POLITEKNIK UNGKU OMAR

THE IMPLEMENTATION OF ARDUINO UNO IN WATER LEVEL DETECTOR DEVICE FOR HOSPITAL BUILDINGS

MUHAMMAD FAUZI BIN GANTI SALIM

(01BCT20F3010)

CIVIL ENGINEERING DEPARTMENT

SESSION 2 2022/2023

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A project report/thesis submitted in partial fulfillment of the requirements for the award of the Bachelor Of Civil Engineering Technology with Honours

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STATEMENT OF AUTHENTICITY AND PROPRIETARY RIGHTS

THE IMPLEMENTATION OF ARDUINO UNO IN WATER LEVEL DETECTOR DEVICE FOR HOSPITAL BUILDINGS

1. I, **MUHAMMAD FAUZI BIN GANTI SALIM (NO KP: 990522-08-8587)** am a student of **Bachelor Of Civil Engineering Technology**, in **Politeknik Ungku Omar**, at address **Jalan Raja Musa Mahadi, 31400 Ipoh, Perak.**

2. I hereby declare that the work in this thesis in my own except for quotations and summaries which have been duly acknowledged.

3. I hereby agree to let go the intellectual property ownership of this project to Ungku Omar Polytechnic in partial of the requirement for the award of the **Bachelor of Civil Engineering Technology with Honours.**

Prepared by;)
MUHAMMAD FAUZI BIN GANTI SALIM) .....
(Identification Number: 990522-08-8587)

Witnessed by;
PUAN AZIZAH BINTI HARON @ HASSAN
(780613-03-5282)) .....
As the project supervisor, dated:)

APPRECIATION

In the name of Allah SWT, most gracious, most merciful, peace and blessing be upon prophet Muhammad SAW, his family and his friend selected. Firstly, I want to offer my deepest gratitude must be towards Allah because of His grace and His guidance; I can enable complete this report “The Implementation Of Arduino Uno In Water Level Detector Device For Hospital Buildings”.

Thank you to my family for their unconditional love, unwavering support, and constant encouragement. Their belief in me, their sacrifices, and their unwavering presence have been instrumental in shaping who I am today. Their guidance, wise counsel, and endless encouragement have been a constant source of inspiration, motivating me to strive for excellence and to overcome challenges with determination and resilience. I am truly blessed to have such a loving and supportive family, and I am forever grateful for their unwavering faith in me.

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Thank you.

ABSTRACT

Nowadays water is crucial to sustainable development since it is necessary for both economic and social progress, as well as for the production of useful energy, ecological security, and human survival. If water leak problems are not handled or rectified it cause property damage, defective equipment, and expensive clean-up charges. In this study, the objectives are to design and develop a water level detector device using Arduino UNO also evaluate the effectiveness of the prototype. Arduino UNO in this prototype acts as single board microcontroller. Furthermore, the Ultrasonic Sensor HC-SR04 detects the water level and sends a signal to Arduino UNO to turn on the pump and provide data about the water level to the LCD if the water level drops to the low level, which is 30%of the tank, in the prototype. The maintenance team will receive a message that there is a problem with the tank if the water does not fill the tank within 20 minutes. A questionnaire was conducted using quantitative method that was distributed among 40 respondents that consist of project manager, engineer, inspector of works, consultants, and client. The effectiveness of the prototype was evaluated using paired t-test and analysed using IBM SPSS. This product was highly recommended to be used in buildings. It was a systematic and efficient device for monitoring water levels and can give early warning to the maintenance team.

ABSTRAK

Dalam zaman ini, air merupakan elemen yang penting bagi pembangunan lestari kerana ia diperlukan untuk kemajuan ekonomi dan sosial, serta untuk pengeluaran tenaga berguna, keselamatan ekologi, dan kelangsungan hidup manusia. Sekiranya masalah kebocoran air tidak ditangani atau diperbaiki, ia boleh menyebabkan kerosakan harta benda, peralatan yang rosak, dan kos pembersihan yang mahal. Dalam kajian ini, objektifnya adalah untuk mereka bentuk dan membangunkan peranti pengesan paras air menggunakan Arduino UNO serta menilai keberkesanan prototaip tersebut. Arduino UNO dalam prototaip ini berfungsi sebagai "microcontroller" papan tunggal. Selain itu, Sensor Ultrasonik HC-SR04 mengesan paras air dan menghantar isyarat kepada Arduino UNO untuk menghidupkan pam dan memberikan data tentang paras air kepada LCD jika paras air jatuh kepada paras rendah, iaitu 30%. Pasukan penyelenggaraan akan menerima mesej bahawa terdapat masalah dengan tangki jika air tidak mengisi tangki dalam tempoh 20 minit. Satu soal selidik telah dijalankan menggunakan kaedah kuantitatif yang diedarkan kepada 40 responden yang terdiri daripada pengurus projek, jurutera, pemeriksa kerja, perunding, dan pelanggan. Keberkesanan prototaip ini dinilai menggunakan ujian-t berpasangan dan dianalisis menggunakan IBM SPSS. Produk ini sangat disyorkan untuk digunakan dalam bangunan. Ia adalah peranti yang sistematik dan efisien untuk memantau aras air dan dapat memberikan amaran awal kepada pasukan penyelenggaraan.

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LIST OF ABBREVIATION

BIM	Building Information Modeling
CII	Construction Industry Institute
SDG	Sustainable Development Goals
IoT	Internet of Things
IR 4.0	Industrial Revolution 4.0
MDG	Millennium Development Goals
LCA	Life-Cycle Analysis
LCD	Liquid-Crystal Display
LED	Light-Emitting Diode
SPSS	Statistical Package For The Social Sciences
SMCD	Sunway Medical Centre Damansara
SunCon	Sunway Construction
TAM	Technology Acceptance Model

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Water is crucial to sustainable development since it is necessary for both economic and social progress, as well as for the production of useful energy, ecological security, and human survival. Water is a human right as well. To ensure that communities have access to enough water, it is necessary to strike a balance between all commercial water resource requirements as the world's population rises. Currently, conventional water tanks are unable to monitor or regulate the water level within the tank, which results in significant water waste. As a result of the local water supply being cut off from the government in new and underdeveloped locations, some families frequently struggle to check the amount of water in their water tanks.

In less developed areas, when the water in the tank runs out, the residents face the challenge of finding someone to refill it. This study article aims to address this issue effectively and affordably, recognizing the crucial role water plays in sustainable development and human existence. Not only is water necessary for economic and social progress, but it also enables the production of useful energy and ensures ecological safety. As the human population continues to grow, the demand for water resources becomes increasingly significant, leading to potential water shortages, especially in newly constructed locations where the water supply may not be readily available. Given water's value and scarcity in the modern world, it is indispensable for agriculture, industrial sectors, and the survival of both humans and other living beings.The Internet of Things is one of the cutting-edge technologies in use today

(IoT). A key feature of this technology is the ability of millions of devices to connect with one another while simultaneously sensing and sharing information. These devices are either linked together via a private or public internet protocol (Kulkarni, 2016).

The internet of things is one of the developments in internet technology. IoT devices gather information, keep track of it, analyse it, and alert the user. This technology is quickly elevating human life to a new level. The use of numerous devices and the breakthroughs in technology are transforming daily life from the mundane to the intelligent. Smart homes, smart cities, and improved healthcare systems are a few instances of developing technology benefits. Another illustration of the Internet of Things is a water monitoring system. Water levels can be tracked using IOT technology, and sensors can be used to gather data on the water level. The users can receive sensor readings (Jeughale, 2018).

The use of automation systems in industry is very important in increasing productive quality production and reducing costs. Existing water level detection systems used in industry today, there are various types including floating switches, radar, ultrasonic, pedal switches and so on. The water level detection device in the tank that will be developed, the budget released is also highly emphasized because the equipment that will be used will be the measuring stick for the success of this project. In this project a water level detector has also been created as an innovation in the field of instrumentation and measurement.

1.2 RESEARCH BACKGROUND

A growing population's increased need for water, water waste, and river pollution are some of the difficulties Air Selangor faces in Malaysia despite the country's vast water resources and plentiful tropical rains. Protecting our raw water sources and proactively conserving our clean water supply has over time become a common obligation - from water operators to consumers alike, and from legislators to the industry participants at large (Air Selangor Report, 2020)

Here, Air Selangor's role is crucial. We take on the role of an example, working in Selangor, Kuala Lumpur, and Putrajaya "Towards Sustainable Water Management" as the largest water operator in the nation. By doing this, we are resolutely moving in the direction of improved social, economic, and environmental performance. For the benefit of our customers, our goal is to work together to find solutions that will help develop resilient and responsible water management policies, infrastructure, strategies, and action.

1.3 PROBLEM STATEMENT

In Malaysia, More than 5,000 m3 of renewable water are consumed annually per person, according to estimates. Therefore, more than 95% of the population has access to water supply, which is available 24 hours a day. Malaysians have access to a sizable amount of water, despite the fact that it can rarely be refreshed per capita at a rate of less than 1,000 m3 annually. However, there are numerous areas of the country where there are water shortages and emergencies. There is always enough water to suit human requirements, despite shortages and tragedies. This issue will result in ongoing water resource management, which harms both people and the environment (WWF-Malaysia, n.d). If the undetected water leak problems are not handled or rectified, they cause property damage, defective equipment, and expensive clean-up charges (Che N, 2021). The leakage itself can be major problem about the waste water.

Additionally, some water levels are detected using a pressure transmitter (Y.Cao, 2016). When a component needs to be replaced right away because it is broken, this results in significant costs. Additionally, some of the controllers employ PID controllers that are more sophisticated than those found in the Arduino (O.Ra, 2019).

Furthermore, the response time for the users to take action and notify the problem in water tank is taking so long. Since the proposal is more focusing at hospital buildings there are many procedure need to be followed before the authorities to take action in repairing the problem that water tank faces.

1.4 OBJECTIVE OF STUDY

Based on the research objectives that have been agreed upon, there are several objectives that we have gathered while make the water level detector in the storage tank.

The objectives of this study are:

1. To design a water monitoring system for early warning of low water level and any leakage.
2. To develop water tank level detector device using Arduino UNO
3. To evaluate effectiveness of water tank level detector device using Arduino UNO

1.5 SCOPE OF STUDY

The scope of this study focuses at hospital buildings that require monitoring of the water level in the storage tank and also where leaks or pipe damage occur without the user noticing. The scope of the study or the limits of the project implementation should be made as a reference to ensure that each project implementation does not deviate from the objective to be achieved.

The scope of this project limit at Sunway Medical Centre Damansara (SMCD) project. This project has an area 81,513 ㎡ . For the project description is to Proposed commercial development Plot 1 which consist of 13 storey private hospital that have 250 hospital bed, 4 storey carpark and 2 storey basement carpark at Lot 65726 (PT 372), Lot 65727 (PT 373), Lot 65728 (PT 374), Lot 65729 (PT 375) and Lot 65730 (PT 376), Jalan PJU 5/1, Kota Damansara, Pekan Baru Sungai Buloh, Daerah Petaling, Selangor Darul Ehsan.

This product is validated using the established procedure, which is the questionnaire method. Any research endeavour should use a questionnaire, which is a common method for acquiring data (Boparai, 2018). Experienced researchers and survey methodologists have therefore concluded that questionnaire pretesting is crucial. When it comes to best practises for survey questionnaire design, there are a few key elements.

To accomplish this research, questionnaire is being used once the constructed system is ready to be assessed and tested in order to provide an assessment of its effectiveness. The place where the data is being collected, the respondents, and the data collecting method will all be discussed as data collection components.

40 respondents has been assigned to answer the questionnaire. Respondents included project managers, site managers, site engineers, site supervisors, coordinators for architecture, contractors, and inspector of works among other jobs and departments.

Figure 1.1 : Sunway Medical Centre Damansara (Source: Sunway Construction, 2022)

1.6 SIGNIFICANT OF THE STUDY

This study was conducted to detect the water level in the storage tank in a hospital building. With this method, it can avoid wasting water if there is a leak or damage to the pipe. The methods and innovations that have been designed by myself can also be incorporated into this study. Therefore, the study to design a device to detect the water level in the tank is a new study for us to reduce the effects of water wastage that is becoming more prevalent. The nature of this tool is environmentally friendly, and it can immediately facilitate the user and the authorities in the repair work when the pipe or tank is damaged. With the presence of this water level detector, it can convey information to users about the condition of the storage tank.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

As a summary of all the relevant research studies, journal articles, books, websites, and other sources that have been cited in this work, a literature review for this study was created. This assessment of the literature looks at published works in a particular topic area and data that was released during a particular time frame. The purpose of this literature review is to present information in the form of a written report and to gain a better grasp of the current research and discussions on a certain subject or area of study. The issue and gaps in the existing research will also be highlighted based on this literature evaluation, and the study piece will then use new research to fill in the gaps.

2.2 WATER MANAGEMENT

Every year, more than one-third of the world's population experiences water shortages. Even Rome, a historical leader in the provision of urban water, had many of its free drinking fountains turned off in 2017. In his scholarly but approachable study The Water Paradox, environmental economist Edward Barbier delves deeply into these and other tales from the fascinating, frequently contentious realm of water management past and present. Barbier also looks into the dangers facing water resources. The irony is that despite abundant scientific proof of the overuse and

exploitation of fresh water, as well as abundant resources, institutional power, and institutional knowledge, humanity has brought about an avoidable water crisis. Despite the fact that we are aware of how scarce fresh water is, we continue to abuse it. The worldwide groundwater problem will affect 2 billion people by 2040 (more water is being extracted from aquifers than is being replenished); Indonesia, Iran, and South Africa will be among the nations experiencing severe or extreme water stress.

Environmental and agricultural pressure will exacerbate social and economic difficulties. It won't be due to a lack of historical warnings if a significant portion of our world collapses because we are unable to bring about change. Environmental mismanagement has caused societies, city states, and regions to crumble into dust or dry leaves. It could occur once again.

In order to comprehend how, Barbier explores centuries of abuse. Citing the "hydraulic hypothesis" of early 20th-century historian Karl Wittfogel (P.Ball Nature, 2018), he examines irrigation and agricultural methods in the ancient Middle East, China, Europe, and beyond. This theory postulated that early agriculture-based empires like Sumer in Mesopotamia rose through control of water, but had a tendency to waste it, leaving them open to outside invasion and environmental damage. Barbier makes the point that securing "free" water was crucial to these large frontier expansions and economic gains. That habit continues. Public goods like lakes, streams, and aquifers are typically undervalued in markets.

2.3 CONSTRUCTION TECHNOLOGY

Construction technology is employed on a variety of projects, from modest residential homes to enormous industrial facilities. Some of the most recent advancements in construction technology include the greater use of prefabricated components, the use of computers to design buildings, and the application of green technology to create environmentally friendly constructions (Agenbag, 2021). The expansion of the sector is associated with a number of occupations, from fundamental planning to actual construction. Construction managers, project managers, building inspectors, cost estimators, architects, civil engineers, and skilled labourers like plumbers, bricklayers, and carpenters are some of the professions most frequently connected with contech. However, many of these positions have educational prerequisites. Trade schools and many universities throughout the world offer degree programmes in construction technology disciplines like construction management, engineering, and architecture. Construction technology courses like these can be studied in trade schools.

All socioeconomic classes can find structures in the building business that suit their needs. A few examples of the contemporary pinnacles of construction technology include heavy or civil construction, industrial construction, residential construction, commercial construction, and residential construction. Each one needs a unique set of technological solutions. Simple technological methods and readily accessible materials are typically used in house construction. These are typically quick, inexpensive projects. The most urgent issue in commercial building is infrastructure, which determines the project's durability and longevity. They are frequently started by government organisations. For these tasks, cutting-edge building techniques, tools, and supplies are needed.

Since everyone wants to live in a good home, one of the branches of civil engineering that directly affects the general public is construction. Buildings have been constructed since antiquity, but there has been a technological advancement since the earliest structures, which were simple and only meant to serve as shelter, were built. Thanks to technology, which is the actual application of your knowledge, significant advances in construction have also occurred over time. Buildings were

originally constructed from stones and mud, but today we use a wide range of materials, including stone, wood, concrete, metals, glass, and so on.

According to the Construction Industry Institute (CII), construction technology is "a combination of unique tools, machines, modifications, software, and other technologies used throughout the construction phase of a project to enhance field construction procedures, including semi-automated and automated construction equipment." Along with the fields of medicine, manufacturing, transportation, agriculture, and energy, it is a crucial area for technological advancement. As it's commonly referred to, "contech" stands for construction technology. However, it still makes use of heavy machinery and power tools that have been around since the 1950s.

The development of the construction sector over time. The importance of planning structures before they are created is one of them. Technology improvements have led to the creation of proper procedures for the construction of sturdy and long-lasting structures. IT development has emerged as the primary source for the newest design methodologies in building technology. One of these digital systems that makes it possible to regularly collect data on ongoing construction projects is Building Information Modeling (BIM). The engineers and designers on the project will communicate much more effectively using this approach.

By enabling defects to be identified and fixed before to actual building construction, computer assisted design helps in the creation of flawless structures. The building sector has made a number of improvements as a result of technological innovation. There are significant differences between modern and traditional construction techniques. Modern technology has been adopted by the civil engineering field. The majority of building elements, including pillars, roofing, and concrete blocks, are available in prefabricated shapes, which considerably expedites the building process. Pre-stressed concrete tendons and beams enable structures to be strengthened while being constructed more quickly.

2.4 SUSTAINABLE CONSTRUCTION

Over time, the necessity for sustainability has gained acceptance on a global scale. The Sustainable Development Goals (SDG) have recently replaced the Millennium Development Goals (MDG) of the United Nations, suggesting a continuing need for such programmes. Natural resource depletion is a growing issue, and both national and international governments are being pushed to find sustainable solutions. This implies that savvy buyers and owners of construction projects will continue to look for cutting-edge yet sustainable projects that, among other things, save energy, save money, improve the environment, and are socially safe.

Aigbavboa (2017) define sustainable development as a type of initiative that meets present needs without endangering the abilities of future generations. Being able to supply houses, schools, water and energy systems, industry, communications, commercial or recreational facilities, as well as jobs and money, makes construction one of the most significant activities in the world (Aigbavboa, 2017). Rashid and Yusoff (2015) assert that energy is used directly during building construction. It was also stated that recent studies have revealed that buildings are responsible for 30–40% of the world's energy use and 40–50% of its greenhouse gas emissions.

Although the construction industry is vital for social and economic development, the process's consequences on the environment are as important. The practise of sustainability is a crucial issue for our future, and professionals, especially architects and engineers involved in the design process, have a big influence on it. When it comes to lessening the impact of the built environment on natural resources, the same is true for facility managers. Increasing environmental awareness and regulatory requirements have made facility management as a profession need to play an active role in the environment. Participating in sustainable and green building techniques is primarily driven by a desire to reduce energy usage and, consequently, the reliance on fossil fuels to provide that energy.

However, it was noted that there is a dearth of study on incorporating sustainability into facility management in less developed nations. In order to support their incorporation in the design process of building activities, this research's objective is to examine the benefits of facility management principles in achieving sustainable

construction goals and practises in the South African construction sector. Technology and sustainable construction are related. This is so that technology can be used to maintain sustainability in construction. Using software, for instance, can make their task simpler.

2.5 SUSTAINABLE TECHNOLOGY

What should we do in light of these challenges for innovators? The well-known and still widely used LCA (life-cycle analysis) method won't be enough, in our opinion. The approach tries to monitor and quantify the multiple environmental effects of a technology. Even if there are still difficulties in estimating direct environmental effects today1, LCA is unable to address all facets of sustainable development because there is no set list. Uncertainty surrounds the contribution of a technology designer who focuses on these technologies to sustainable growth. The general consensus is that using less resources to deliver the same functionality is preferable. The potential for such optimised designs is frequently rather constrained. The "rebound effect" (Jevons 1865), a phenomenon that worsens the situation, is a phenomenon where increased resource efficiency may act as a stimulant for consumption. Similar to how dangerous or destructive activities may be moved to nations with looser regulations when wealthy nations forbid them. When developing nations try to outlaw dangerous work, jobs could disappear or the task could be done illegally with less safety. Technically speaking, solving problems that require more complex solutions than system upgrades is common. These choices affect the entire machine, or possibly the entire system in which it functions, rather than just a single element of it.

Compared to current systems, these system enhancements usually offer a significantly greater potential to support sustainable growth.

Engineers may appreciate working on these challenging breakthrough technologies. But enjoyment by itself is insufficient to support dangerous technical research. Such initiatives require the assistance of governments and business executives, and it is essential that they include the urgency of sustainable development into their

innovation agendas. Therefore, how can the viability of technology be assessed? By citing a single concept of sustainability, one cannot declare a design to be sustainable.

There is much to learn for the engineering student who claims that their design is environmentally friendly because it will be made entirely of steel 37, a material that is completely recyclable. The truth is more complicated than that. Learning about the numerous challenges to sustainable development that affect the production, use, recycling, and end-of-life disposal of designs is the first step.

2.6 INDUSTRIAL REVOLUTION (IR 4.0)

The industry has completely overridden three prior revaluations, each of which had an impact on its operations and productivity. The third key transformation began earlier with the significant computerization, with steam power serving as the transformative energy during the nineteenth century and electricity becoming more prevalent in the twentieth. With intelligence as its foundation, the industry will achieve IR 4.0 in the twenty-first century. A confluence of abilities that is obfuscating the distinctions between the physical, digital, and biological scopes is how IR 4.0 is defined. In 2011, the fundamental ideas of IR 4.0 were published for the first time. It will transform the industry more quickly than any of its three predecessors and as completely and irrevocably. Even if IR 4.0 universal has received a lot of attention, no official description of it exists. However, it can also be described as "a new level of value chain organisation and management across the lifecycle of products," or "the integration of complex physical machinery and devices with networked sensors and software, used to predict, control, and plan for better business and societal outcomes."The CPS (connection between the physical and cybernetic realm), the IoT, the IoS, and the intelligent units are the four fundamental components of IR 4.0. M2M communications and intelligent items aren't considered to be autonomous parts, though. Intelligent products are a component of the CPS, while M2M is a component of the Internet of Things. The productivity gained through the application of intelligent technologies can help to create jobs and raise customer demand with additional income (compensation influence), but it can also result in the abolition of some existing positions (redundancy influence). There are worries that, in the long

term, the redundancy effect from IR 4.0 may dominate and cause "technology unemployment."

2.7 INTERNET OF THINGS (IoT)

The idea of linking any gadget (with an on/off switch) to the Internet and other linked devices is the Internet of Things, to put it simply. The Internet of Things (IoT) is a huge network of networked people and things that gather and share information about their usage and environment. This encompasses a wide variety of items of all sizes and shapes, such as intelligent microwaves that cook your food for the proper amount of time, self-driving cars with sophisticated sensors that identify objects in their path, and wearable fitness devices that monitor your heart rate and the number of steps you take each day and then use that information to recommend exercise regimens that are specific to you.

Even connected footballs can track how far and quickly they are thrown and store the information in an app for use in the future. The Internet of Things has recently become recognised as one of the most significant 21st-century technologies. Since embedded objects, such as cars, thermostats, baby monitors, and household appliances, can now connect to the internet, continuous communication between people, processes, and things is now conceivable. With the use of low-cost computers, the cloud, big data, analytics, and mobile technologies, physical objects can exchange and gather data with little assistance from people. Digital computers can record, watch, and modify every interaction between interconnected components in this highly connected environment. The physical and digital worlds collide and work together.

Although the idea of the Internet of Things has been around for a while, recent developments in a number of different technologies, including access to economical cost, connectivity, cloud computing platforms, machine learning and conversational artificial intelligence

For access to economical cost, sensor technology with minimal power. More manufacturers may now use IoT technology thanks to reasonably priced and trustworthy sensors.

Next is Connectivity, it is now simple to link sensors to the cloud and other "things" for effective data transfer thanks to a variety of network protocols for the internet.

From cloud computing platforms businesses and consumers may now get the infrastructure they need to scale up without having to manage it all thanks to the expansion of cloud platforms.

Businesses may acquire insights more quickly and easily thanks to improvements in machine learning and analytics, as well as access to diverse and enormous volumes of data that are kept in the cloud. The development of these complementary technologies pushes the limits of IoT, and the data generated by IoT feeds these complementary technologies.

There are conversational artificial intelligence (AI). Natural language processing (NLP) is now available on Internet of Things (IoT) devices, including digital personal assistants like Alexa, Cortana, and Siri. This has made IoT devices more appealing, practical, and inexpensive for usage at home.

An Internet of Things platform connects products and objects with built-in sensors. This platform gathers data from many sources and uses analytics to share the most important data with apps designed for certain purposes. These advanced IoT systems are capable of determining which data is essential and which may be safely ignored. This data can be used to identify trends, formulate suggestions, and identify potential issues before they arise. The data collected by linked devices allows me to make informed judgements about which components to stock up on based on real-time data, saving me time and money. Information from advanced analytics can be used to improve operations' efficiency. Using intelligent devices and systems, some occupations, particularly those that are repetitive, tiresome, time-consuming, or even dangerous, can be automated. Things (IoT) technology in industrial settings, notably in the instrumentation and management of cloud-based sensors and devices, is known as Industrial IoT.

2.8 ARDUINO

Arduino is a platform for creating electronic and software-based interactive projects. Arduino is preferred because it is user-friendly and open source.

In their own projects, people and organisations can design and construct their own Arduino. According to Hochenbaum (2013), Arduino projects are simple to use, faster, more stable, and less expensive in terms of cost. Advanced technologies may also be simply implemented into the board.

Users can utilise the open source Arduino software for nothing at all. Arduino libraries, which enable anyone to programme without being familiar with the microcontroller, are the key factor in choosing Arduino. By looking at the library section of the written programme, you may observe how the programme is written. Additionally, the programming codes in the Library part provide us the chance to edit them in the way we want to (Oxer, 2011).

Systems that can readily interact with the environment can be created with Arduino. Systems and robots that interact with the environment can be created by processing the signals from the sensors. The open source development platform of Arduino is its most significant feature since it allows us to create and utilise any kind of software we like. Since the codes are not concealed in the works, people may quickly access these works, and Arduino libraries make it simple to programme microcontrollers. Due to its analogue and digital inputs, this data can be processed with the help of observations to perform a wide range of tasks.

When we enter the parking lot of a shopping mall to park our car, it can assist us by delivering a light warning and feeding the fish we feed in the aquarium automatically at the set time intervals. Likewise, we can turn the light on and off. In summary, with Arduino UNO and the power of ideas throughout our life, we can design any system we wish. Numerous further things are possible with Arduino. It is possible to realise Bluetooth scales, line-following robots, intelligent home systems, agricultural technology, etc. Originally intended to interact with the outside world, reactions can be produced in terms of temperature, sound, motion, and light.

Additionally, Arduino offers a variety of modules and cards created to address specific purposes.

2.8.1 Arduino Card Types

There are more Arduino cards are appearing. In general, Arduino cards have twenty type of it. One of it is Arduino UNO

Arduino Uno is the one that is most frequently utilised. A microcontroller-based card called ATMega328 will be examined using an Arduino Uno. It contains 6 analogue inputs, a 16Mhz crystal, 6 digital input/output pins (6 of which can be used as PWM output pins), a USB port, a power socket, an ICSP connector, and a reset button (Website Arduino, 2016).

It has every component needed for the card's microcontroller to function. It is simple to connect to the computer using a USB cable. It can be powered by a battery or an adaptor.

The most fundamental features are available on the Arduino Uno device used in this example. Additionally, the price is more practical. As a result, this card serves as a tutorial model. Both project developers and programmers just starting out prefer both Arduino Uno variants in this regard.

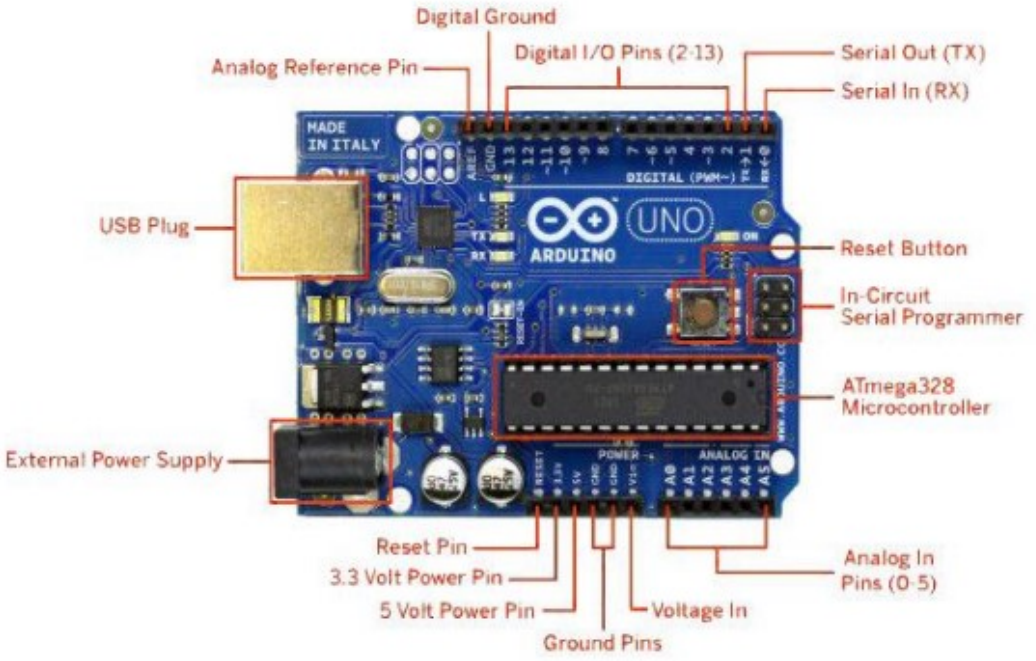


Figure 2.1 : Arduino UNO (Source : Arduino Website,2022)

The Arduino Uno card's material layout is shown in the table below. The positioning and connections between the materials are clearly shown in the following diagram. If there is a problem with our card, using this diagram will enable me to fix it by paying attention to the connections.

2.9 RELATED PROJECTS

2.9.1 A Design of a Water Tanks Monitoring System Based on Mobile Devices

The delay in finding water leaks in pipes was the issue. The solution was to create a system that promptly detects water leaks after they occur. For monitoring water tanks, a system named Interface was created (IRMA). In the water tank, an ultrasonic sensor was employed. It had an Arduino device attached to it. Then, it was linked to a created application service. A GSM network was utilised so that users could access the programme from any location and adjust the water levels. The

software was run on a server machine. Through the GSM network, SMS conversations were used to monitor and control water levels.

2.9.2 IOT Based Greenhouse Environment Monitoring and Controlling System using Arduino Platform

Focuses on keeping track of and managing the environmental conditions in greenhouses. Parameters include things like pH, humidity, and temperature. A system built on Arduino is intended to handle greenhouse environmental conditions. This project's goal is to keep an eye on and control the variables for the best possible plant growth. The primary sensors for this project are the DHT11 sensor, soil moisture sensor, LDR sensor, and pH sensor, which provide data on temperature, humidity, water content, light intensity, and soil pH, respectively. SMS communication takes place over a GSM modem. Actuators used include motor pumps, exhaust fans, water pumps, and artificial light sources. Using a cooling fan to lower the temperature. Use of an exhaust fan to lower humidity. When the pH of the soil surpasses a predetermined level, a motor pump is utilised to spray alkaline and acidic solutions. When needed, artificial light is employed to improve the brightness. When the soil moisture sensor does not detect enough moisture, a water pump is employed.

2.9.3 Water Monitoring System Using Arduino with LabVIEW

Maintains water quality by monitoring and managing water parameter qualities from a distance, such as pH level, temperature, and turbidity. uses a system based on Arduino. Sensors for temperature, pH, and turbidity are used. The Arduino board is connected to all sensors. It uses an Arduino Uno. It comes with an ADC (analog to digital converter). The Arduino is utilised as an interface between LabVIEW software and a display device for the parameters. advantageous for industrial application as well as agricultural.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

The methodology stage will provide a quick overview of the methods used so far and those that will be used in this investigation. This chapter will discuss every step of the study process, including the population, population frame, and sampling strategies utilised for the interviews. The chapter concludes with a detailed discussion of the form of analysis that was chosen and the procedure employed to acquire the data.

Primary and secondary data, both of which will be used in this paper. Where, Primary data is a type of information that is gathered by researchers directly from primary sources using methods including tests, questionnaires, and interviews. The best type of data for study is considered to be primary data, which is typically gathered from the original source. Qualitative data, on the other hand, describes attributes or characteristics. It is gathered by observation, interviews, or questionnaires and frequently takes the shape of stories. The information could take the form of descriptive words that can be coded or otherwise analyzed for patterns or significance.

A set of qualitative data will be used as primary data. The researcher's discussions with the architect, engineer, and consultants involved in the Sunway Medical Center Damansara (SMCD) project will be used to extract the data.

The authors will also obtain secondary data from the earlier study. The results of earlier investigations can also be drawn from research, theses, journals, and newspapers. Additionally, the effectiveness of the finished product will be determined

using the secondary data. The distribution of a questionnaire to engineers, architects, consultants, and developers (Sunway Integrated Properties) can yield quantifiable data.

3.2 RESEARCH DESIGN

This approach is crucial for being ready for any form of observation. To identify potential issues, it is vital to monitor the phases leading up to implementation. It is vital to modify the procedure if a significant obstacle stands in the way of finishing the task. Finally, in order to keep the flow steady, control techniques must be used.

Design thinking serves as the study's framework. The flow of the study that was taken into consideration for this project is given in Figure 3.1, which is a research development flowchart.

In this analysis, the process is divided into various phases, each of which will be covered in depth. Other methods are also employed for questioning, reading study reports from the literature review, completing questionnaires, and previewing the progress made during this project. There are 3 stages of methodology that will be used over the course of this project's completion:

Phase 1 – Problem discovery and literature reviews

Planning the design and analysis of the project that will be constructed is the most important part of this phase. This phase emphasizes meeting with the mentor and supervisor as well as obtaining data for the project's development. This process takes at least two weeks to complete.

Phase 2 – Product Development & data collection

The evaluation and comparison of older and more recent market applications is the main goal of this phase. The analysis makes use of questionnaires, interviews, and fact-finding methods. The information received will be used to build the model and prototype before moving on to the next steps.

a. **Primary Source**

In order to acquire challenging facts, the questionnaire was employed to conduct the interview and observation. In order to obtain assurance and comprehensive information on the elements being evaluated based on survey results, this interview method is required. This information was acquired through direct contact with persons involved in construction projects that employed contractors and professionals.

b. **Secondary Source**

secondary information collected from other sources. The significance of this research is highlighted by the information. These details are also necessary in order to gather more data for this project. Extra details that were included in the project's content. This study's sources included journals, the Internet, and the company's data gathering activities.

Phase 3 – (Testing of data, analysis, and interpretation of data), and recommendation and conclusion

A number of steps will be taken after the device is finished to make sure the system is tested and that there are no defects or problems with how the device is being used. The process of this development study starts at the beginning and ends at the end. To create the system's flowchart in order to make sure the project goes as planned and without a hitch.

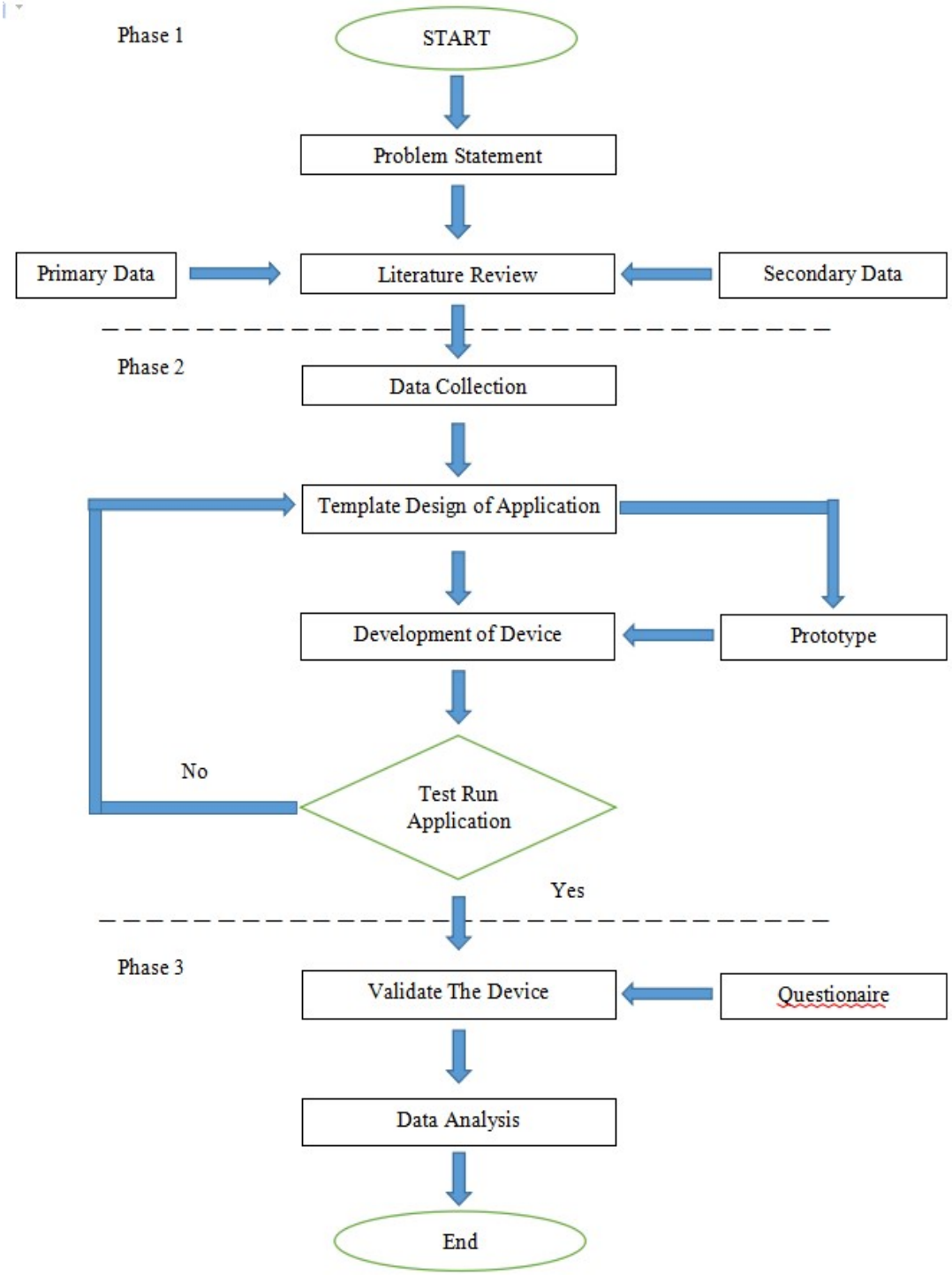


Figure 3.1: Research Flowchart

3.3 DEVELOPMENT OF THE RESEARCH

Planning and observation heavily rely on the research design. The implementation process should be watched carefully to spot any potential issues. When a serious issue is a primary reason for job implementation failure, changes must be implemented. It is necessary to apply control measures to keep the flow consistent. Figure 3.2 show a design flowchart for this study.

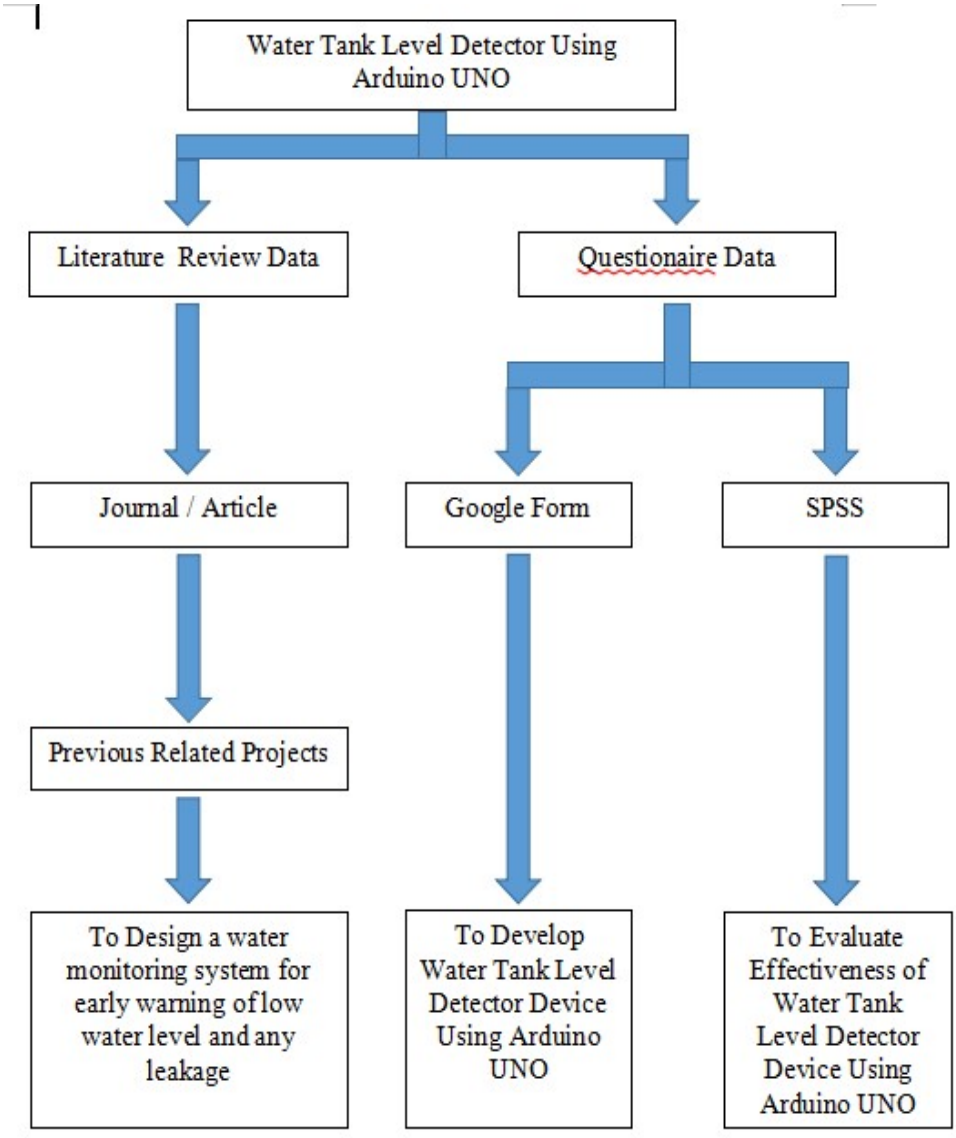


Figure 3.2: Design Flowchart

3.4 PROTOTYPE PROCESS

Design teams experiment by turning their ideas into physical prototypes, which might range from paper to digital. For the purpose of capturing design concepts and user testing, teams create prototypes with varied levels of realism. You may improve and evaluate your designs using prototypes, allowing your company to release the proper products.

A prototype is an experimental model of a suggested solution that may be used to quickly and accurately test or assess concepts, design assumptions, and other aspects of its ideation so that contributing developers can make the necessary adjustments or change of course. The only thing all concepts have in common with prototypes, which might have many distinct forms, is that they all have observable forms. (Maxwell, 2020)

A prototype is a model, sample, or version of a product made before to production in order to test a concept or process. It's a cliche that's employed in a variety of industries, including software development, electronics, design, and semantics. A prototype is generally used by system analysts and users to evaluate a novel design to improve precision. Prototyping, as opposed to a theoretical system, provides specifications for a real, working system.

In this section, explain how the device systems works and functions of each components. This device is based on IoT with several supporting parts, including Arduino UNO, ultrasonic sensors, motor pumps and wi-fi. All these components have their respective functions and cooperate to produce device that can monitor the level of water in the tank. The device system itself will send a notification to the maintenance department and the authorities if there unusual matter happen.

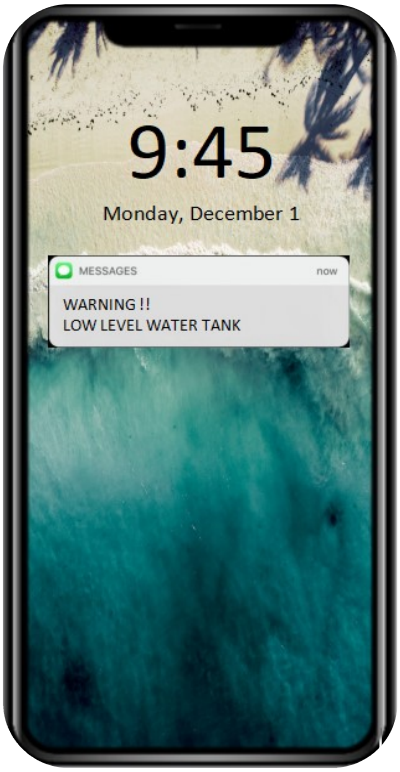


Figure 3.3 : Prototype of warning Low Water Level

3.4.1 Prototype Device Development

i. Installing the Arduino on the board

Connect the jumper wire on the Arduino UNO to be connected to the board used and it works to flow electricity to certain parts.

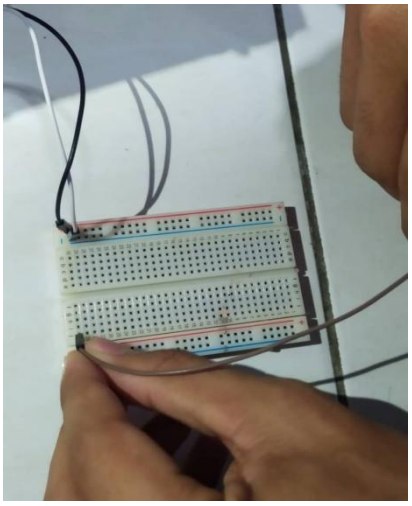


Figure 3.4 : Connecting Wires to Arduino and Circuit Boards

Figure 3.5 : The Wires already Attach from Arduino to Circuit Boards

ii. Connecting LED and LCD

The LCD is connected to the Arduino and the board that works to convey information. Meanwhile, the LED is connected to the board only to give a signal through light.

Figure 3.6 : The wire is connected to the LCD

iii. Install the water pump motor and ultrasonic sensor

Next install the water pump motor on the relay because it works to stop and run the flow of the pump. After installing the motor, the tool is set on the level or meter on the ultrasonic sensor.

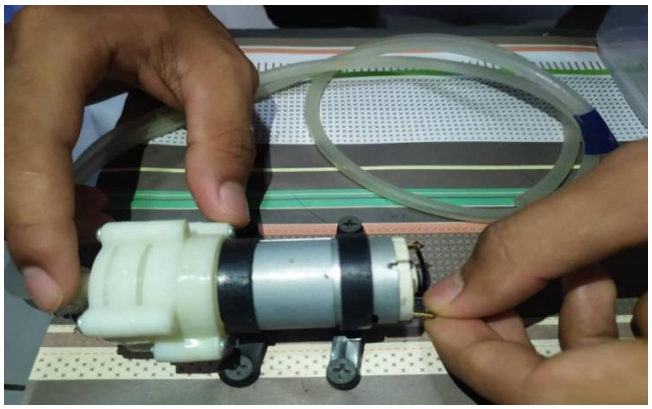


Figure 3.7 : Wire is connected to the water pump motor

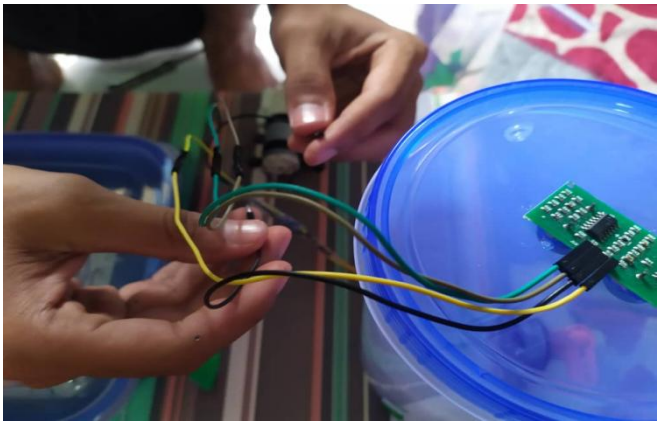


Figure 3.8 : Make a connection to the ultrasonic sensor

iv. Tool programming

For this project, Arduino IDE will be used as a "compiler" to program on this tool. The relevant "programming library" is required to be installed in the Arduino IDE software.

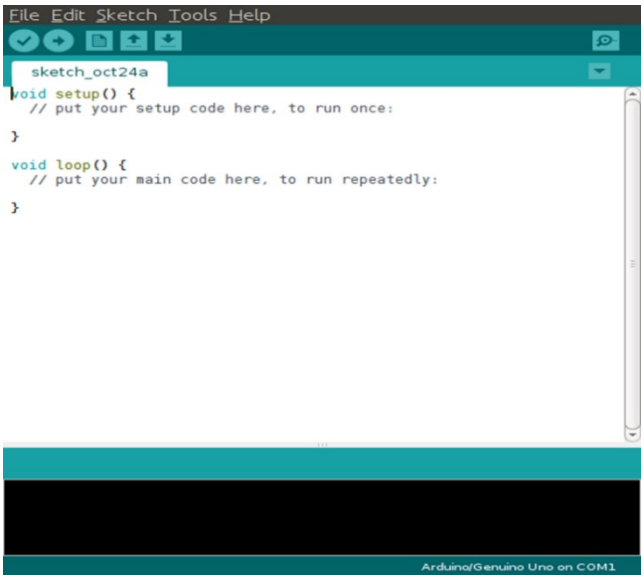


Figure 3.9 : Doing Arduino programming

3.5 DATA COLLECTION

3.5.1 Data collection method

Data gathering will be done by creating a questionnaire to be used once the constructed system is ready to be assessed and tested in order to provide an assessment of its effectiveness. The place where the data will be collected, the respondents, and the data collecting method will all be discussed as data collection components.

3.5.2 Location

The SMCD, Damansara construction site will serve as the study's location since research found the organizations chosen are the best and are familiar with the circumstances and issues present there. A response is a relative who works in the structural, architectural, mechanical, and maintenance departments and is in charge during building.

3.5.3 Respondents

Who is participating in the structure and architecture work for the Sunway Medical Centre Damansara (SMCD) project is required to answer the survey questions in order to evaluate the efficacy of the product. 40 respondents are given the survey to complete in order to react to the questions. Respondents included project managers, site managers, site engineers, site supervisors, coordinators for architecture, contractors, and inspector of works among other jobs and departments.

3.5.4 Questionnaire

A questionnaire was employed by the researchers to collect the study's data. With the use of this technique, data could be gathered through open-ended or face-to-face interviews. When researchers are aware of what the study needs, the questionnaire is a useful tool for gathering data. People can use questionnaires to obtain the information they need in a straightforward and concise manner.

Table 3.1 : Distribution of Questionnaire

Assessment Aspect	Issue of Question
Demography	4
Perceived ease of use	2
Perceived usefulness	3
Attitude Towards Using Technology	3
Behavioural Intention to Use	3

Both objective style questions and a five-level scale based on the Likert scale were included in the questionnaire to evaluate respondents' responses.

Table 3.2 : Likert scale

Scale	Description
1	Strongly Disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly Agree

3.6 DATA ANALYSIS

Designing and generating data for the purpose of finding relevant information, putting forth hypotheses, and assisting in decision-making is known as data analysis. The goal of this process is to convert the gathered data into reliable evidence on how the intervention was developed and how well it worked.

Microsoft Excel and the Statistical Package for the Social Sciences (SPSS) software will be used to calculate the data when it has been collected. Tables and pie charts with percentages of respondents will be used to depict the data. The water tank level detector using Arduino UNO will compare with water tank level detector using existing method. Due to the variations, it is possible to upgrade and make certain improvements to create a new product using IR 4.0 technology.

CHAPTER 4
DATA ANALYSIS

4.1 INTRODUCTION

In this chapter, the expected outcome of the project should be summarized for the researcher. As part of the pre-project planning duties, researchers carefully assessed what data will be created throughout the project's execution. 40 respondents were given a questionnaire utilizing the quantitative approach. The feedback from the respondents was process using SPSS and the results was analysis using a paired t-test to find 2 dependent means. In order to find two dependent means, a paired t-test was used to process the feedback from the respondents using Excel. The Implementation of Arduino UNO In Water Level Detector Device For Hospital Buildings is expected capable of achieving the following objectives.

1. To design a water monitoring system for early warning of low water level and any leakage.
2. To develop water tank level detector device using Arduino UNO.
3. To evaluate effectiveness of water tank level detector device using Arduino UNO

4.2 DESIGN WATER TANK LEVEL DETECTOR DEVICE USING ARDUINO UNO FOR HOSPITAL BUILDINGS

The design of a water tank level detector device using Arduino UNO is an innovative solution to monitor and control the water levels in a tank. This device utilizes the popular Arduino UNO microcontroller board along with other electronic components to accurately measure the water level and provide real-time information to the user.

The system consists of an Arduino UNO, an ultrasonic sensor, and a liquid crystal display (LCD) module. The ultrasonic sensor is responsible for detecting the water level by emitting ultrasonic waves and measuring the time taken for the waves to bounce back after hitting the water surface. The Arduino UNO then calculates the distance based on the time of flight and converts it into a water level reading.

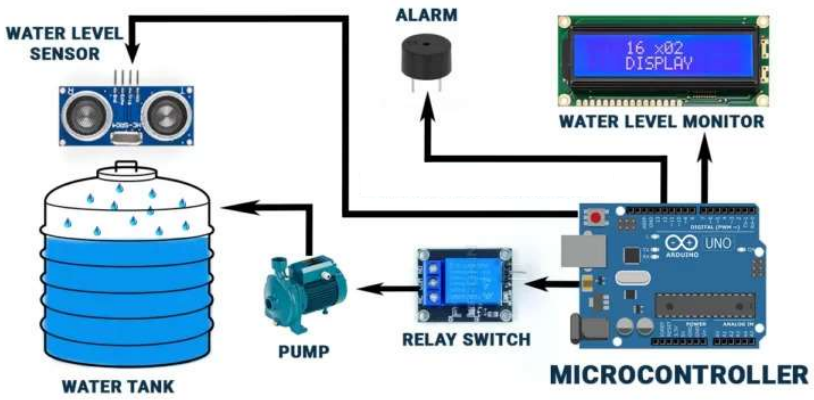


Figure 4.1: Design Of Water Tank Level detector Device

To display the water level information, the Arduino UNO is connected to an LCD module. The LCD module provides a user-friendly interface that shows the current water level in a clear and readable format. The Arduino code is programmed to update the LCD display with real-time readings, ensuring that the user can easily monitor the water levels.

4.3 DEVELOP WATER TANK LEVEL DETECTOR DEVICE USING ARDUINO UNO FOR HOSPITAL BUILDINGS

The development of a water tank level detector device using Arduino UNO, coupled with the SIM900A GSM module, offers an advanced solution to monitor water levels and provide early warning notifications. This device combines the capabilities of Arduino UNO, an ultrasonic sensor, and the SIM900A module to accurately measure water levels and send messages for timely alerts.

The system comprises an Arduino UNO microcontroller board, an ultrasonic sensor, the SIM900A GSM module, and a power supply. The ultrasonic sensor is employed to detect the water level by emitting ultrasonic waves and measuring the time it takes for the waves to bounce back after hitting the water surface. The Arduino UNO processes this information and converts it into a water level reading.

To enable early warning notifications, the SIM900A GSM module is integrated into the system. This module allows the Arduino UNO to send SMS messages to designated recipients when predefined water level thresholds are reached. The Arduino code is programmed to continuously monitor the water level and trigger the SIM900A module to send messages when necessary, ensuring that timely alerts are delivered.

The power supply provides the necessary electrical power for the Arduino UNO, ultrasonic sensor, and SIM900A module to operate reliably. It is essential to consider a stable power source to ensure uninterrupted functioning of the device.

By combining the Arduino UNO with the SIM900A GSM module, this water tank level detector device offers a robust and efficient solution for monitoring water levels and providing early warning notifications. The integration of the SIM900A module enables the device to send SMS messages, ensuring that users are promptly alerted in case of critical water level conditions. Table 4.1 show the development of Water Tank Level Detector Device Using Arduino UNO For Hospital Buildings.

Table 4.1: Development of The Implementation of Arduino UNO In Water Level Detector Device

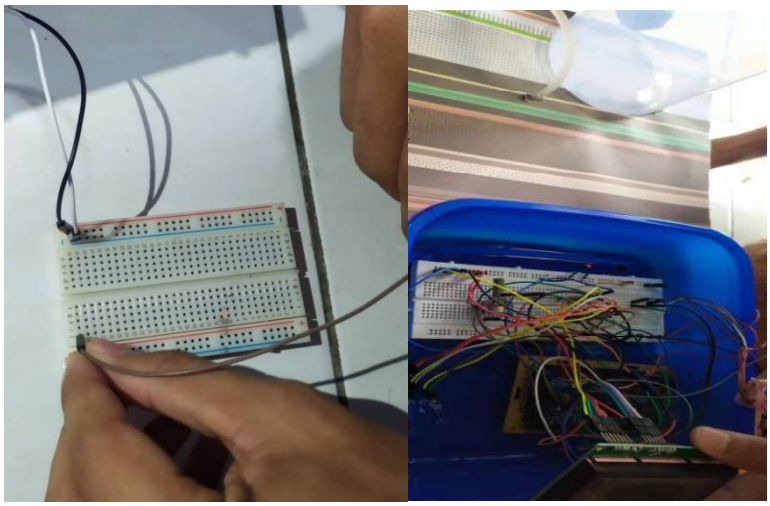
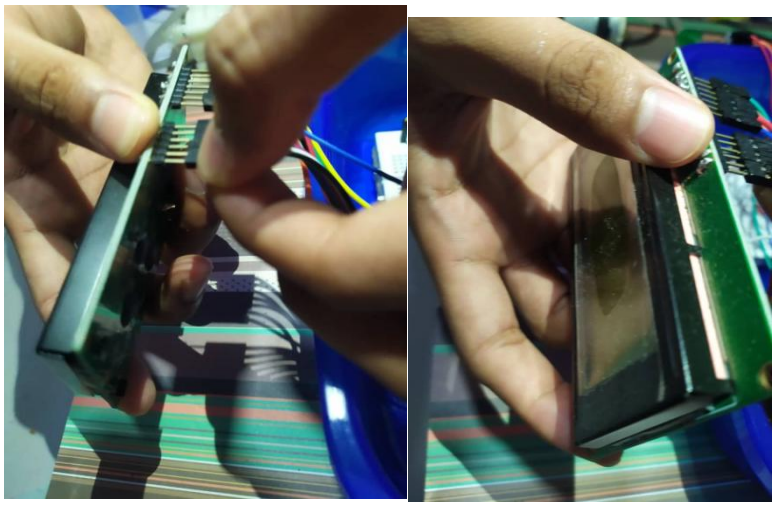
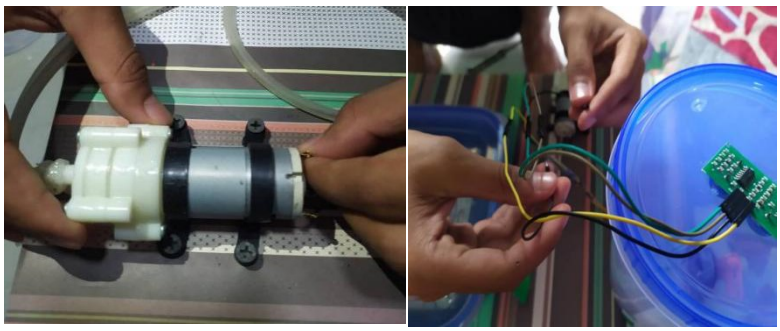
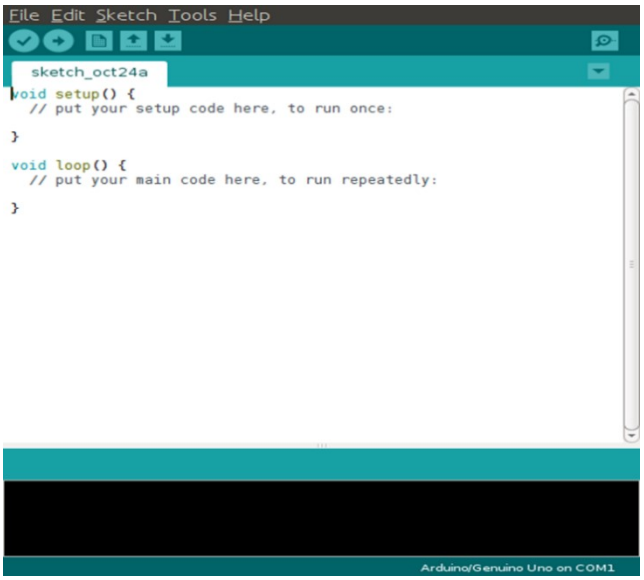
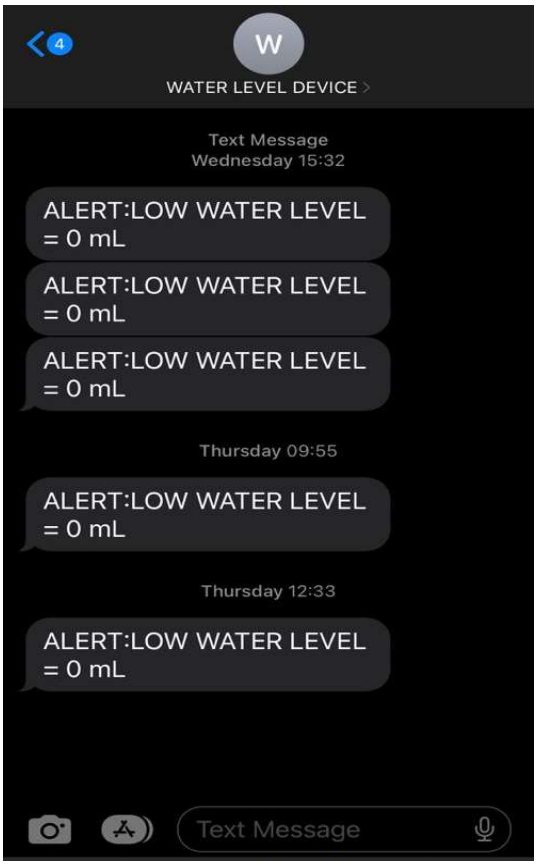
Step To Develop Water Level Detector Using Arduino UNO	Description
	Step 1: Connect the jumper wire on the Arduino UNO to be connected to the board used and it works to flow electricity to other parts.
	Step 2: The LCD is connected to the board that works to convey information. Meanwhile, the LED is connected to the board only to give a signal through light.
	Step 3: Next install the water pump motor on the relay because it works to stop and run the flow of the pump. After installing the motor, the device is set on the level or meter on the ultrasonic sensor.

Table 4.1 (Continuation)

Step To Develop Water Level Detector Using Arduino UNO	Description
	Step 4: For this project, Arduino IDE will be used as a compiler to program on this device. The relevant programming library is required to be installed in the Arduino IDE software.
	Step 5: if the ultrasonic sensor detect low water level, the SIM900A GSM module will send messages to the phone.

4.4 TEST THE EFFECTIVENESS OF THE IMPLEMENTATION OF ARDUINO UNO IN WATER LEVEL DETECTOR DEVICE FOR HOSPITAL BUILDINGS

The Technology Acceptance Model (Davis, 1989) questionnaire was modified. The Technology Adoption Model (Davis, 1989), which focuses on the two crucial aspects of perceived usability and simplicity of use that influence a person's interest in adopting new technology, is one of the most well-known models of technology adoption. Perceived Ease of Use, Perceived Usefulness, Attitude Towards Using Technology, and Behavioural Intention to Use are the TAM elements being evaluated in this study.

For the population of 40 samples, the samples of 36 respondents from (Krejcie, 1970) would be adequate. According to simulation studies by (Winter, 2019), applying a normal t-test to extremely tiny sample sizes is not always incorrect. He said that there would be no issues with a sample size of merely two.

This study presents the results of questionnaire that was given to respondents, together with project manager, engineers, inspector of works, and others, to find out the need for Water Level Detector Device Using Arduino UNO for the Sunway Medical Centre Damansara project. This questionnaire consists of 6 sections in total. Information about demographics is included in Section 1. Issues relating to the existing device are covered in Section 2,3,4,5 and 6. This questionnaire have been distributed to 40 respondent. Section 1 is a demographic data section that includes four question regarding the respondent’s backgrounds. The respondents of pre and post questionnaire was the same.

This research included 75% male respondents and 25% female respondents. The percentage indicates that male respondents outnumber female respondents by a significant amount. The age group of 26 to 35 years old is the largest number of respondents with 26 people covering up to 65%. For the age 46 years and above are the lowest which is 2.5% or 1 respondent only. The numbers for the 36 years to 45 years old is 12.5% meanwhile, for respondents that under 25 years old only have 20% which equal to 8 respondents.

Position in the Sunway Medical Centre Damansara Project which comprises project manager, inspector of works, engineers, construction manager, site supervisor and operation. Operation team have the most respondents which are 26 respondents

which is 65%. The second highest respondents came from site supervisor, which 12.5% that equal to 5 respondents. For the engineers only have 10% respondents. For Inspector of works they have 7.5% of respondents because for this project site only have 3 inspector of works. Meanwhile for project manager and construction manager both come with a same number, that is 2.5%.

Table 4.2: Respondents Background

	Gender	**No of respondents**	**Percentage (%)**
1	Male	30	75
2	Female	10	25
	Age	**No of respondents**	**Percentage (%)**
1	Under 25 years old	8	20
2	26 to 35 years old	26	65
3	36 to 45 years old	5	12.5
4	Above 46 years old	1	2.5
	Position	**No of respondents**	**Percentage (%)**
1	Project Manager	1	2.5
2	Construction Manager	1	2.5
3	Inspector of works	3	7.5
4	Engineer	4	10
5	Site Supervisor	5	12.5
6	Operation	26	65
	Work Experience	**No of respondents**	**Percentage (%)**
1	Under 2 years	8	20
2	2 to 5 years	26	65
3	6 to 10 years	5	12.5
4	Above 10 years	1	2.5

The following section focused on the issues with the existing method. On a scale from 5 to 1, respondents were prompted to pick the relevant scores. The following scoring system was used:

- Strongly Agree - 5
- Agree - 4
- Slightly Agree - 3
- Disagree - 2
- Strongly Disagree - 1

Section 2-6 of the Pre - questionnaire included question about respondents attitude toward the existing method of water level detection. Table 4.3 below contains the data for section 2-6 of the Pre - questionnaire. Section 2 (P.E 1) to (P.E 2) collected information on the Perceived ease of use of the existing method. According to the findings, half of the respondents believe that the existing method is inconvenient. In response to section 2 (P.E 1), 20% of respondents disagree about the existing method is easy to use, while 80% strongly disagree. For section 2 (P.E 2), 47.5% of respondents disagree and 52.5% strongly disagreeing. This demonstares that the existing method is inconvenient.

Section 3 (P.U 1) to (P.U 3) collected information on the existing method Perceived usefulness. According to the findings, most respondents believe that the existing method is less effective. For section 3 (P.U 1), 12.5% of the respondents disagree and 87.5% strongly disagree with the existing method was efficiency enough. For section 3 (P.U 2), 20% of respondents disagree and 80% strongly disagree that the existing method is effective to use. Meanwhile for section 3 (P.U 3), 52.5% respondents disagree and 47.5% respondents strongly disagree that existing method can send early warning.

Section 4 (A.U 1) to (A.U 3) collected information on the respondents Attitude towards using technology. According to the findings, most respondents believe that the existing method is less comfortable to use. In response for section 4 (A.U 1), 37.5% of respondents disagree and 62.5% strongly disagree that they satisfied with the existing method. For section 4 (A.U 2), which is about the efficiency with the existing method, 25% of the respondents disagree and 75%was strongly disagree. For

section 4 (A.U 3), 17.5% of respondents choose disagree about the positive attitude meanwhile 82.5% choose strongly disagree.

Section 5 (I.U 1) to (I.U 3) gave information about the behavioral intention to use. In this section, majority of the respondents indicated that they will not continue using the existing method for water level detection in buildings. For section 5 (I.U 1), majority of the respondents choose strongly disagree that they will continue using the existing method for the hospital buildings, while the rest of the respondents choose disagree. For section (I.U 2), 22.5% choose disagree that they will recommend the existing method to other for water level detection and the rest, 77.5% choose strongly disagree. Finally, for section (I.U 3), 42.5% disagree that the existing method can send early warning about low water level. 57.5% of the respondents choose strongly disagree.

The last section for pre - questionnaire is section 6 (N.I 1) to (N.I 4) collected information on the need of improvement for water tank level detector in this construction site. For section 6 (N.I 1), 32.5% choose disagree about the existing method is systematic and efficient. While, 67.5% choose strongly disagree. Section (N.I 2), 17.5% disagree that the existing method solve the existing constraint. 82.5% of respondents choose strongly disagree about that. For section (N.I 3), 47.5% of the respondents disagree that the existing method increases the speed and responsiveness of detecting water level variations and 52.5% of them strongly disagree. Finally, for section (N.I 4), 30% choose disagree that they will recommend this water level detector device to others due to its efficiency and the rest 70% choose strongly disagree.

Table 4.3: Existing Method survey data

Section	Constraint elements of the current Water Level Detector	(1) %	(2) %	(3) %	(4) %	(5) %
1	The existing method is easy to understand and use (P.E 1)	80.0	20.0	0.0	0.0	0.0
	Existing method is convenient to operate and interact (P.E 2)	52.5	47.5	0.0	0.0	0.0
2	The existing method contributes to the overall efficiency (P.U 1)	87.5	12.5	0.0	0.0	0.0
	The existing method effectively helps in detecting water levels (P.U 2)	80.0	20.0	0.0	0.0	0.0
	The existing method can send notification for early warning (P.U 3)	47.5	52.5	0.0	0.0	0.0
3	I feel comfortable using existing method for water level detection (A.U 1)	62.5	37.5	0.0	0.0	0.0
	I believe that existing technology can improve the efficiency and effectiveness of water level detection in the buildings (A.U 2)	75.0	25.0	0.0	0.0	0.0
	I have a positive attitude towards using existing technology in water level detection (A.U 3)	82.5	17.5	0.0	0.0	0.0
4	I intend to continue using the existing method for water level detection in buildings (I.U 1)	57.5	42.5	0.0	0.0	0.0

Table 4.3 (Continuation)

	I would recommend the existing method to others for water level detection in buildings (I.U 2)	77.5	22.5	0.0	0.0	0.0
	Existing method can send notification for early warning (I.U 3)	57.5	42.5	0.0	0.0	0.0
5	The existing method solve delay information about water level ? (N.I 1)	67.5	32.5	0.0	0.0	0.0
	Existing method is systematic and efficient enough to know the water level ? (N.I 2)	82.5	17.5	0.0	0.0	0.0
	Do you agree that existing method is fast enough to give early warning if there any problem about pump or the water tank itself ? (N.I 3)	52.5	47.5	0.0	0.0	0.0
	Existing method is easy to identify if there any pipe leakage ? (N.I 4)	70.0	30.0	0.0	0.0	0.0

Note: 5=Strongly Agree, 4=Agree, 3=Slightly Agree, 2=Disagree, 1=Strongly Disagree

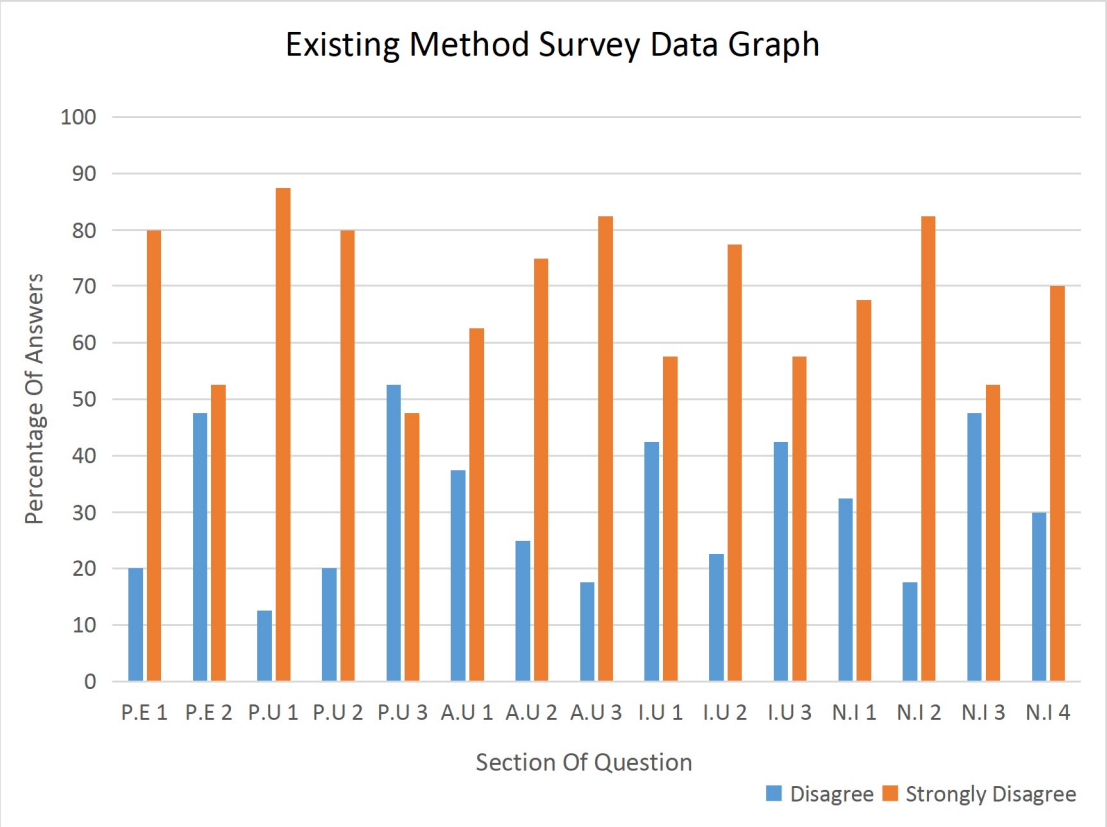


Figure 4.2: Percentage of level agreement of existing method

Section 2-6 of the Post - questionnaire consisted of questions concerning respondents experience with the Implementation Of Arduino UNO In Water Level Detector Device For Hospital Buildings. Table 4.4 below contains the data for section 2-6 of the post - questionnaire.

Section 2 (P.E 1) to (P.E 2) collected information on the Perceived ease of use of the implementation of Arduino UNO in water level detector device. According to the findings, half of the respondents believe that this device is convenient. In response to section 2 (P.E 1), 60% of respondents agree about this device is easy to use, while 20% strongly agree. For section 2 (P.E 2), 35% of respondents agree and 65% strongly agree. This demonstrates that the existing method is convenient and easy to understand also use it.

Section 3 (P.U 1) to (P.U 3) collected information on this device perceived usefulness. According to the findings, most respondents believe that the device is effective. For section 3 (P.U 1), 60% of the respondents agree and 40% strongly agree with statement that the device was efficiency enough. For section 3 (P.U 2), 40% of respondents agree and 60% strongly agree that the device is effective to use.

Meanwhile for section 3 (P.U 3), 40% respondents agree and 60% respondents strongly agree that the device can send early warning.

Section 4 (A.U 1) to (A.U 3) collected information on the respondents Attitude towards using technology. According to the findings, most respondents believe that the implementation of Arduino UNO in water level detector device is comfortable to use. In response for section 4 (A.U 1), 60% of respondents agree and 40% strongly agree that they satisfied with the device that have Arduino UNO. For section 4 (A.U 2), which is about the efficiency with the device, 35% of the respondents agree and 65% was strongly agree. For section 4 (A.U 3), 65% of respondents choose agree about the positive attitude meanwhile 35% choose strongly agree.

Section 5 (I.U 1) to (I.U 3) gave information about the behavioral intention to use. In this section, majority of the respondents indicated that the implementation of Arduino UNO in water level detector device will be using it for water level detection

in buildings. For section 5 (I.U 1), majority of the respondents choose strongly agree that they will continue using the device for the hospital buildings, while the rest of the respondents choose agree. For section (I.U 2), 65% choose agree that they will recommend the device to other for water level detection and the rest, 35% choose strongly agree. Finally, for section (I.U 3), 40% agree that the device can send early warning about low water level. Meanwhile 60% of the respondents choose strongly agree.

The final section for post - questionnaire is section 6 (N.I 1) to (N.I 4) collected information on the efficiency of the implementation of the Arduino UNO in a water level detector device for hospital buildings. For section 6 (N.I 1), 50% choose agree about the device is systematic and efficient. While, 50% choose strongly agree. Section (N.I 2), 35% agree that the device solve the existing constraint. 65% of respondents choose strongly agree about that. For section (N.I 3), 40% of the respondents agree that the device increases the speed and responsiveness of detecting water level variations and 60% of them strongly agree. Finally, for section (N.I 4), 40% choose agree that they will recommend this water level detector device to others due to its efficiency and the rest 60% choose strongly agree.

Table 4.4: Feedback after using the device with Arduino UNO

Section	Elements for the implementation of the Arduino UNO in a water level detector device for hospital buildings	(1) %	(2) %	(3) %	(4) %	(5) %
1	The implementation of the Arduino UNO in a water level detector device is easy to understand and use (P.E 1)	0.0	0.0	0.0	60.0	40.0
	The implementation of the Arduino UNO in a water level detector device is convenient to operate and interact (P.E 2)	0.0	0.0	0.0	35.0	65.0
2	The implementation of the Arduino UNO in a water level detector device will bring benefits to my team (P.U 1)	0.0	0.0	0.0	60.0	40.0
	The implementation of the Arduino UNO in a water level detector device will improve the accuracy and efficiency of measuring water levels (P.U 2)	0.0	0.0	0.0	40.0	60.0
	I am satisfied with the speed at which this device detects and reports water reach low level (P.U 3)	0.0	0.0	0.0	40.0	60.0
3	I have a positive viewpoint towards using this technology for water level detection (A.U 1)	0.0	0.0	0.0	60.0	40.0

Table 4.4 (Continuation)

	I believe that implementing the water level detector using Arduino UNO will improve the efficiency and effectiveness of water level detection (A.U 2)	0.0	0.0	0.0	35.0	65.0
	I feel comfortable using technology, such as Arduino UNO, for managing water level detection (A.U 3)	0.0	0.0	0.0	35.0	35.0
4	I would recommend this water level detector device to others for water level detection (I.U 1)	0.0	0.0	0.0	60.0	60.0
	I am motivated to adopt this water level detector device for water level detection (I.U 2)	0.0	0.0	0.0	35.0	35.0
	I intend to use the water level detector device in my buildings (I.U 3)	0.0	0.0	0.0	60.0	60.0
5	This device is systematic and efficient (N.I 1)	0.0	0.0	0.0	50.0	50.0
	This device solve the existing constraints (N.I 2)	0.0	0.0	0.0	65.0	65.0
	The implementation of Arduino UNO in the water level detector device increases the speed and responsiveness of detecting water level variations (N.I 3)	0.0	0.0	0.0	60.0	60.0

Table 4.4 (Continuation)

I would recommend this water level detector device to others due to its efficiency (N.I 4)	0.0	0.0	0.0	60.0	60.0

Note: 5=Strongly Agree, 4=Agree, 3=Slightly Agree, 2=Disagree, 1=Strongly Disagree

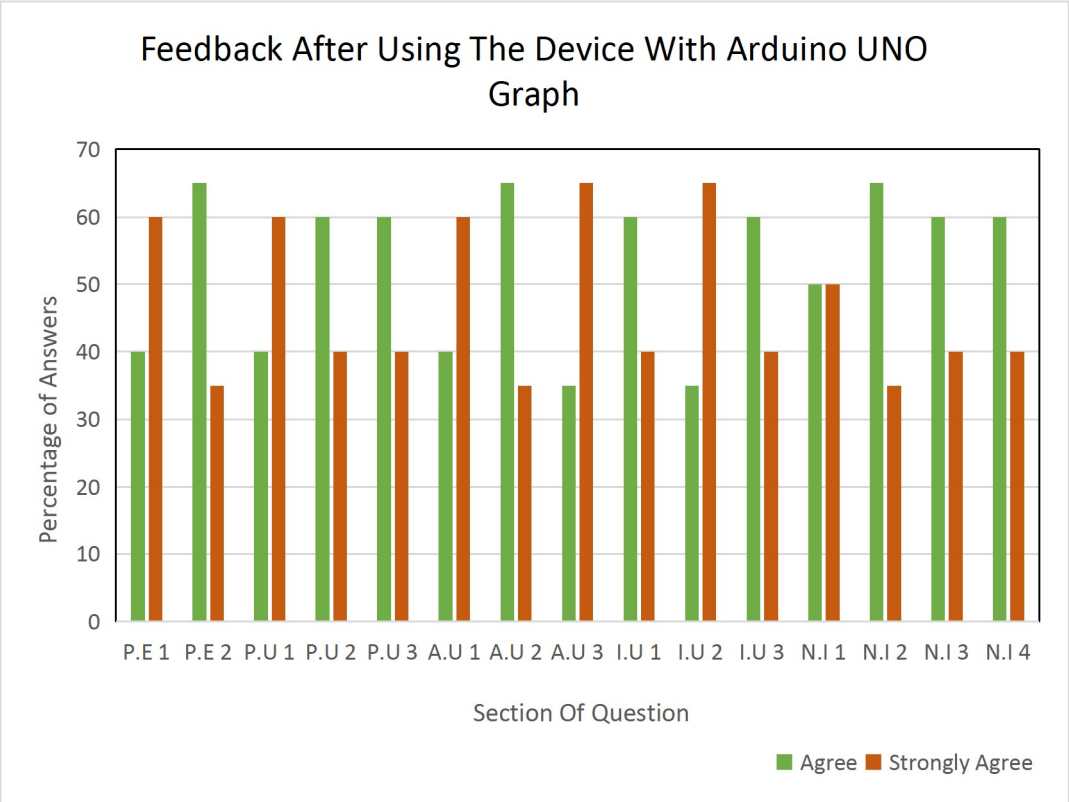


Figure 4.3: Percentage of level agreement of the implementation of Arduino UNO in water level device

Table 4.5 shows respondent level of usability toward using existing method whereby analysis shows for all variables tested the mean score were less than 3.00 meaning that the usability level of existing method was low. Whilst Table 4.6 shows respondent level of usability toward using the implementation of water level detector using Arduino UNO whereby analysis shows for all variables tested the mean score were more than 4.00 meaning that the implementation of water level detector using Arduino UNO much effective compare with the existing method.

Table 4.5: Usability Level of existing method among respondents

Variables	Mean	Interpretation
Perceived Ease of Use	1.30	Low
Perceived Usefulness	1.30	Low
Attitude Towards Using Technology	1.30	Low
Behavioral Intention to Use	1.40	Low
The Need of Improvement	1.30	Low

Table 4.6: Usability Level of The implementation of Arduino UNO in the water level detector device among respondents

Variables	Mean	Interpretation
Perceived Ease of Use	4.50	High
Perceived Usefulness	4.50	High
Attitude Towards Using Technology	4.50	High
Behavioral Intention to Use	4.50	High
Efficiency of The Device	4.60	High

In order to evaluate the effectiveness of The Implementation Of Arduino Uno In The Water Level Detector Device in the project, a paired sample T-Test was performed. Results as shown in Table 4.7, respondent preferred using The Implementation Of Arduino Uno In The Water Level Detector Device whereby all variable measured, Perceived Ease of Use (Mean = 4.50), Perceived Usefulness (Mean = 4.50), Attitude Towards Using Technology (Mean = 4.50) and Behavioral Intention to Use (Mean = 4.50) and Efficiency of The Device (Mean = 4.60) were higher compared with existing method, Perceived Ease of Use (Mean = 1.30), Perceived Usefulness (Mean = 1.30), Attitude Towards Using Technology (Mean = 1.30) and Behavioral Intention to Use (Mean = 1.40) and The Need of Improvement (Mean = 1.30) . A paired sample T-Test found this difference to be significant for all variables being measured, the value of t of Perceived Ease of Use is 21.33 and the value of p is < .00001. The result is

significant at p < .05. The value of t of Perceived Usefulness is 19.01 and value of p is < .00001. The result is significant at p < .05. The value of t of Attitude Towards Using Technology is 17.98 and the value of p is < .00001. The result is significant at p < .05. The value of t of Behavioral Intention to Use is 14.67 and the value of p is < .00001. The result is significant at p < .05. This suggests that using The Implementation Of Arduino Uno In The Water Level Detector Device was much effective and efficient compared with existing method.

Table 4.7: Paired sample t-test

Pair	Paired Different Mean	t	Significant (two tailed)
Perceived Ease of Use - Existing Method	3.00	21.33	.000
Perceived Usefulness - Existing Method	2.90	19.01	.000
Attitude Towards Using Technology- Existing Method	2.80	17.98	.000
Behavioural Intention to Use- Existing Method	2.80	14.67	.000

4.5 CONCLUSION

A water level detector device is essential in building construction due to its ability to monitor and detect water levels accurately. By promptly identifying rising water levels, it helps prevent potential water damage, safeguarding the structural integrity of the building and protecting valuable assets. The device ensures early detection of leaks or problem, enabling immediate action to mitigate the risk of electrical hazards and costly repairs. Overall, a water level detector device is a vital tool in building construction, ensuring the protection of the building, its occupants, and valuable resources.

Therefore, it was determined that respondents from Sunway Medical Centre Damansara Project employees including project managers, assistant managers, supervisors, engineer, and operation team agreed that the implementation of Arduino UNO in the water level detector device is superior than the current approach. The existing method was dated and efficient enough to use. The implementation of Arduino UNO in the water level detector device was praised for having a higher mean (> 4.00), and they intend to use it. The Social Science Statistics online website's analysis of the paired T-Test was used to assess the efficiency of the implementation of Arduino UNO in the water level detector device. The outcome demonstrates that the implementation of Arduino UNO in the water level detector device differs significantly from the existing method. This indicates that, in comparison to the current system, the implementation of Arduino UNO in the water level detector device was more efficient.

CHAPTER 5
CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

The research project had been analysed and the conclusions drawn from previous chapters were summarised. At the conclusion of the chapter, a few suggestions for more research were provided. It was established from the findings in the previous chapter that the implementation of Arduino UNO in the water level detector device in hospital buildings is suitable to be use and, consequently, for implementation throughout the whole construction industry. A water level detector device utilizing Arduino Uno can significantly enhance efficiency in buildings. By integrating the Arduino platform with sensors, the device can accurately measure water levels and provide real-time data. This enables efficient management of water resources and helps optimize water usage within the building.

The device can be programmed to trigger alerts or automate actions based on predefined thresholds, allowing for timely response to leaks or excessive water consumption. By promoting proactive water management, the Arduino-based water level detector device reduces wastage, conserves water, and lowers operational costs. Its ability to provide precise and continuous monitoring also aids in early detection of potential water-related issues, preventing damage to the building and ensuring the safety of occupants. Overall, the implementation of a water level detector device using Arduino UNO enhances efficiency in buildings by facilitating effective water management and promoting sustainable practices.

From this studies, it reveal that the undetected water leak problems are not handled or rectified, they cause property damage, defective equipment, and expensive clean-up charges. The leakage itself can be major problem about the waste water.

Furthermore, the response time for the users to take action and notify the problem in water tank is taking so long.

5.2 DISCUSSION

The Sunway Medical Centre Damansara Project has engaged in multiple discussions to address the challenges it faces. One approach involved utilizing the design thinking methodology. By conducting interviews with professionals in the construction industry, including project managers, the environment department, and clients, the researcher advanced through the stage of understanding and empathizing with their perspectives. As a result, the difficulties were identified, and projects were created to tackle them through brainstorming and generating ideas.

Two sets of surveys were developed to evaluate the effectiveness of the water level detector device. The initial questionnaire focused on gathering feedback and ideas regarding the existing method of acquiring information about the water level detector. The subsequent questionnaire aimed to collect comments and feedback on the implementation of a water level detector device using Arduino UNO. The results of the analysis indicated that the new device outperformed the existing method. The existing method posed difficulties for employees in detecting issues with the water tank itself. In contrast, the new device can be use in various projects and is user-friendly in terms of understanding and operation.

According to the questionnaire feedback, respondent level of usability toward utilizing current method, whereby analysis shows that the mean score for all variables examined was less than 3.00, indicating that the usability level of existing method was low. While the feedback demonstrates respondent usability toward utilizing the water level detector device using Arduino UNO, research shows that the mean score for all variables examined was greater than 4.00, implying that using water level detector device using Arduino UNO is significantly easier than the present approach. A paired sample T-Test was used to assess the performance of the implementation of Arduino UNO in the water level detector device in the project. According to the findings in Table 4.5 and Table 4.6, respondents preferred using the implementation of Arduino UNO in the water level detector device in hospital buildings, with all variables

measured Perceived Ease of Use (Mean = 4.50), Perceived Usefulness (Mean = 4.50), Attitude Towards Using Technology (Mean = 4.50), Behavioral Intention to Use (Mean = 4.50), and The Efficiency Of The Device (Mean = 4.60) being significantly higher than the existing method. Perceived Ease of Use (Mean = 1.30), Perceived Usefulness (Mean = 1.30), Attitude Towards Using Technology (Mean = 1.30), Behavioral Intention to Use (Mean = 1.40), and The Need Of Improvement (Mean = 1.30).

A paired sample T-Test found this difference to be significant for all variables being measured, the value of t of Perceived Ease of Use is 21.33 and the value of p is < .00001. The result is significant at $p < .05$. The value of t of Perceived Usefulness is 19.01 and value of p is < .00001. The result is significant at $p < .05$. The value of t of Attitude Towards Using Technology is 17.98 and the value of p is < .00001. The result is significant at $p < .05$. The value of t of Behavioral Intention to Use is 14.67 and the value of p is < .00001. The result is significant at $p < .05$. This suggests that using The Implementation Of Arduino UNO In The Water Level Detector Device was much effective and efficient compared with existing method.

5.3 RECOMMENDATION

In the context of building construction, a water level detector device powered by an Arduino UNO can offer valuable recommendations to enhance efficiency and mitigate potential risks. Firstly, the device can provide real-time monitoring of water levels in construction site trenches or foundation pits. By continuously tracking the water levels, it can alert construction teams to potential flooding or water logging issues. The device can recommend appropriate drainage measures or the installation of additional pumps to manage water accumulation effectively, thereby preventing delays and damage to the construction site.

Secondly, the water level detector device can aid in the management of concrete curing processes. Maintaining proper moisture levels during the curing stage is crucial for ensuring the strength and durability of concrete structures. The device can monitor the water levels in curing tanks or reservoirs and offer recommendations to adjust water supply or implement misting systems for consistent and optimal curing conditions. By providing accurate and timely guidance, the device helps contractors

achieve high-quality concrete results, reducing the risk of structural deficiencies in the building.

Lastly, the water level detector device can assist in the identification and prevention of potential leaks in plumbing systems during the construction phase. By detecting abnormal fluctuations in water levels within pipes or storage tanks, the device can alert construction teams to the presence of leaks or faulty connections. Recommendations can then be made to conduct thorough inspections, repair or replace damaged components, and ensure the integrity of the plumbing system. These proactive measures minimize water wastage, prevent property damage, and contribute to the overall sustainability of the construction project.

5.4 CONCLUSION

In conclusion, the water level detector device using Arduino UNO, equipped with the SIM900A module for sending messages to a phone, offers a highly effective solution for water level monitoring and notification. The device provides real-time information about water levels in tanks, reservoirs, or other water storage systems. By utilizing the SIM900A module, it can send timely alerts and updates directly to a user's phone, ensuring prompt action can be taken to address any issues.

Compared to existing methods of water level monitoring, this device proves to be highly effective. Traditional methods often rely on manual checks or visual inspections, which can be time-consuming and prone to human error. The water level detector device, on the other hand, automates the monitoring process, eliminating the need for constant manual intervention. With its ability to send messages to a phone, it provides convenience and accessibility, enabling users to stay informed about water levels even when they are not physically present at the location.

Furthermore, the device's integration with Arduino UNO allows for customization and flexibility. Users can easily program the device to suit their specific needs and requirements. Additionally, the Arduino UNO platform offers a wide range of compatible sensors and modules, allowing for the expansion of functionality beyond water level detection if desired. Overall, the water level detector device using Arduino UNO with SIM900A integration presents an effective and versatile solution for water level monitoring and notification, enhancing convenience, accuracy, and proactive management of water resources.

REFERENCES

Al Wadhahi, E. K. M., & Ahmed, S. A. (2019). Smart Water Tank Monitoring and Booking Using IoT Framework. Journal of Student Research.

Agenbag, H., & Amoah, C. (2021, February). The impact of modern construction technology on the workforce in the construction industry. In IOP Conference Series: Earth and Environmental Science (Vol. 654, No. 1, p. 012001). IOP Publishing.

Baballe, Muhammad Ahmad, Abubakar Sadiq Muhammad, Fatima Abubakar Usman, Naja'atu Kabir Mustapha, Abdulkadir Habibu Kofar Naisa, and Abdullahi Kabiru Shehu. "A Review of an Automatic Water Level Indicator." Journal homepage: https://gjrpublication. com/gjrecs 2, no. 03 (2022).

Bande, S.J. Nandedkar (2016) Low-Cost sensor network for real-time water quality measurement system Int. J. Innovat. Res. Sci. Eng. Technol., pp. 20691-20696

Boparai, J. K., Singh, S., & Kathuria, P. (2018). How to design and validate a questionnaire: a guide. Current clinical pharmacology, 13(4), 210-215.

Che N, Omar K, Azir K and Kamarudzaman M. (2021). Water Pipeline Leakage Monitoring System based on Internet of Things. Journal of Physics: Conference Series.10.1088/1742-6596/1962/1/012025.1962:1. (012025). Online publication date: 1-Jul-2021

D.K. Fisher, R. Sui An inexpensive open-source ultrasonic sensing system for monitoring liquid levels Agricul. Eng. Int.: CIGR J.,15(2013),pp.328-334

Ismail H, Elabyad R and Dyab A. (2022). Smart Residential Water Leak and Overuse Detection System Using Machine Learning 2022 IEEE/ACS 19th International Conference on Computer Systems and Applications (AICCSA). 10.1109/AICCSA56895.2022.10017508. 979-8-3503-10085.

Joshi, S. S., & Kulkarni, K. R. (2016). Internet of Things: An Overview. ISOR Journal of Computer Engineering, 18(4), 117-121.

Kaushik Gupta, Mandar Kulkarni, Manas Magdum, Yash Baldawa and Shivprasad Patil, "Smart Water Management in Housing Societies using IoT", 2018 Second International Conference on Inventive Communication and Computational Technologies (ICICCT), pp. 1609-1613, 2018

Kumar, Sachin, Prayag Tiwari, and Mikhail Zymbler. "Internet of Things is a revolutionary approach for future technology enhancement: a review." Journal of Big data 6, no. 1 (2019): 1-21.

M.R. Hidayat, S. Sambasri, F. Fitriansyah, A. Charisma, H.R. Iskandar (2019) Soft water tank level monitoring system using ultrasonic HC-SR04 sensor based on ATMega 328 microcontroller , pp. 1-4

MS Bennet raba, Naresh Rengaswamy and O. Deepak, "IoT Based Smart Water System", 2018 3rd International Conference on Communication and Electronics Systems (ICCES), pp. 1041-1045, 2018.

N. Min-Allah, M. Farooqui, A. Alwashmi, S. Almahasheer, M. Alsufayyan and N. Altulaihan, "Smart Monitoring of Water Tanks in KSA", 2018 International Conference on Computational Science and Computational Intelligence (CSCI), pp. 1044-1047, 2018, December.

P.P. Shah, A.A. Patil, S.S. Ingleshwar (2017) IoT based smart water tank with Android application , pp. 600-603

Prasad, A. N., K. Al Mamun, F. R. Islam, and Haq Haqva. "Smart water quality monitoring system." In 2015 2nd Asia-Pacific World Congress on Computer Science and Engineering (APWC on CSE), pp. 1-6. IEEE, 2015.

T. Perumal, M.N. Sulaiman, C.Y. Leong (2015) Internet of Things (IoT) enabled water monitoring system , pp. 1-3

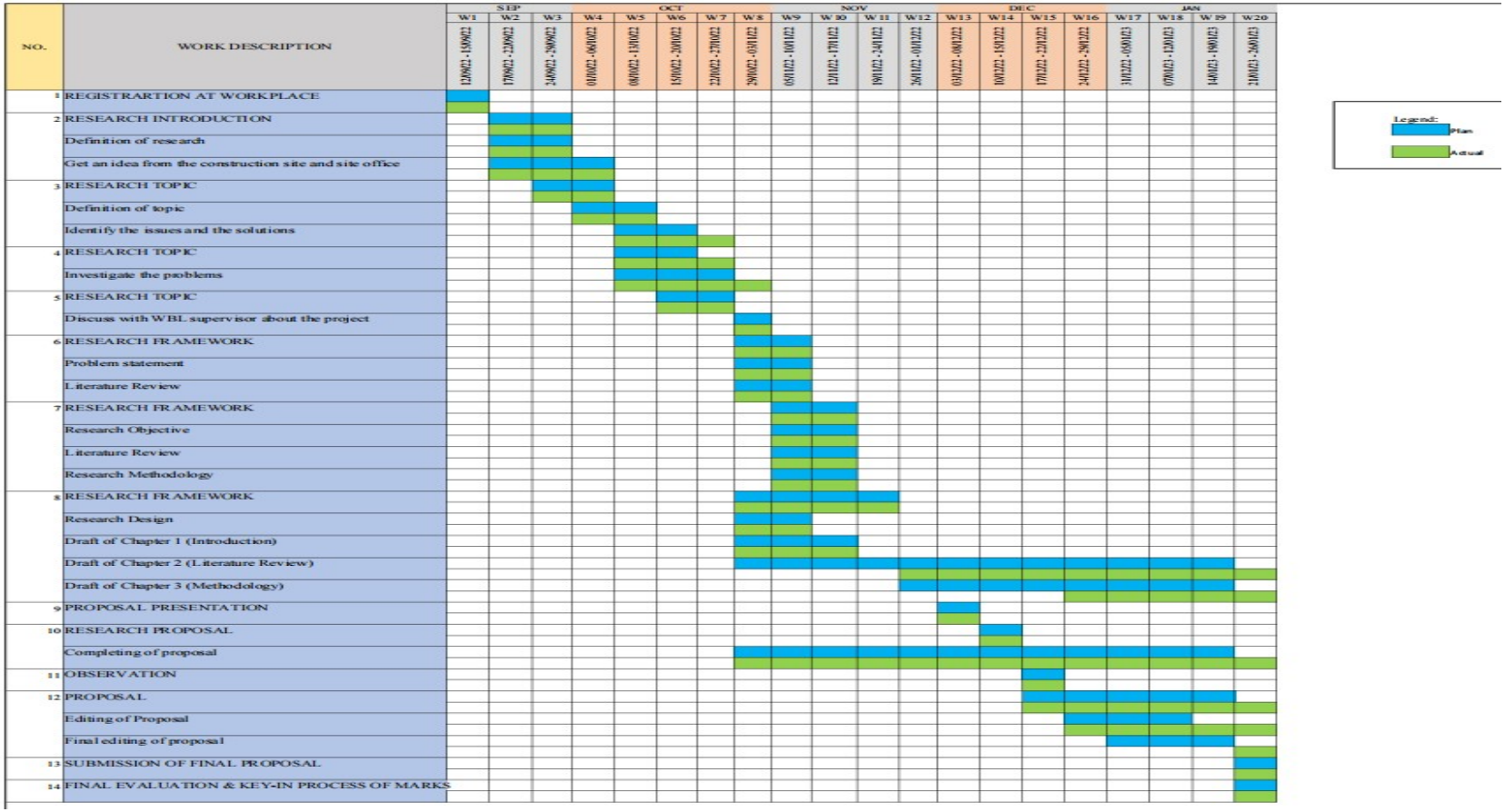
APPENDIX

Appendix A **Gantt Chart Of Semester**

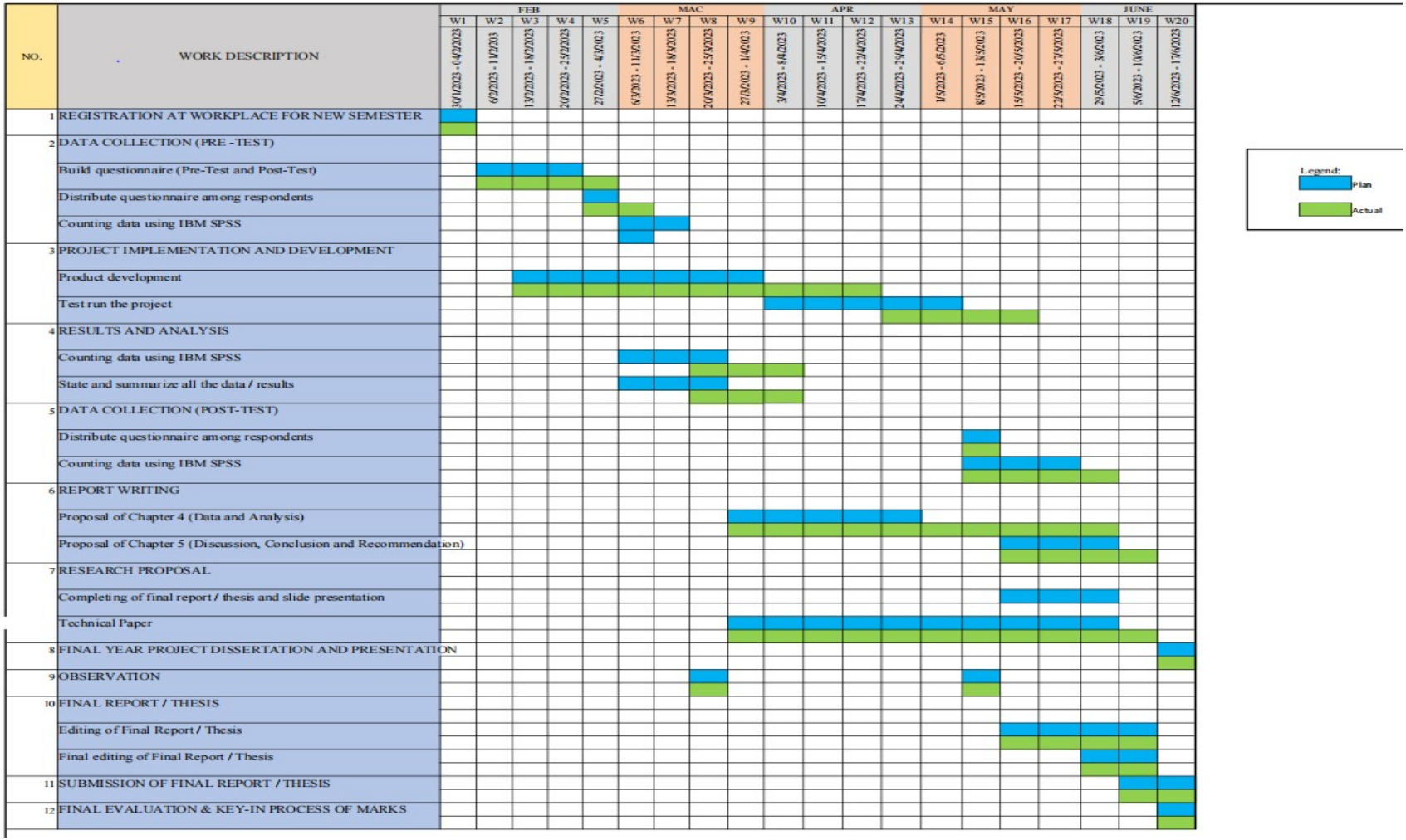
Appendix B **Final Year Project Questionnaire Pre And Post**

APPENDIX A

Gantt Chart Semester 7



Gantt Chart Semester 8



APPENDIX B

THE EXAMPLE OF QUESTIONAIRE FORM
FINAL YEAR PROJECT

Title:

THE IMPLEMENTATION OF THE ARDUINO UNO IN A WATER LEVEL DETECTOR DEVICE FOR HOSPITAL BUILDINGS

The Respondents Point Of View Regarding The Issues Related To Water Level Detector on Site

1. A part of my study of Final Year Project for Bachelor of Civil Engineering Technology (BCT) at Politeknik Ungku Omar (PUO), Ipoh, Perak. I am MUHAMMAD FAUZI BIN GANTI SALIM (01BCT30F3010) conducting a survey to evaluate **THE IMPLEMENTATION OF THE ARDUINO UNO IN A WATER LEVEL DETECTOR DEVICE FOR HOSPITAL BUILDINGS**

SECTION A : TICK (/)
DEMOGRAPHY

a) Gender

Male	
Female	

b) Age

Under 25 years old	
26-35 years old	
36-45 years old	
46 years or older	

c) Position

Project Manager	
Construction Manager	
Engineer	
Site Supervisor / Assistant Engineer	
Inspector Of Works	
Operation	
Others	

d) Work Experience

< 2 Years	
2-5 Years	
6-10 Years	
> 10 Years	

SECTION B: TICK (/)
PRE-TEST

No.	Constraint elements of the current Water Level Detector	Issues related to the current Water Level Detector	Level of Agreement				
			Strongly Disagree	Disagree	Slightly Agree	Agree	Strongly Agree
			1	2	3	4	5
1	Perceived ease of use	The existing method is easy to understand and use.					
		Existing method is convenient to operate and interact					
2	Perceived usefulness	The existing method contributes to the overall efficiency					
		The existing method effectively helps in detecting water levels					
		The existing method can send notification for early warning					
3	Attitude towards using technology	I feel comfortable using existing method for water level detection					
		I believe that existing technology can improve the efficiency and effectiveness of water level detection in the buildings					
		I have a positive attitude towards using existing technology in water level detection					
4	Behavioral intention to use	I intend to continue using the existing method for water level detection in buildings					
		I would recommend the existing method to others for					

		water level detection in buildings					
		Existing method can send notification for early warning					
5	The need of improvement for water tank level detector in this construction site	Do you need an improvement to solve delay information about water level ?					
		Existing method is systematic and efficient enough to know the water level ?					
		Do you agree that existing method is fast enough to give early warning if there any problem about pump or the water tank itself ?					
		Existing method is easy to identify if there any pipe leakage ?					

SECTION C: TICK (/)
POST-TEST

No	Elements for the implementation of the arduino uno in a water level detector device for hospital buildings	The effectiveness of the implementation of the arduino uno in a water level detector device for hospital buildings	Level of Agreement				
			Strongly Disagree	Disagree	Slightly Agree	Agree	Strongly Agree
			1	2	3	4	5
1	Perceived ease of use	The implementation of the arduino uno in a water level detector device is easy to understand and use					
		The implementation of the arduino uno in a water level detector device is convenient to operate and interact					
2	Perceived usefulness	The implementation of the arduino uno in a water level detector device will bring benefits to my team					
		The implementation of the arduino uno in a water level detector device will improve the accuracy and efficiency of measuring water levels					
		I am satisfied with the speed at which this device detects and reports water reach low level					

3	Attitude towards using technology	I have a positive viewpoint towards using this technology for water level detection					
		I believe that implementing the water level detector using Arduino Uno will improve the efficiency and effectiveness of water level detection					
		I feel comfortable using technology, such as Arduino Uno, for managing water level detection					
4	Behavioral intention to use	I would recommend this water level detector device to others for water level detection					
		I am motivated to adopt this water level detector device for water level detection					
		I intend to use the water level detector device in my buildings					
5	The efficiency of the implementation of the arduino uno in a water level detector device for hospital buildings	This device is systematic and efficient					
		This device solve the existing constraints					
		The implementation of Arduino Uno in the water level detector device increases the speed and responsiveness of detecting water level variations					
		I would recommend this water level detector device to others due to its efficiency					