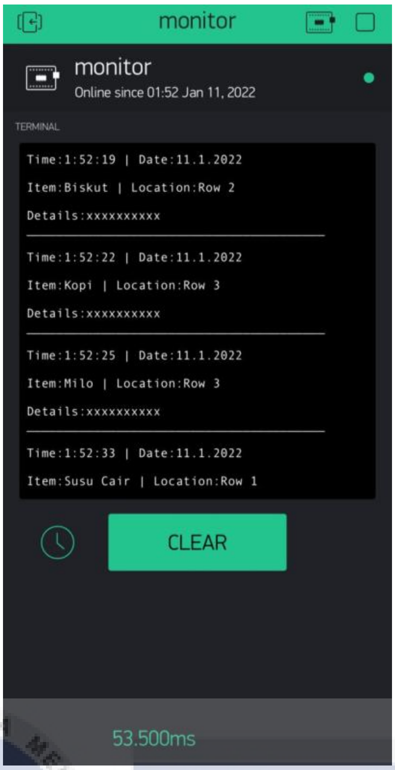

Figure 4.9: Blynk Applications monitor

As shown in Figure 4.9, the Blynk Apps monitor will go online when it is connected with the Wi-Fi. After that, when the tag has been scan by RFID, the output data will be store on the terminal system.

4.3.4 Coding for RFID sensor

Based on Figure 4.10 below, the coding shows the initial declaration of RFID sensor which was executed in Arduino IDE software. These initial helps sensors to work without error and helps to convert magnetic field detection to analog once the coding programmed into Arduino UNO. The transmitter pin is declared as pin number 12 and port D0 to D7 is used to sensor and it is declared on the coding. Analog data that collected is transfer to receiver by using transmitter. This coding is important because it able to interpret data and collect information at end of the experiment.

```
#include <SPI.h>
#include <MFRC522.h>

#define SS_PIN D8
#define RST_PIN D1
MFRC522 mfrc522(SS_PIN, RST_PIN);

int buzer = D3;

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

char Card1[]="04 18 B7 D2 27 73 81";
char Card2[]="04 13 B7 D2 27 73 81";
char Card3[]="04 0F B7 D2 27 73 81";
char Card4[]="04 0B B7 D2 27 73 81";
char Card5[]="04 20 B7 D2 27 73 81";

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

char Item1[]="Kerusi Pejabat";
char Location1[]="Row 1";
char Details1[]="xxxxxxxxxx";

char Item2[]="Kerusi Makan";
char Location2[]="Row 2";
char Details2[]="xxxxxxxxxx";

char Item3[]="Meja Bulat";
char Location3[]="Row 3";
char Details3[]="xxxxxxxxxx";

char Item4[]="Meja Dapur";
char Location4[]="Row 4";
char Details4[]="xxxxxxxxxx";

char Item5[]="Almari";
char Location5[]="Row 5";
char Details5[]="xxxxxxxxxx";
```


Figure 4.10: RFID coding

4.3.5 Coding for Blynk application

Based on Figure 4.11 below, the coding shows the initial declaration of Blynk apps which was executed in Arduino IDE software. These initial helps Blynk apps to work without error and helps to convert magnetic field detection to analog once the coding programmed into Arduino UNO. The transmitter pin is declared as pin number 12 and port D0 to D7 is used to sensor and it is declared on the coding. Analog data that collected is transfer to receiver by using transmitter. This coding is important because it able to interpret data and collect information at end of the experiment.

```
BLYNK_CONNECTED() {
  // Synchronize time on connection
  rtc.begin();
}

void setup()
{
  Serial.begin(9600);

  Blynk.begin(auth, ssid, pass);

  while (!Serial)
  {
  }
  SPI.begin();      // Initiate  SPI bus
  mfrc522.PCD_Init();   // Initiate MFRC522

  pinMode(buzer,OUTPUT);

  setSyncInterval(10 * 60); // Sync interval in seconds (10 minutes)

  // Display digital clock every 10 seconds
  timer.setInterval(10000L, clockDisplay);

}

void loop()
{
  Blynk.run();
  timer.run();

  String currentTime = String(hour()) + ":" + minute() + ":" + second();
  String currentDate = String(day()) + "." + month() + "." + year();

  if ( ! mfrc522.PICC_IsNewCardPresent())
  {
    return;
  }
  // Select one of the cards
  if ( ! mfrc522.PICC_ReadCardSerial())
  {
```


Figure 4.11: Blynk coding

4.3.6 Coding for Buzzer

Based on Figure 4.12 below, the coding shows the initial declaration of Buzzer which was executed in Arduino IDE software. These initial helps Buzzer to work without error and helps to convert to sound output once the coding programmed into Arduino UNO. The transmitter pin is declared as port D3 and Ground is used to detect input and it is declared on the coding. Analog data that collected is transfer to receiver by using transmitter. This coding is important because it able to interpret data and collect information at end of the experiment.

```
void buzzer()
{
  digitalWrite(buzer,HIGH);
  delay(100);
  digitalWrite(buzer,LOW);
  delay(100);
  digitalWrite(buzer,HIGH);
  delay(100);
  digitalWrite(buzer,LOW);
}

BLYNK_WRITE(V1)
{
  terminal.clear();
  terminal.flush();
  digitalWrite(buzer,HIGH);
  delay(50);
  digitalWrite(buzer,LOW);
  delay(50);
  digitalWrite(buzer,HIGH);
  delay(50);
  digitalWrite(buzer,LOW);
  delay(50);
}
```


Figure 4.12: Buzzer coding

4.4 Final Development Overview

Once the hardware and software required is successfully run and tested the system was attached and finalize. Data for analysis were collected and the system was tested. Figure 4.13 below shows the final development of RFID Tracking System Drone.

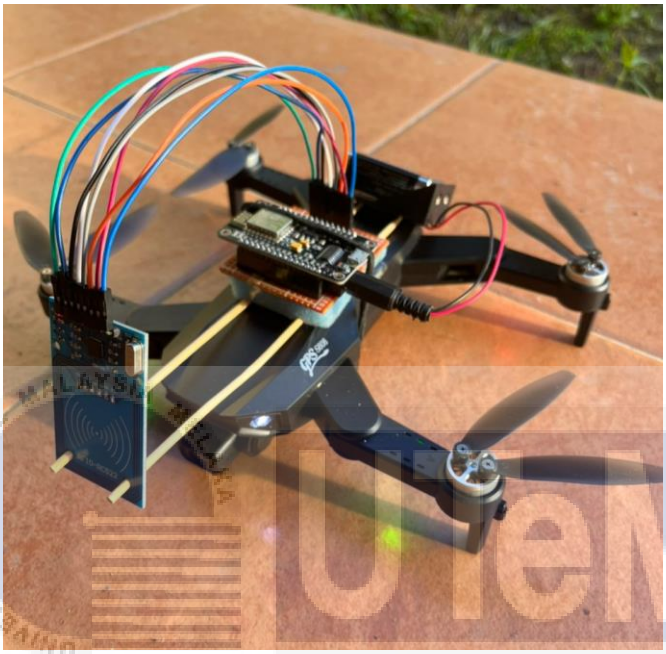

Figure 4.13: Final development of RFID Tracking System Drone

4.5 Analysis

This section describes the general analysis and discussion about all the data obtained. This research has been done in order to fulfil the requirement of the final year project. The data been evaluated and summaries in two phases. First section is the transmitter and second part of it is obtained on the receiver side. The performance test of the wheelchair has been done and the different load test been done.

4.5.1 Analyze the performance of the drone system

This analyze discuss about the result that has been achieved by performing the overall system to determine whether this system is successful or not. This experiment was done by using the final developed hardware and done by assuming user is using the system and how they move the RFID drone movement by using controller. When user switch on the controller, the drone, and RFID that is attached on drone, it is connected detects the magnetic field and convert the analog data to digital data. The drone is manually fly by user to any places that needed for RFID to be detected. The obtained data from RFID then were transmitted by transmitter based on Arduino signal that been coded. The receiver which connected to ESP8266 receive the signal from transmitter and detect which output should be performed. As example is receiver received data from RFID reader sensor, which is the ESP8266 will send output to Blynk system for data. Table 4.2 and 4.3 below shows how accurate and efficiency of the system. The drone and RFID sensor detection and switching on and off sequences of motor were illustrated in table 42 and 4.3. The input signal referred as 1 and the 0 stands for no signals also 1 is knowns as high and 0 is low.

Table 4.2: Detection of movement drone

Drone		**Drone Controller**					**Drone Rotate**	
		Analog Forward	**Analog reverse**	**Analog stop**	**Analog left**	**Analog right**	**Clockwise**	**Anticlockwise**
Forward	Yes	1	0	0	0	0	1	1
	No	1	0	1	0	0	0	0
Stop	Yes	0	0	1	0	0	1	1
	No	1	1	1	1	1	1	1
Reverse	Yes	0	1	0	0	0	1	1
	No	0	1	1	0	0	0	0
Left	Yes	0	0	0	1	0	1	1
	No	0	0	1	1	0	0	0
Right	Yes	0	0	0	0	1	1	1
	No	0	0	1	0	1	0	0

Table 4.3: Detection range of RFID sensor in signal 1/0

Distance of RFID sticker & RFID sensor/reader (cm)	Detection of RFID sensor/reader
0.5	1
1	1
1.5	1
2	1
2.5	0
3	0

4.5.2 Test the performance of RFID sensor and Drone

As shown in table 4.4 below when the RFID sticker is detected from centre front, left, right, or top of RIFD reader. Distance range of RFID signal detection has been tested from different angle. The result of detection is measured and analyze data through graph plot. Figure 4.14 below shows the graph of position and distance range of RFID.

Table 4.4: Distance of RFID by position

Position	RFID Distance (cm)				
	D1	D2	D3	D4	D5
Centre	0.5	1	1.5	2	0
Left	0.5	0	0	0	0
Top	0.5	1	0	0	0
Right	0.5	0	0	0	0

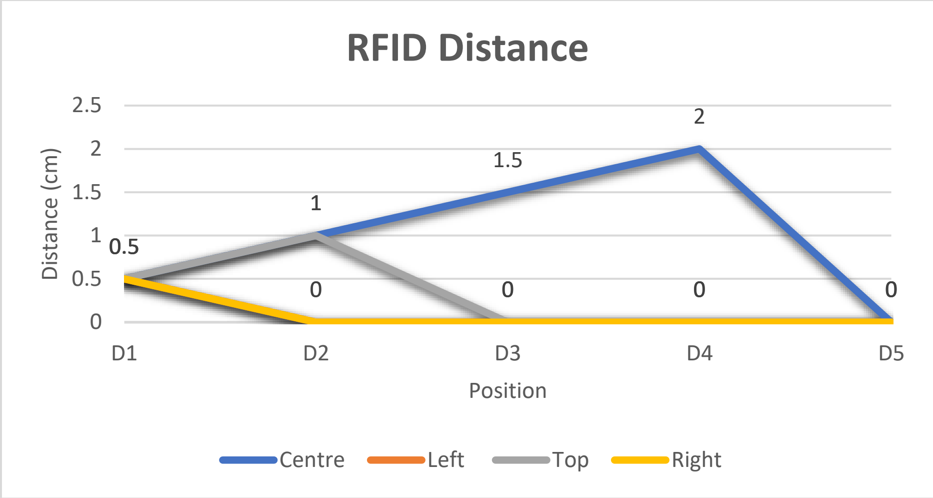

Figure 4.14: Graph of RFID distance by position

Meanwhile for the RFID sensor and ESP8266 that needs to be attached on the drone has been tested by using certain material. Four items have been choosing to be tested as support to attach RFID and ESP8266 to the drone. After all material have been tested, the drone can only be fully stable by using bamboo stick. Table 4.5 below shows material used to attach on RFID and ESP module and weight of load of each material. Figure 4.15 below shows the weight of load (g) by materials in plot graph.

Table 4.5: Material and weigh of load (g)

Materials	Weight of load (g)
Sponge	5
Trunking	10
Board	5
Bamboo Stick	1

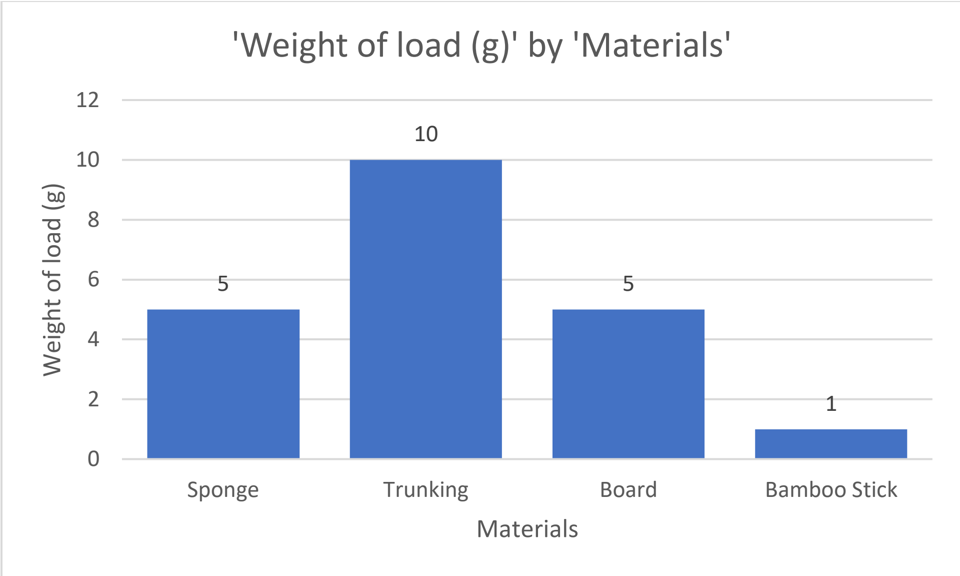

Figure 4.15: Graph of weight of load (g) by materials

4.5.3 Analysis on distance between RFID sensor and RFID sticker

In order to identify the RFID sensor detection, range an experiment was conduct by using RFID sticker and RFID sensor. This is because RFID sensor has its specific detection range and easily attracted to magnetic field. The range is important to make sure RFID sensor that produce is affected accurately to RFID sticker. The RFID is tested manually by bring near to the sensor. Table 4.6 below shows data that obtained. Figure 4.16 below show how the experiment was tested.

Table 4.6: Detection range of RFID sensor

Distance of RFID sticker and RFID sensor (cm)	**Detection of RFID sensor**
0.5	Yes
1.0	Yes
1.5	Yes
1.8	Yes
2.0	Yes
2.5	No
3.0	No

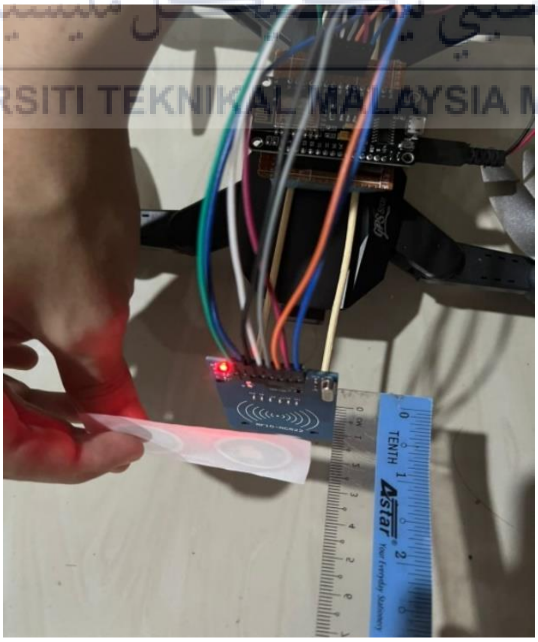

Figure 4.16: Detection range of RFID sensor

4.6 Conclusion

RFID drone system is a project which will be very useful to assist physically challenged people to move freely without depending on others. This implementation is one of way to help the challenged to reduced time and energy of individual to do extra things. In this modern world, device like intelligent electronic came will be very handful since it able to assist to reduce the time taken and energy of workers. The system is portable user friendly due to its features in it. In future, this kind of system in the device will be one of the main needs for the challenged workers as it gives a large impact in saving time and labour cost for worker.

CHAPTER 5

CONCLUSION

5.1 Introduction

This chapter conclude about the overall process of Development of Radio Frequency Identification Tracking System using RFID sensor, drone and Arduino. Furthermore, the propose of this chapter is to give suggestion to improve and develop the system to become more efficient that can be done for the future expansion.

5.2 Conclusion

Nowadays, there is still an old technology and manual method that has been used in certain industries or warehouses. Still many industries that fell behind by using manual method. Radio Frequency Identification tracking system is a new technology that have many purposes which can be controlled by system. This is very helpful for industries and warehouse to operate smoothly. Based on this project, the RFID is used as tracking or detecting material or item. It is easier than manual method or by using barcode technology. Moreover, this RFID is attached to a drone to make is easier to go any places in the warehouse to track or detect material. It might also reduce the cost, worker's burden and reduce time taken to find any material in warehouse. This RFID system is more efficient and easier to use unlike manual method or barcode, RFID system and drone would give more advantages for tracking and detecting material in short time and effectively. The system is made up of RFID RC522 reader and tag as transmitter and receiver where the reader is attached at the drone while the tag will be place at the material. Moreover, Esp8266 is applied to extend and faster the connection for RFID and Arduino.

5.3 Recommendation

For future recommendations, the RFID Tracking system can be upgraded by using Ultra-High Frequency (UHF) RFID sensor for better range of detection. This will ensure the less time consuming to detect items and can be detect from far away. Once the UHF RFID sensor detects the tracking items, while the Wi-Fi module notifies the user, the Blynk Apps will also activate automatically to save data of the items.

Besides, the drone with better specs and fly range can be function throughout the warehouse and by monitor using smartphone can be an upgrade to the monitor and control of RFID Tracking system. If anything happens to the drone, the Wi-Fi module can send a notification to the smartphone. Only getting notifications without knowing anything happens to the drone can be quite frustrated. So, by upgrading the drone, the user will be able to monitor and control the drone from miles away.

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APPENDIX

Gantt Chart