POLITEKNIK UNGKU OMAR

SMART WATER TANK

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CIVIL ENGINEERING DEPARTMENT

SESSION 1: 2023/2024

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This report has been submitted to the Department of Civil Engineering as part of the conditions for awarding the Diploma in Civil Engineering

CIVIL ENGINEERING DEPARTMENT

SESSION 1: 2023/2024

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1. I am **NORLIYANA AMILIN BINTI HANIZAM (IC NO: 030202-08-0342)** a Civil Engineering Diploma Student at Polytechnic Ungku Omar whose address is at Jalan Raja Musa Mahadi, 31400 Ipoh, Perak.

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Done and truly acknowledged,

by the said;)

NORLIYANA AMILIN BT HANIZAM) ……

(IC NO: 030918031351)) NORLIYANA AMILIN

In front of me

ENCIK NIK MOHD IZNAN BIN TUAN YAAKUB) ..…….....

NIK MOHD IZNAN

as Project Supervisor on the date: ..……...)

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HAMZAH

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In front of me

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In front of me

ENCIK NIK MOHD IZNAN BIN TUAN YAAKUB) ..…….....

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APPRECIATION

Thank you and grateful to Allah and the support from our supervisor, Encik Nik Mohd. Iznan bin Tuan Yaakub, we get finished our project Smart Water Tank. This project is to design and create a water filter that can be brought into any difficult situation.

We want to thank and give appreciation to Politeknik Ungku Omar and our lecturer for giving us the chance to finish this project without support and idea gave from authorities' polytechnic, as students, maybe we will face many problems while doing the project proposal and project.

Finally, we want to thank our family for giving us their support to finish this project. We would also like to thank all our outstanding team and class since that without group member our cooperation among group project will not be completed.

ABSTRACT

Water scarcity is a pressing global challenge aggravated by factors such as population growth, urbanization, and climate change. Despite the indispensable nature of water for life, it is often taken for granted and wasted. This project responds to the urgent need for innovative solutions to conserve water and optimize its usage, particularly in the face of escalating demand. The project focuses on integrating solar energy, a renewable and non-polluting resource, into water management systems to enhance sustainability. Solar energy, being abundant and environmentally friendly, stands out as a promising solution in the 21st century. By alerting users through alarm sounds or varied light colors when water levels are too high or low, the system serves as an effective tool for water conservation. Particularly, in construction sites and rural areas where energy resources are limited, this project seeks to provide a simple yet effective solution. Aiming to ease water access for construction work while minimizing waste and reducing pollution associated with energy generation, the project incorporates Computer Aided Design (CAD) for precision and efficiency. The project's primary objectives include designing the product using CAD, developing a Smart Water Tank integrated with a water level detector and solar panel, and rigorously testing the system's effectiveness. The results showed the system was highly effective, with a mean score of 1.7 for question 9 and the lowest score of 1.2 for question 5. The findings have implications for the development of smart water detection systems and provide a deeper understanding of the system's effectivenessThe exploration encompasses the installation of sensors, network connectivity, data analysis, and thorough testing and refinement of the system. Ultimately, this project not only addresses immediate concerns related to water wastage but also contributes to a broader understanding of how technology can be harnessed to promote sustainable water management in the face of escalating global water challenges. The results of the study found that we successfully used CADD to design a prototype. Next, we succeeded in developing a combination of solar and water tanks to be used as a smart water tank. Finally, we successfully tested the prototype to be used at the construction site as a result of the findings of the study by the public based on mean score obtained which is 70, 60, and 50.

ABSTRAK

Kekurangan air merupakan cabaran global yang mendesak yang diburukkan lagi oleh faktor seperti pertumbuhan penduduk, pembandaran dan perubahan iklim. Walaupun sifat air yang sangat diperlukan untuk kehidupan, ia sering dipandang remeh dan dibazirkan. Projek ini bertindak balas kepada keperluan mendesak untuk penyelesaian inovatif untuk menjimatkan air dan mengoptimumkan penggunaannya, terutamanya dalam menghadapi permintaan yang semakin meningkat. Projek ini memberi tumpuan kepada penyepaduan tenaga suria, sumber yang boleh diperbaharui dan tidak mencemarkan, ke dalam sistem pengurusan air untuk meningkatkan kemampanan. Tenaga suria, yang banyak dan mesra alam, menonjol sebagai penyelesaian yang menjanjikan pada abad ke-21. Dengan memberi amaran kepada pengguna melalui bunyi penggera atau warna cahaya yang pelbagai apabila paras air terlalu tinggi atau rendah, sistem ini berfungsi sebagai alat yang berkesan untuk pemuliharaan air. Terutamanya, di tapak pembinaan dan kawasan luar bandar di mana sumber tenaga adalah terhad, projek ini berusaha untuk menyediakan penyelesaian yang mudah tetapi berkesan. Objektif utama projek termasuk mereka bentuk produk menggunakan CAD, membangunkan Tangki Air Pintar yang disepadukan dengan pengesan paras air dan panel solar, dan menguji keberkesanan sistem dengan teliti. Keputusan menunjukkan sistem ini sangat berkesan, dengan skor min 1.7 untuk soalan 9 dan skor terendah 1.2 untuk soalan 5. Penemuan ini mempunyai implikasi untuk pembangunan sistem pengesanan air pintar dan memberikan pemahaman yang lebih mendalam tentang keberkesanan sistem. merangkumi pemasangan penderia, ketersambungan rangkaian, analisis data, dan ujian menyeluruh dan penghalusan sistem. Akhirnya, projek ini bukan sahaja menangani kebimbangan segera berkaitan pembaziran air tetapi juga menyumbang kepada pemahaman yang lebih luas tentang cara teknologi boleh dimanfaatkan untuk menggalakkan pengurusan air yang mampan dalam menghadapi cabaran air global yang semakin meningkat. Hasil kajian mendapati kami berjaya menggunakan CADD untuk mereka bentuk prototaip. Seterusnya, kami berjaya membangunkan gabungan tangki solar dan air untuk digunakan sebagai tangki air pintar. Akhirnya, kami berjaya menguji prototaip yang akan digunakan di tapak pembinaan hasil dapatan kajian oleh orang ramai berdasarkan skor min yang diperolehi iaitu 70, 60, dan 50

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CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION

Water is a substance composed of the chemical elements hydrogen and oxygen and exists in gaseous, liquid, and solid states. It is one of the most plentiful and essential compounds. A tasteless and odorless liquid at room temperature, it has the important ability to dissolve many other substances. Indeed, the versatility of water as a solvent is essential to living organisms. Water also exists on other planets and moons both within and beyond the solar system. In small quantities, water appears colorless, but water has an intrinsic blue color caused by slight absorption of light at red wavelengths.Water's density is greatest at about 4 °C (39.2 °F), in the liquid phase. Ice, water's solid phase, is more buoyant, so it forms at the surface of water bodies and freezes downward. Lakes and rivers rarely freeze completely, and the liquid water below can become a winter refuge for aquatic life.[1]

Smart water tank has been designed to give new innovations to engineers out there. This product can provide many advantages to people such as on construction sites. This Smart Water Tank has solar that can supply electricity or as a backup when there is no electricity. It can be used at the construction site to carry out work that uses electricity such as drilling, cement mixing, welding and so on. Previously, workers at the construction site usually used electric generators where it uses a lot of energy and can pollute the environment. In addition, this Smart Water Tank also has another advantage which is that there is a water level detector inside. The purpose of this water detector is to detect the water level when the water is full along with the sound of the buzzer. This situation can at once prevent water wastage at the construction site and lighten the burden of the workers there to monitor water level.[1]

1.2 BACKGROUND OF STUDY

Water is a precious resource that is essential for life, yet it is often taken for granted and wasted. In many parts of the world, water scarcity is a growing problem, and the water demand is expected to increase due to population growth, urbanization, and climate change. To address this challenge, there is a need for innovative solutions that can help to conserve water and optimize its usage.

Solar energy is radiation from the sun capable of producing heat, causing chemical reactions or generating electricity. In the 21st century, solar energy is expected to become increasingly attractive as a renewable energy source because of its inexhaustible supply and its non-polluting character, in stark contrast to the finite fossil fuels coal, petroleum, and natural gas [2]. Solar radiation is light also known as electromagnetic radiation. That is emitted by the sun. While every location on earth receives some sunlight over a year, the amount of solar radiation that reaches any one spot on the earth's surface varies. Solar technologies capture this radiation and turn it into useful forms of energy [3].

The water level detector circuits are used in factories, chemical plants, electrical substations and other liquid storage systems. There are many possible uses for this simple system, examples include monitoring a sump pit (to control pump activation), rainfall detection, and leakage detection. Electronic water level circuits have the capability of alerting if there is a water leak somewhere in the factory. When the water level is too high or too low or exceeds the higher limit, it can detect the water level easily by hearing an alarm sound or from different colors of a light bulb. The purpose of the water level detector is To learn the workings of a water indicator and measure the water level when the circuits indicate when the tank is half and full.

In this project, it will explore the various components and steps involved in implementing a smart water tank project. The discussion of the purpose and requirements, the installation of sensors, the connection to a network, the analysis of data, the implementation of control mechanisms, and the testing and refinement of the system. The end of this project, readers will have a better understanding of how technology can be leveraged to conserve water and promote sustainable water management.

Figure 1: Smart Water Tank

1.3 PROBLEM STATEMENT

The problem statement of this project are water wastage, because they forgot to turn off the motor when the tank is full. The need of this project is to make it easier for people to get water in a simple way. At the same time to avoid wasting water. This is due to the lack of sufficient water at the construction site for them to do construction work. In addition, there is pollution due to the use of electricity from generators that use a lot of energy. Previously, workers at construction sites used electricity from generators as electricity to do work such as drilling, welding, turning on lights and so on.Besides,in rural areas, energy resources are very limited to obtain. Workers at construction sites find it difficult to obtain energy sources such as electricity because in rural areas only natural energy is supplied.

Based on the article we got from [4], a contractor was fined RM5,000 after he was found to have wasted air at a construction site in Kampung Gudang Empat, Tawau, last Friday.In the incident at 4pm, the water pipe connection belonging to the 51 year old man was cut off due to the imprudent use of water.It is understood that the man's action of letting the water out of his two water storage tanks caused the water supply to more than 300 users in the same area to be affected due to the problem of low water pressure.

1.4 OBJECTIVE

1. To design a smart water tank using Computer Aided Design and Drafting (CADD).
2. To develop a multi function water tank with water level detector and solar panel.
3. To test the effectiveness of the project succesfully.

1.5 SCOPE OF PROJECT

In this study, water tanks are essential especially in construction sites used by workers, engineers, contractors. This study also uses the latest solar system. This is because there is a lack of space for users to use electricity or in a way they have to find a generator that is the main electricity supply.

Besides, testing the solar panel and water tank systems to make sure they meet the necessary standards and operate as intended was another aspect of the project. The project scope may also include making sure that all applicable laws and standards are followed, as well as obtaining the required permissions and approvals from local authorities. The project scope is more aimed at contractors or engineers at the construction site for workers. This is to provide them with convenience.

CHAPTER 2
LITERATURE REVIEW

2.1 INTRODUCTION

This chapter discuss about the previous research and the components used to develop this project. This studies included in this chapter are also obtained from several sources such as the internet and other reading materials.

2.2 PREVIOUS RESEARCH OF WATER

Water it is a chemical compound, resulting from the fusion of two elements namely hydrogen and oxygen. Under normal conditions, at room temperature, water is usually in liquidform and covers 70 percent of the earth's surface and water is needed by every living thing on earth to continue life. The current use and management of freshwater is not sustainable in many countries and regions of the world. If current trends are maintained, about two-thirds of the world's population will face moderate to severe water stress by 2025 compared to one-third at present. This water stress will hamper economic and social development unless action is taken to deal with the emerging problems. Although most problems related to water quantity and quality require national and regional solutions, only a global commitment can achieve the necessary agreement on principles, as well as financial means to attain sustainability. Due to the central and integrated role played by water in human activities, any measures taken need to incorporate a wide range of social, ecological and economic factors and needs.[5]

The Assessment thus addresses the many issues related to freshwater use, such as integrated land and water management at the watershed level, global food security, water supply and sanitation, ecosystem requirements, pollution, strengthening of major groups, and national water resource assessment capabilities and monitoring networks.Governments are urged to work towards a consensus regarding global

principles and guidelines for integrated water management, and towards their implementation in local and regional water management situations. The alternative development options available to countries facing water stress, or the risk thereof, needs to be considered in all aspects of development planning.[6]

2.3 WATER TANK

Water tanks as well as rainwater needed for daily use purposes must often be stored in water storage tanks.For all types of residential or commercial buildings, the selection of a storage tank is crucial because Malaysia's water shortage problem worsens every year.

Additionally, the requirement for a water storage tank on the property has increased as a resultof the Department of Irrigation and Drainage in Malaysia emphasising rainwater harvesting.Perak's recent experience with water supply interruptions serves as evidence of the value of saved water.But the design and purpose of each water tank varies. Therefore, selecting the appropriate watertank is difficult because there are many things to take into account.[8]

There are many different types, sizes, forms, and layouts of water tanks. The location of a water tank, as well as its shape or design, are frequently determined by the intended use of the water and how quickly a specific volume of stored water is needed. Of course, you anticipate seeing water tanks near industrial buildings. Similar to this, many housing projects feature water supply tanks a top hills or mountains to meet resident needs. Everywhere you look, you can find water tanks being used for almost any purpose.[7]

2.4 TYPES OF WATER TANKS

2.4.1 Fiberglass Reinforced Plastic (FRP) Water Tank

Figure 2.1: Fiberglass Reinforced Plastic Water Tank

Fiberglass Reinforced Plastic (FRP) Sectional Panel Water Tank is also known as Glass Reinforced Plastics (GRP) Water Tank.These are made of resin mixed with fiberglass and hardener. These water tanks usually come with a food grade coating on the inner surface which makes the material completely safe to store drinking water. The non-cytotoxic coating makes it one of the best choices for drinking water storage.Overall, FRP water tanks are economical, easy to adapt to any size,flexible and strong with a long lifespan. This makes it suitable for industrial, commercial and residential use.[8]

Moreover, FRP Water Tank Size is since these tanks are basically an assembly of different sectional panels, they can be made to fit your needs. FRP water tanks can be made in capacities ranging from 1,000 liters to 500,000 liters. Inaddition, it can also be adapted to different shapes, such as square, L-shaped, rectangular, Z-shaped, T-shaped, U-shaped or unique irregular shapes to fit into the available space.[8]

The advantages FRP Water Tank is firstlly, the walls of the fiberglass tank are relatively thin because the material itself is quite stiff and rigid and can hold large quantities of water.Secondly,FRP tanks offer safe water storage with a food grade coating Next it was less maintenance.Other than that,the tank is light and therefore easy totransport and install. Beside that,the disadvantage FRP Water Tank ,firstly, anki is transparent and allows partial sunlight to pass through. The presence of sunlight can cause algae growth. However, most FRP tanks today are constructed with pigments added to the glass to prevent sunlight. Rigid glass-based materials sometimes become brittle and crack.[8]

2.4.2 Hot Dipped Galvanized Press Steel Tank

Figure 2.2: Hot Dipped Galvanized Press Steel Tank

The HDG water tank is a type of pressed steel tank Q235 Pressed Steel with a thick protective zinc alloy coating on its surface. Zinc coating is added to prevent rust and corrosion on the inner surface of the tank. This makes the tank very durable to last at least 10 years. Various panel sizes areavailable depending on the required coating thickness. The price of the tank varies depending on the size and thickness of the coating. A thicker layer of coating will translate to a more expensive price.[8]

Moreover, HDG Press Steel Water Tank Size has this type of galvanized steel water tank is considered a heavy duty type and is usually produced inlarger sizes. It can be built with a capacity from 30,000 liters to millions of liters. Steel panels are fastened together with bolts and nuts. The thickness of the panel depends on the height of the tank to ensure that the panel can support the weight of the tank. Panel sizes usually range between 1220 x 1220 mm, 1000 x 1000 mm, 1000 x 500 mm, 500 x 500 mm.[8]

The Advantages of HDG is ,it can last 50-60 years and less maintenance. And the cost effective in the long run andvarious steel finishes are available to choose from.Beside that, the diisadvantaged of HDG is,the inner poly layer can be damaged by corrosion and requires the installation of additional cathodes which may add expense and maintenance.And it heavy and difficult to transport.However,the colour options are not available.[8]

2.4.3 Polyethylene Water Tank (Plastic)

Figure 2.3: Polyethylene Water Tank

Polyethylene tanks are a lightweight yet robust water storage solution for storing potable waterfor both residential and industrial purposes. These are usually made using non-toxic high-density linear polyethylene. Also, the plastic used for this tank is food grade and UV treated. This makes them strong and resistant to chemical attacks.Temperature changes, adverse weather conditions, or even UV rays. Although the tank is made using polyethylene, it is not transparent. This means they do not allow sunlight to pass through and are therefore a good choice for minimizing algae growth on tank wall.[8]

Moreover, the polyethylene Water Tank Size is plastic tanks are built using rotational molding techniques. The tank is made according to different capacities and can hold a capacity of up to 50k liters of water. Size and shape may also vary by manufacturer.The flexibility associated with plastic allows for a variety of shapes and styles.The wavy design is the most commonly used. Tanks are also available in a variety of colour options.[8]

The Advantages of Polyethylene Water Tank Size is, light weight, easy to handle and transport.It also low cost and more economical than alternative materials. Moreover, plastic tanks are constructed using food grade plastic and are thereforesafe to store potable water. The plastic is treated with UV and therefore can withstand the effects of the sun.Disadvantage of Polyethylene Water Tank Size is they are not always the best choice for underground installations and colours may fade over time. Although the plastic tank is light, its transportation and installation are not necessarily easy.They are often transported as one piece rather than isolated panels.[8]

2.4.4 Stainless Steel Water Tank

Figure 2.4: Stainless Steel Water Tank

As is clear, this tank is made of stainless steel plates that offer high strength to the structure. Stainless steel materials have stable physical and chemical properties, do not affect air quality, and ensure clean and pure drinking water.The water tank has high strength, light weight, clean appearance, beautiful appearance, and elegance.Needless to say, the texture offered by steel is solid and shiny, easy to clean and eye-catching.This material is completely corrosion resistant, high temperature resistant, and therefore suitable for use in factories, homes, schools, hospitals, restaurantsand dobby, large hotels, institutions, apartments, research and teaching buildings, and food processing, medicine and health , and the electronics industry.[8]

Moreover, stainless Steel Water Tank Size is there is almost no limit to size options when it comes to steel tanks. Since steel tanks can be produced using steel panels or corrugated steel, it allows manufacturers to create tanks ranging from1000 liters to 2,000,000 liters.[8]

The advantages of Stainless Steel Water Tanks is high strength makes it durable and it’s excellent corrosion resistance and good sealing performance.Other than that,the temperature and UV resistant.Offers a visually appealing glossy texture that is easy to clean and maintain.However, high impact resistance and strong seismic performance.Can last more than 15 years and non-toxic also nature friendly.Suitable for undergroundinstallation.Lastly, it’s easy to transport as it is produced as separate pieces.Beside that, the disadvantage of stainless steel water tanks is steel water tanks may be more expensive than alternative options such as plastic.However, their long-term durability makes them cost effective in long run .And no color options available and its’s heavy.[8]

2.4.5 Concrete Water Tank

Figure 2.5: Concrete Water Tank

Concrete tanks are a very popular choice for above ground and underground installations. There arebasically three types of concrete tanks such as pre-made concrete tanks, concrete tank built on site and most tanks are reinforced with steel to add extra strength.[8]

The advantages of concrete water tanks is the high strength of concrete makes it very durable. These tanks are ideal for undergroundcommercial installations as well as residential purposes The disadvantages of concrete water tanks is lime found in concrete may leach into water making it unfit for human consumption. Excess lime bitter taste can increase pH .Steel reinforcement may corrode and cause rusting or cracking. However, expensive to install. The option of removal if needed may be as expensive as installation .Old concrete tanks may sweat white powdery salt residue.[8]

2.5 SOLAR PANEL

Regardless of the harmful effects of burning fossil fuels on global climate,other energy sourceswill become more important in the future because fossil fuels could run out by the early twenty- second century given the present rate of consumption. This implies that sooner or later humanity will rely heavily on renewable energy sources. Here we model the effects of an idealized large-scale application of renewable energy on global and regional climate relative to a background climate of therepresentative concentration pathway.[10]

Beside that,the solar panels alone induce regional cooling by converting incoming solar energy to electricity in comparison to the climate without solar panels. The conversion of this electricity to heat, primarily in urban areas, increases regional and global temperatures which compensate the cooling effect. However, there are consequences involved with these processes that modulate the global atmospheric circulation, resulting in changes in regional precipitation.[10]

There are many uses for solar cells and solar panels. They can be found in commonplace items such as calculators, watches, and flashlights. There are MP3 players, radios, and toys that run on solarpower. Both pagers and cell phones can be fueled by the sun. You won't ever have to worry about batteries with devices like these because they run on solar power.In some cases, solar panels are employed to generate the electricity needed to power bus stops and up road signs. They might generatethe electricity needed to run parking metres or emergency phones found along roads. Some ATMs, which allow you to withdraw money from or deposit money into your bank account, even include solar panels.[10]

2.5.1 How Solar Cells use Light

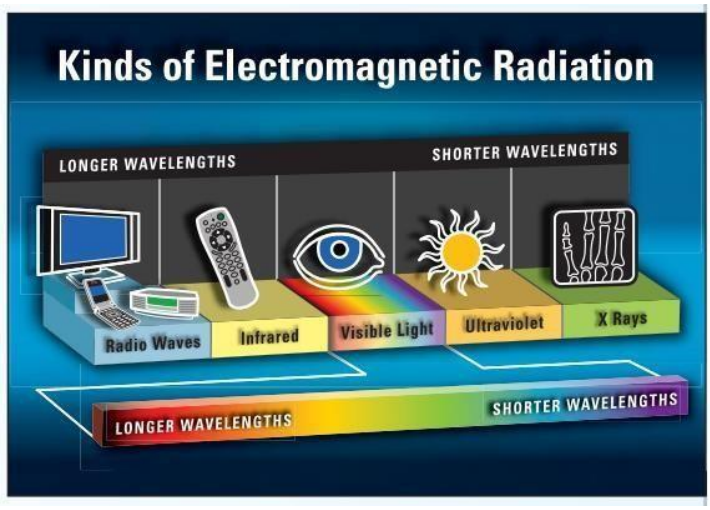


Figure 2.6: Solar's flow

History for solar panel, is Edmond Becquerel of France first noticed that light can cause materials to make electricity. This was in 1839. Other scientists later studied the ties between light, matter, and electricity. One of them was Albert Einstein .In 1905 he explained how atoms take in electromagnetic radiation (such as light) and then give off electrons. This process is called the photoelectric effect.[11]

His cell was made of silicon is found in sand and in many types of rock. He called the cell a "light-sensitive electricdevice." He filed for a patent on it in 1941. Five years later, he got the patent. In 1954, Bell Labs made the first practical solar cell. It was the first one to make enough electricity to run ordinary electrical devices. Still, early cells didn't make much electricity.[11]

Also, they were very costly. Their first important use was in space satellites, starting in 1958.As cells became cheaper, they were used in other ways. The first power station able to make 1 megawatt of electricity with solar panels opened in Hesperia, California, in 1982.[11]

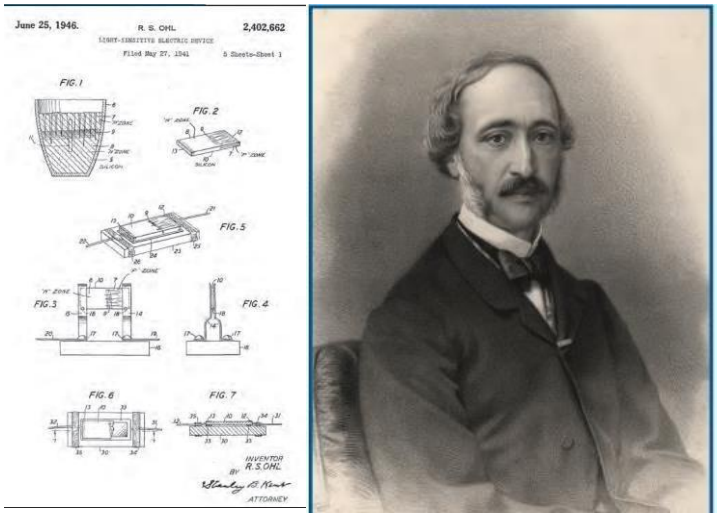


Figure 2.7: Process of Solar and Edmond Becquerel of France

2.5.2 Inside a Solar Cell

Solar cells come in various sizes. Some are tinier than a stamp. Some are 5 inches 12 centimeters across. The cells are made of a type of material known as a semiconductor. Often, they are made of silicon. Semiconductors can conduct, or carry, electricity. They don't do this as well as metals, however. That is why they are called semi. Because the only semi conduct electricity, they can be used to control electric current. On the top and bottom is typically have metal contacts through which current can flow. A typical simple cell has two layers of silicon. One is known as n type. The other is p-type. The layers are different from each other.[11]

2.5.2 How Solar Cells Make Electricity

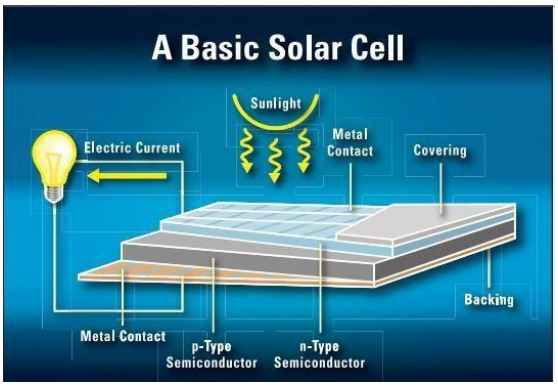


Figure 2.8: Solar cell make electricity

The process of making electricity begins when the silicon atoms absorb some light. The light's energy knocks some electrons out of the atoms. The electrons flow between the two layers. The flow makes an electric current. The current can leave the cell through the metal contacts and be used. Whenlight hits a solar cell, much of its energy is wasted. Some light bounces off or passes through the cell. Some is turned into heat. Only light with the right wavelengths, or colors, is absorbed and then turned into electricity.[11]

2.6 Types of Solar Panel

One of the most popular energy sources nowadays is solar energy. This solar invention will use asolar panel as a tool to help with energy production. Sunlight is captured by the solar panel and converted into power.

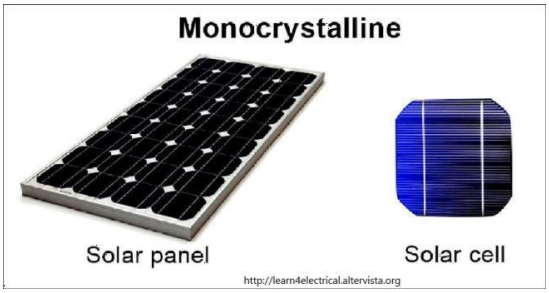


Figure 2.9: Monocrystalline solar panel

Monocrystalline Silicon solar panels are the earliest variety. The primary component of the solar cells in this kind of solar panel is silicon. Using sophisticated technology, this silicone substanceis thinly cut. The solar cells that are made using this method will be identical to one another and have a high energy level.High efficiency solar cells of the single crystalline variety are used in this type of solar panel. Physical characteristics of this sort of solar panel include dark black cells with cut modelsat each corner.[12][13]

Figure 2.10: Polycrystalline solar panel

Polycrystalline,this kind of solar panel is created by pouring many melted silicon crystal rods intoa mould shaped like a face. These solar panels use silicon crystals that are different from those found in monocrystalline solar cells. As a result, no two solar cells created are exactly alike. Additionally, energy capacity is less than monocrystalline.[12][13]

2.7 WATER LEVEL DETECTOR

Definition of a water level indicator: An information-relaying system that tells a control panel if the water level in a body of water is high or low. Certain water level indicators detect water levels by combining float switches and probe sensors. "To detect and indicate the water level in an overhead tank or any other water container, the Water Level Indicator uses a straightforward mechanism".[14]

The sensor that alerts the control panel to the need for remedial action is the water level indicator sensor, sometimes referred to as a probe sensor. The control panel is informed when the water levels are too high or too low by a combination of high and low sensors. After that, the control panel will automatically stop.

A water level indicator sensor, also known as a probe sensor, is what tells the control panel that corrective action is needed. A combination of high and low sensors are used to tell the control panel when water levels are too high or too low. The control panel will then automatically turn the pump on or off depending on the corrective action needed.

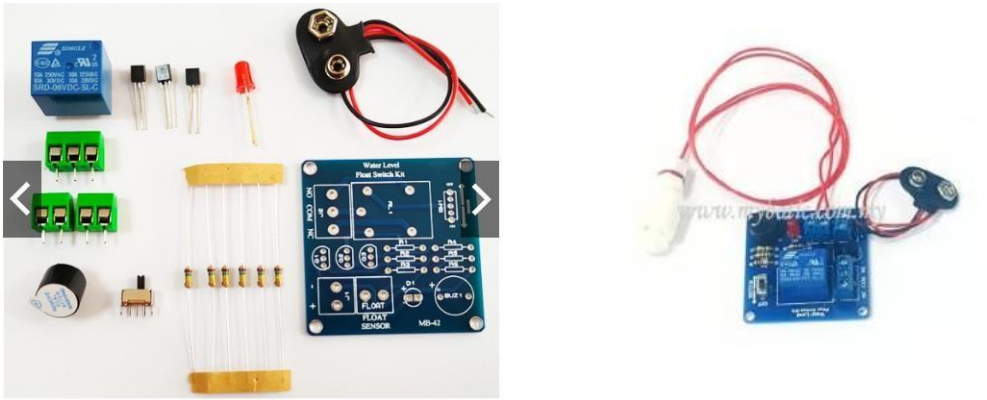


Figure 2.11: Water level detector

2.7.1 HOW WATER LEVEL WORKS

The water level sensor's principle of operation is that the pressure on its front surface is translated into the liquid level height when it is submerged to a specific depth in the liquid to be measured. $P=\rho.g$ is the calculating formula. $H+Po$ is the formula where P is the liquid surface pressure of the sensor, ρ is the liquid's density to be measured, g is the local acceleration of gravity, Po is the liquid's atmospheric pressure, and H is the liquid's depth at which the sensor descends.[14]

A gadget called a level sensor is used to measure and keep track of liquid and occasionally solid levels. Upon detecting the liquid level, the sensor transforms the sensed information into an electrical signal. Level sensors are mainly used for monitoring reservoirs, oil tanks or rivers.[14]

2.7.2 BENEFITS OF WATER LEVEL SENSOR

First is simple structure which there are no movable or elastic elements, so the reliability is extremely high, and there is no need for regular maintenance during use. The operation is simple and convenient.[14]

Secondly is Convenient installation when using,can connect one end of the wire correctly, and then put the other end of the water level probe into the solution to be measured.Moreover, strong function it can be directly connected to the digital display meter to display the value in real-time, or it can be connected to a variety of controllers and set the upper and lower limits to control the water volume in the container.[14]

Furthermore, is variety of types which have liquid level sensors have various structural designs such as input type, straight rod type, flange type, thread type, inductive type, screw-in type, and float type. It can meet the measurement needs of all different places.Next is accurate measurement which can built-in high-quality sensor has high sensitivity, fast response, and accurately reflects the subtle changes of the flowing or static liquid level, and the measurement accuracy is high.[14]

2.7.3 DETECTION OF WATER LEVEL

Δ'E is defined as the difference between two colors in an L*a*b* color space. The type of color is determined by comparing the values generated from a mathematic equation. In other words, the differences of images can be found by looping over each pixel between images and checking if the pixel of the first image is similar with the pixel of the second image in the same spot. For two images, it only requires to loop over the pixels of the first and compare them with those of the second. If the pixels were different, the differences were calculated by using the ΔE* metric and the value were recorded. The source code to detect the differences between two images is shown in Figure 4.2.

```
diff = [] images.first.height.times do |y|
images.first.roy(y).each_with_index do |pixel, x| diff <<
[x,y] unless pixel == images.last[x,y] end end
```

Figure 4.2: The source code for detecting color difference.

2.8 TYPES OF WATER LEVEL SENSORS

Figure 2.12: Optical water level sensors

Optical water level sensors which use infrared LEDs and phototransistors, and when the sensor is in the air, they are optically coupled. When the sensor head is immersed in the liquid, the infrared light will escape, causing the output to change. These sensors can detect the presence or absence of almost any liquid.Are not sensitive to ambient light, are not affected by foam when in air, and are not affected by small bubbles when in liquid. This makes them useful in situations where state changes must be recorded quickly and reliably, and in situations where they can operate reliably for long periods without maintenance. Advantages is non-contact measurement, high accuracy, and fast response. Disadvantages is do not use under direct sunlight, water vapor will affect the measurement accuracy.[14]

Figure 2.13: Capacitance liquid level sensor

Capacitance level switches use 2 conductive electrodes (usually made of metal) in the circuit, and the distance between them is very short. When the electrode is immersed in the liquid, it completes the circuit. Benefits: It's possible to gauge how much the liquid in the container is rising or falling. The capacitance between the electrodes can be determined by setting the electrode and the container to the same height. Without capacitance, there is no liquid. A whole container is represented by a full capacitance. After recording the measured values for "empty" and "full," the liquid level is shown using metres that are calibrated to show 0% and 100%. Advantages is the electrode's capacitance will change due to corrosion, and it will require cleaning or calibration.[14]

Figure 2.14: Turning fork level sensor

Tuning fork level sensor: The tuning fork level gauge is a liquid point level switch tool designed by the tuning fork principle. The working principle of the switch is to cause its vibration through the resonance of the piezoelectric crystal. Every object has its resonant frequency. The resonant frequency of the object is related to the size, mass, shape, force of the object. A typical example of the resonant frequency of the object is: the same glass cup in a row Filling with water of different heights, you can perform instrumental music performance by tapping.Advantages: It can be truly unaffected by flow, bubbles, liquid types, etc., and no calibration is required.Disadvantages: Cannot be used in viscous media.[14]

Figure 2.15: Diaphragm liquid level sensor

Diaphragm liquid level sensor is the diaphragm or pneumatic level switch relies on air pressure to push the diaphragm, which engages with a micro switch inside the main body of the device. As the liquid level increases, the internal pressure in the detection tube will increase until the microswitch is activated. As the liquid level drops, the air pressure also drops, and the switch opens. Benefits the switch won't come into touch with liquids, it works with a wide variety of liquids, and the tank doesn't need power.[14]

Figure 2.1 : Float water level sensor

Float water level sensor : The first level sensor was a float switch. They are devices made of metal. The arm is attached to the hollow float. The arm will be forced up and down as the float rises and lowers in the liquid. The arm can be wired to a level gauge that turns from full to empty when the liquid level falls, or it can be wired to a mechanical or magnetic switch to indicate on/off. A cheap and efficient way to gauge the water level in the basement pumping pit is to utilise float switches on your pumps. Advantages: The

float switch can measure any type of liquid and can be designed to operate without any power supply.Disadvantages: They are larger than other types of switches, and because they are mechanical, they must be used more frequently than other level switches.[14]

Figure 2.17: Ultra liquid level sensor

Ultrasonic liquid level sensor is the ultrasonic level gauge is a digital level gauge controlled by a microprocessor. In the measurement, the ultrasonic pulse is emitted by the sensor transducer. The sound wave is reflected by the liquid surface and received by the same sensor. It is converted into an electrical signal by a piezoelectric crystal. The time between the transmission and reception of the sound wave is used to calculate the Measure of the distance to the surface of the liquid. The ultrasonic water level sensor operates on the following principle: when the ultrasonic transducer probe comes into contact with the surface of the material being measured, it emits a high-frequency pulse sound wave that is reflected. The transducer then receives the reflected echo and transforms it into an electrical signal. the duration of the sound wave's propagation. It is proportionate to the separation between the object's surface and the sound wave. The formula S=CT/2 can be used to represent the relationship between the sound wave transmission distance S, sound speed C, and sound transmission time T.Benefits include: non-contact measurement, nearly infinite measured medium, and broad applicability for height measurements of different liquids and solids.[14]

Figure 2.18: Radar altitude indicator

Radar altitude indicator is a liquid level measuring device based on the time travel theory is called a radar liquid level. Radar waves travel at the speed of light, and electrical components can transform their running time into a level signal. High-frequency pulses from the probe travel across space at the speed of light. When the pulses encounter a material's surface, they are reflected back and picked up by the meter's receiver, which transforms the distance signal into a level signal. Advantages is wide application range, not affected by temperature, dust, steam. Disadvantages , it is easy to produce interference echo, which affects the measurement accuracy.[14]

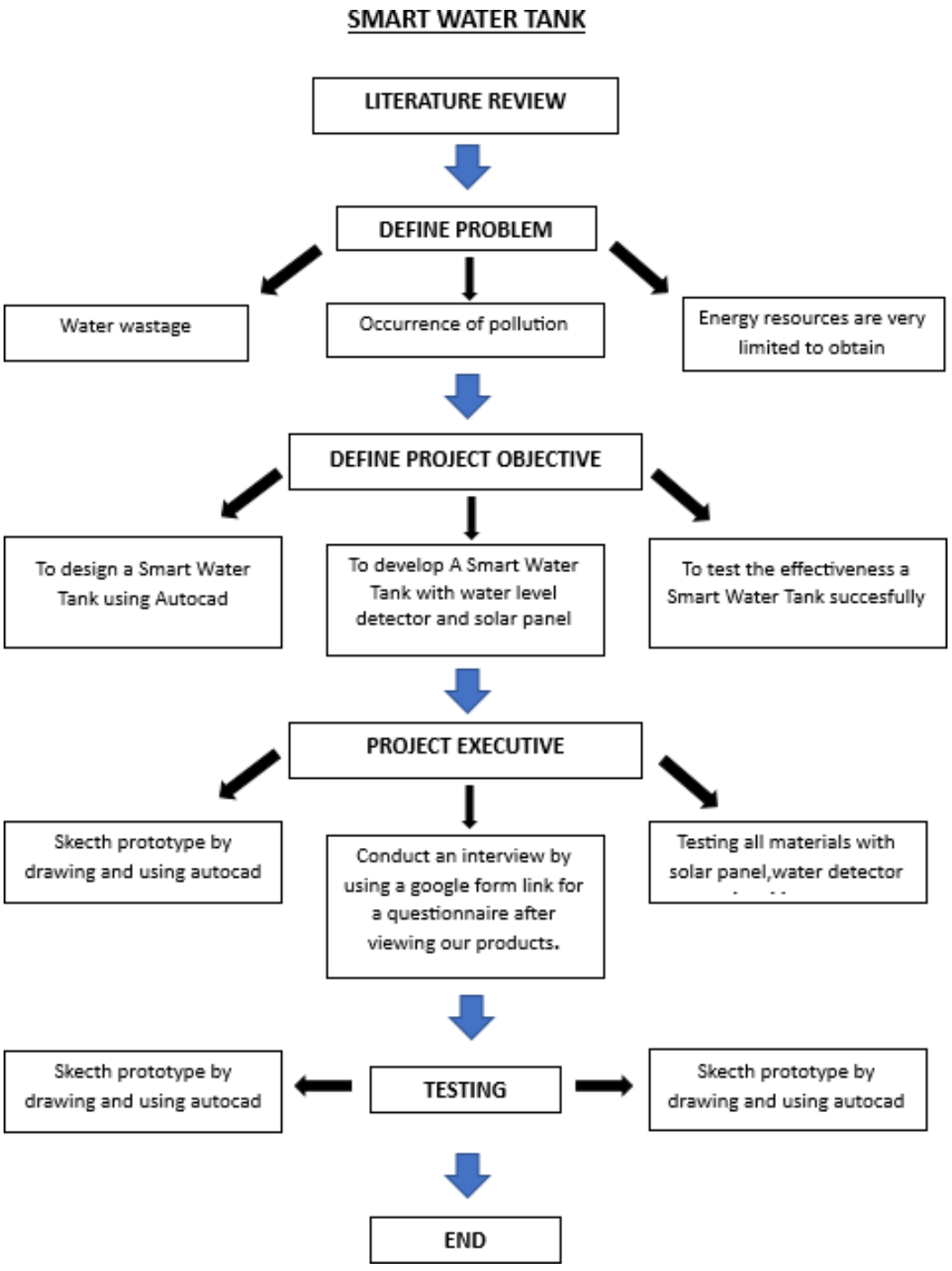
CHAPTER 3
RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter will explain about the design of the project,which is the method of project production,materials and equipment and the method of data analysis.All the design content of this project is discussed together with the group members and the project supervisor.

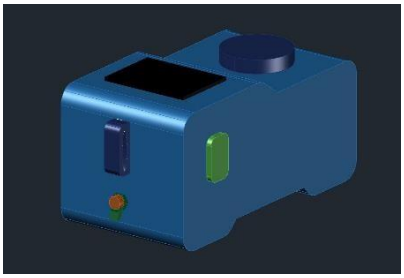
Each step of project is a process to complete the project. Every step must be followed one by one and must be done carefully. If or when any error occurs, it can make a project probably not to operate properly and perfectly. We will discuss the purpose and requirements, the installation of sensors, the connection to a network, the analysis of data, the implementation of control mechanisms, and the testing and refinement of the system. The water tank would be designed to store and distribute water efficiently. It should be made of durable materials, properly insulated to minimize heat transfer, and equipped with Solar panels, also known as photovoltaic (PV) panels, are devices that convert sunlight into electricity through the photovoltaic effect. They are a crucial component of solar power systems and have become increasingly popular due to their renewable and clean energy generation capabilities.

3.2 METHODOLOGY FLOW CHART

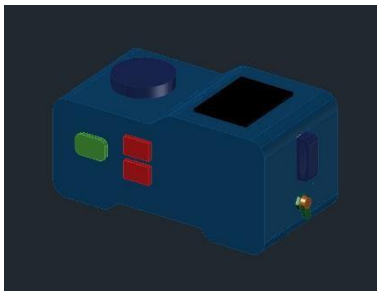


3.2.1 Design the combination between water tank and solar energy.

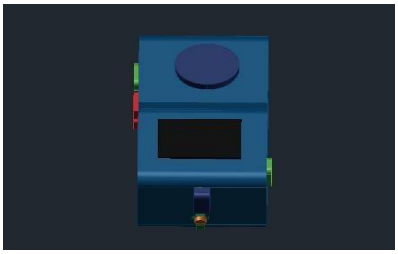
To design the combination between water tank and solar energy that will give many benefits towards user using AutoCADD. Designing a smart water tank with solar using AutoCADD requires a good understanding of the software tools and commands.



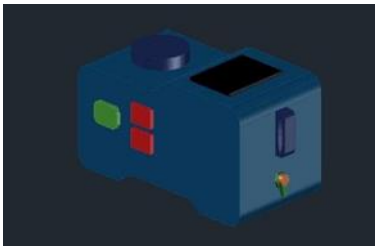
Front view



Side view



Plan view



Side view

Figure 3.1: View (front, side left, side right, plan)

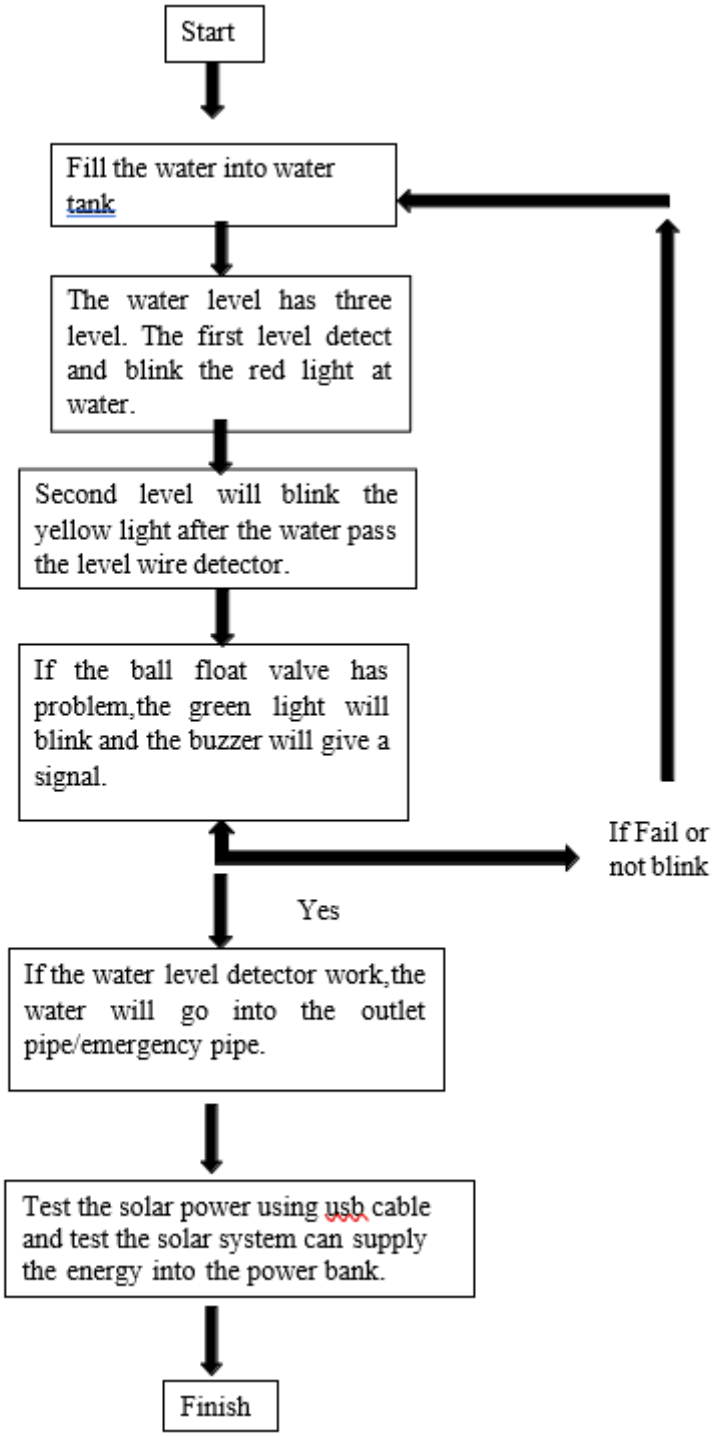
3.2.2 Develop a smart water tank appliance for users and the environment.

User interviews allow we to have a more in-depth conversation with users, and can provide valuable insights into their needs and preferences. we can conduct interviews by using online question like questionnaire and be sure to ask open-ended questions and actively listen to the user's responses. Collecting of data and information about this ‘Smart Water Tank’ by distributing questionnaires to respondents which we have a citizen or student and on the run. The data we can obtained from various methods evaluated together. The result of the finding through the interview are also helpful in facilitating the work of analysing data. This smart water tank is carried out by experimenting on the product to prove that it can be placed at the construction site.

Figure 3.5: show the data from questionnaire.

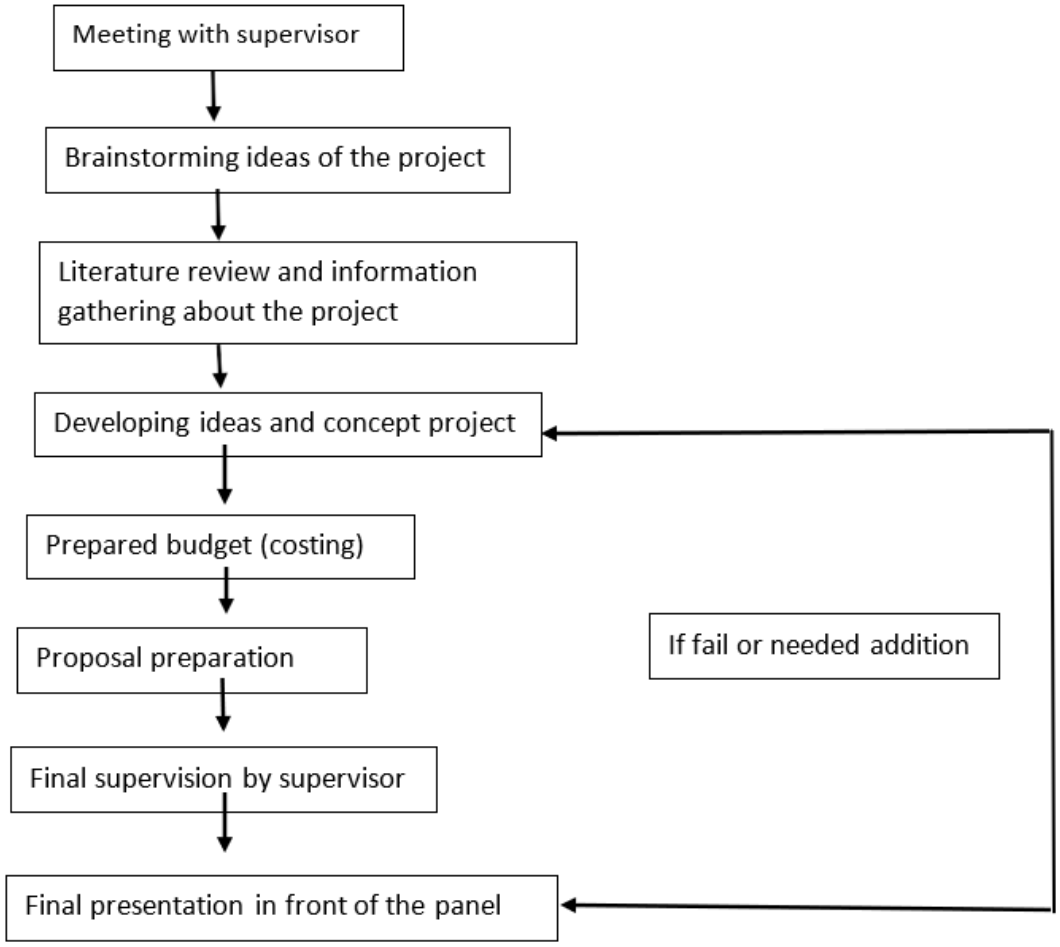
3.2.3 Test the product before release it.

We will test the prototype system to identify any issues or areas for improvement, and refine the system design as needed.



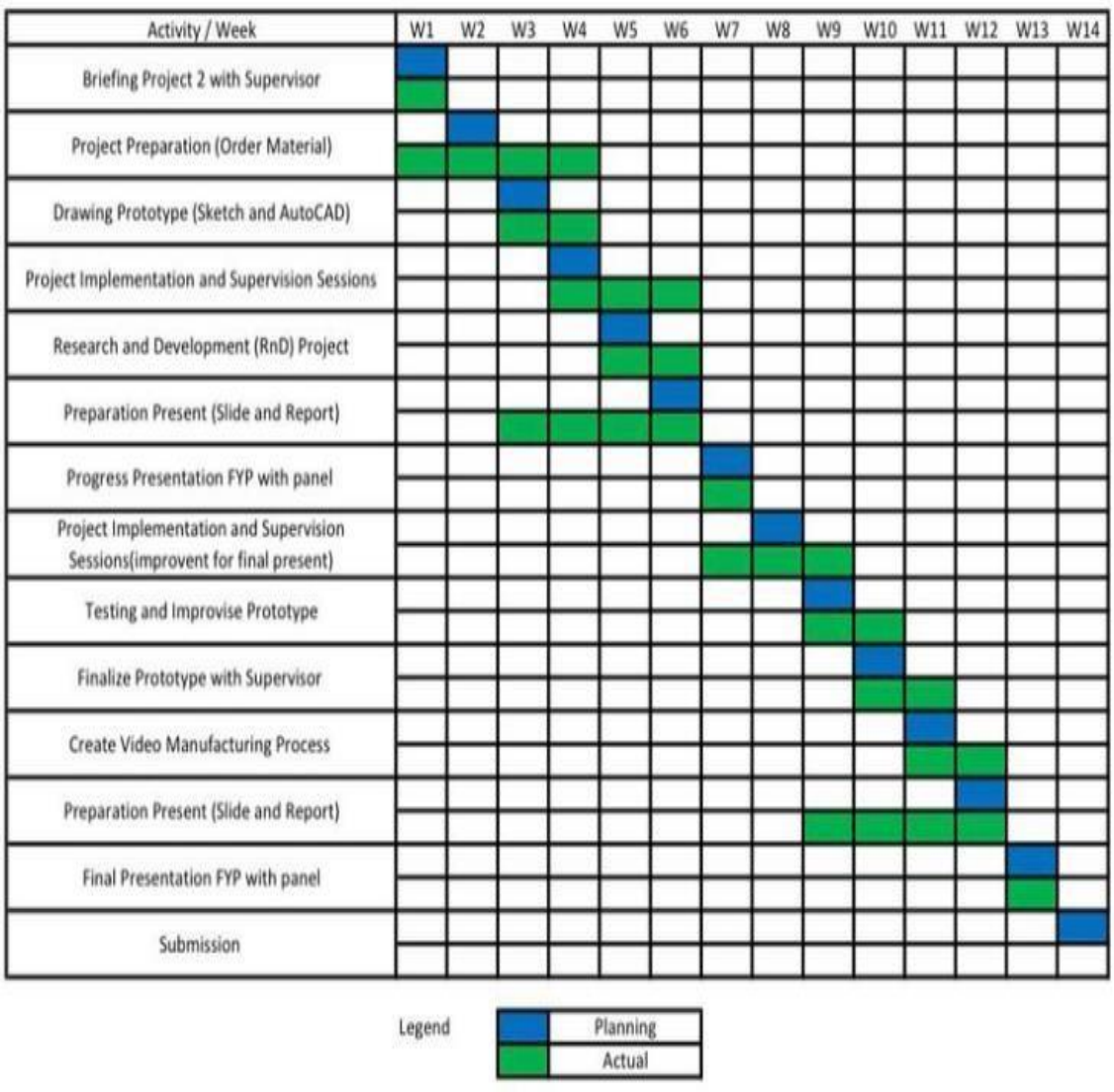
3.3 FLOW CHART AND GANTT CHART OF PROJECT

3.3.1 Project implementation procedure



3.3.2 Gantt Chart

A Gantt chart is a project management tool that allows project managers to create a project schedule. It has two main parts, a task list on the left side and a timeline on the right side. The timeline shows the start and end dates of a project's components, such as resources and planning. Each task is represented by a bar, and the length of the bar represents the duration of the task.



3.4 MATERIAL AND EQUIPMENT

Table 3.2: Explanation on material and equipment components.

MATERIAL	EXPLANATION
Solar panel  Figure 3.2	Solar panels absorb the sunlight as a source of energy to generate electricity or heat. A photovoltaic (PV) module is a packaged, connect assembly of typically 6x10 photovoltaic solar cells. Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications. Each module is rated by its DC output power under standard test conditions (STC), and typically ranges from 100 to 365 Watts (W). A single solar module can produce only a limited amount of power; most installations contain multiple modules.
Hot glue gun  Figure 3.3	A hot glue gun is a very useful tool for joining modelling materials and even more substantial materials can be fixed together with it. 'Sticks' of solid glue are pushed into the back of the gun, the trigger is pressed pushing the glue stick forward and molten glue comes out of the nozzle.

Water Tank  **Figure 3.4**	A water tank is a container used to store and hold water. It can come in various shapes, sizes, and materials, and its design often depends on its intended use. Water tanks are commonly made of materials like plastic, fiberglass, concrete, or metal, and they can be above ground or underground.
Solar charger power bank  **Figure 3.5**	A solar charger power bank is a portable device that typically combines the functionalities of a power bank (a portable battery) with solar panels to harness solar energy for charging.
Water level detector  **Figure 3.6**	A water level detector is a device used to monitor and indicate the level of water in a tank or a container. There are various types of water level detectors, each employing different methods to measure and signal the water level.
Buzzer  **Figure 3.7**	A buzzer is an electronic device that produces a loud, audible sound. It's typically used to indicate or draw attention to something. Buzzer sounds can vary in tone and intensity depending on their design and purpose.

Test pen  **Figure 3.10**	Test Pen is one of the most common tools used by electricians in doing their work. Its relatively small shape and similar to a pen makes it very easy to carry everywhere. The tip of the Test Pen in the form of a "Minus" can be used as a screw to loosen or tighten the screw. So the test pen is basically ameasuring instrument that is used to find out or check whether an electrical conductor has an electrical voltage or not. The electricity conductor referred to here can be in the form of electrical cables, electrical wires or electrical outlets.
Pipe and connector  **Figure 3.11**	Polyvinyl Chloride pipes – also known as PVC pipes – are the most common pipes for plumbing today. They are durable and able to withstand the water pressure without tearing or cracking. Fixing PVC leak is much easier than fixing coppxer leaks, which is another reason plumbers prefer them.

3.5 SUMMARY

To innovate on the water tank design for construction sites, combining water tanks and solar energy is a viable option. Project innovation for construction sites that experience water shortages or lack of electricity supply. It's important to consider factors such as solar resource, climate, local building code requirements, and safety issues when designing and installing such systems. The goal of system design and development is to create solutions that meet the needs of stakeholders, including users and other interested parties. This is an important step in the construction of software systems and involves the development of stakeholder expectations, technical requirements, logical decomposition, and design.

CHAPTER 4
ANALYSIS DATA AND RESULT

4.1 INTRODUCTION

This chapter reviews the results and analysis of the data whether significant or not. After the compilation of the questionnaire and the results have been analyzed, whether this innovation is able to have an impact on teaching and learning or not.

Thus, the project's development is going well. In order to expand on the meaning, significance, and broader context of the conclusions drawn from the data analysis, it tries to elucidate the insights discovered from data sets gathered throughout the research process.

The data analysis was performed based on the method that has been discussed in Chapter 3. Analysis is done once all the data has been collected to determine how successful the creation of the Smart Water Tank was. The results obtained are the result of feedback filled in by students and members of the public using the Google form platform.

4.2 DATA ANALYSIS

4.2.1 Respondent demographic data

Gender, occupation are among the demographic information provided by respondents.The result of this finding is given as a percentage.

Table 4.1 Respondents Based on gender

Bil	Gender	Number of responders	Percentage
1	Female	23	33.3
2	Male	46	66.7
TOTAL		69	100

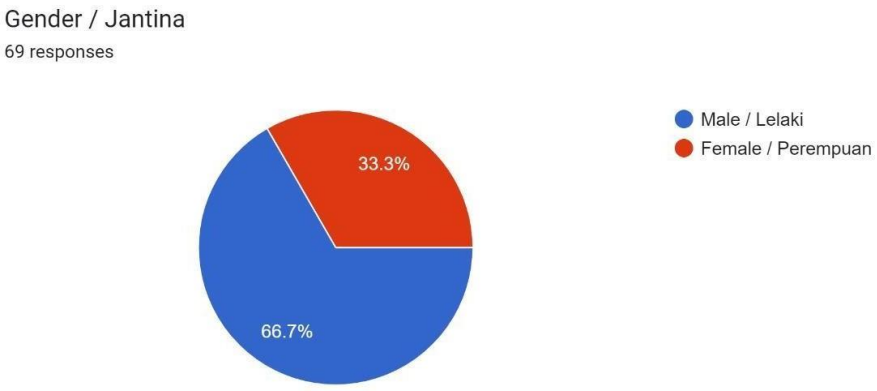


Figure 4.1: Gender of respondent

This pie chart displays the total number of respondents is 69 residents of Taman Cempaka who provided input on the study that was carried out. Of the respondents, 33.3% were female and 66.7% were male.

4.2.2 Occupation

Table 4.2 Respondents Based on Occupation

Bil	Occupation	Number of responder	Percentage
1	Citizen	42	60.9
2	Students	27	39.1
	TOTAL	69	100

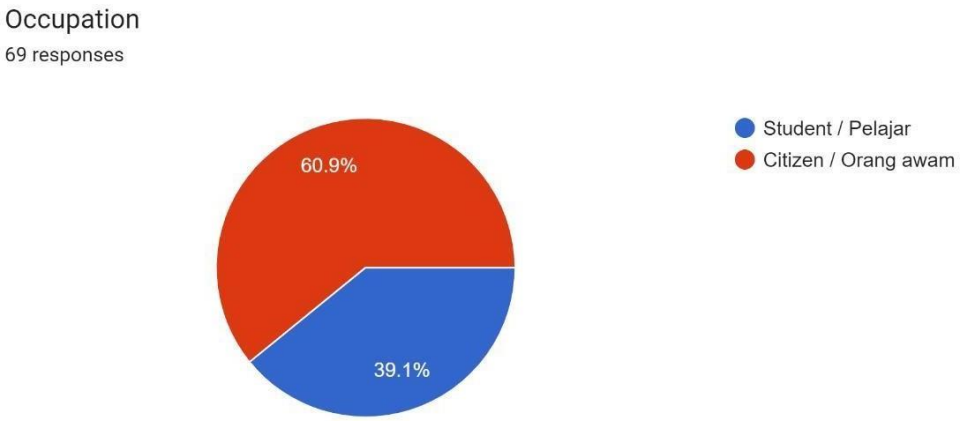


Figure 4.1 Occupation of Responder

This pie chart displays the total number of respondents is 69 residents ofTaman Cempaka who provided input on the study that was carried out. Of the respondents, 60.9% were citizen and 39.1% were male.

4.3 Identify the level of effectiveness of the products produced

The level of agreement was done with 71 respondents who submitted their answers in Google Forms. This analysis is based on data from a questionnaire from the respondents of the students and the public of different genders.

4.3.1 List of Questionnaire question

In the questionnaire, there are 10 questions to identify the level of effectiveness of the development of Smart Water Tank. Based on Table 4.3 below, there are several questions contained in the questionnaire that we have distributed to students and the public.

Table 4.3 show the question of the product developed.

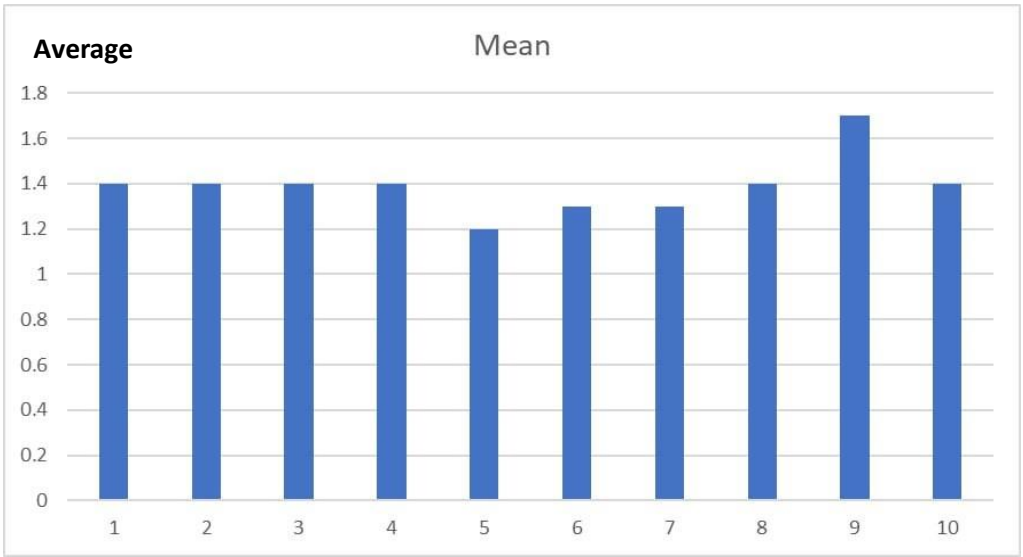
No	Questions	Scale: strongly Disagree, Disagree, Satisfactory, Agree, Strongly Agree
1	Do you think this smart water tank is suitable for use nowadays?	1.4
2	If you are a worker at a construction site, do you agree that water sources are important at the construction site?	1.4
3	Do you agree if solar energy is combined with water sources?	1.4
4	Do you think this design can save the use space?	1.4
5	When there is no source of electricity, do you think solar panels can provide another alternative in supplying electricity?	1.2

6	Do you agree if the use of green energy technology is applied today?	1.3
7	Do you agree that the water level detector is placed in the smart water tank to monitor the height of the water level?	1.3
8	Is the water level detector able to prevent wastage of water at the construction site?	1.4
9	Is this smart water tank easy to operate?	1.7
10	Do you think the lifespan of this smart water tank can last long?	1.4

4.3.2 Graph of the level effectiveness of product carried out

In the graph in Figure 4.4 below, it shows the percentage of people who answered the question on the google form. This graph shows the average of satisfied, agree and strongly agree.

Figure 4.2: Graph average of satisfied, agree, and strongly agree



4.4 Material Cost

Table 3.41: material cost

	MATERIALS	**QUANTITY**	**PRICE PER UNIT(RM)**	**TOTAL(RM)**
1	Solar panel	1	31.90	31.90
2	Water tank	1	54.00	54.00
3	Water level detector	1	31.00	31.00
4	Battery holder	1	5.00	5.00
5	Battery	5	2.00	10.00
6	Buzzer	1	3.00	3.00
7	Solar charger power bank	1	55.00	55.00
8	Hot glue gun	1	15.00	15.00
9	Test pen	1	2.00	2.00
10	Pipe 1’ + connector	1	3.60	3.60
11	Float valve	1	8.50	8.50
	TOTAL(RM)			**RM223.50**

4.4 DEVELOP THE PROJECT

Several tools are used to punch and join all the materials to produce a prototype for this projectas shown in Figure 4.4.1 and Figure 4.4.2

Figure 4.4.1: Developing process

Figure 4.4.2: Semi-Finished Prototype

4.5 SUMMARY

The results of the study show that most respondents agree and strongly agree with our product, the Smart Water Tank. In addition, the findings of this study also show that there is a lot of support that this product can help users in knowing the uses of water tank combinations. The combination of a product is important to give innovation to people out there.

CHAPTER 5
CONCLUSION

5.1 INTRODUCTION

This chapter will present the conclusion of the studies that have been reported and its suitability in accordance with the objective of the studies that have been done. This chapter is the last chapter in this review and generally this chapter will discuss in more detail the findings of the studies that have been analyzed in Chapter 4. This chapter are supported by opinions that may strengthen the results of the analysis of the study. The decision made is based on all the results obtained from the trials conducted and suggestions that will presented for this chapter. In addition, conclusions have been made to test this prototype. Next suggestions and conclusions will be made after reference from the results of the finished prototype being developed. This chapter will also suggest idea that are new to the upcoming product.

The incorporation of a water level detector not only provides a reliable means of tracking water levels but also lays the foundation for a more responsible and efficient use of this precious resource. The automated features of this prototype contribute to user convenience while simultaneously fostering environmental sustainability. By preventing overflows and optimizing water usage, this system aligns with the goals of water conservation and resource efficiency. As we continue to face challenges related to water scarcity, innovations like the smart water tank with water level detector become indispensable tools in building a more resilient and sustainable future. This project serves as a testament to the potential of technology in addressing pressing global issues and promoting responsible resource management.

5.2 CONCLUSION

The result from the analysis found that the prototype that we developed have achieved the objectives we target. For the first objective about this project was we had successful design the combination between water tank and solar energy that will give many benefits towards user using CADD. First of all, we download the CADD by Autodesk from google site. By using our skill that we had learn it from semester 1, there is no problem to design it follow to the prototype shape. We design the prototype by 4 view such as plan view, side view, front view and back view.

Next, we can conclude that the respondent has a positive perspective of the prototype that we produce. The second objective of this study is to develop a smart water tank with solar and water level detector. Collecting of data and information about this 'Smart Water Tank' by distributing questionnaires to respondents which we have a citizen or student and on the run. The data we can obtained from various methods evaluated together. The result of the finding through the interview are also helpful in facilitating the work of analysing data. This smart water tank is carried out by experimenting on the product to prove that it can be placed at the construction site.

In this study, the effectiveness of the smart water tank was focused to supply the clear water resource and electric power source using friendly environment solar panel. For example, if there was a construction in the forest, the user can use pump water to supply the water into the smart water tank. A part from that, if the workers at the construction need an electric power supply, they must bring a generator machine that will give many weaknesses at the environment. By using the solar panel that already developed into the smart water tank, it will give benefits to the environment and surrounding.

This smart water tank also come with water level detector to make sure that the water intake into the water tank is not waste. When the clear water fill into the water tank, it will blink the red light to tell the water already pass from the first level water in the water tank, then continue with the yellow light at the water tank to tell that the water already reach the second level.Lastly, the green light will blink followed by buzzer ring to give a sign that the water tank is already full in the water tank. The noise that made

from the buzzer will inform to the worker around the water tank to close the water pump and if there is no worker at the water tank, the overflow pipe will remove the water from the tank.

Lastly, our third objective from this project was to test the product before release it.Before we release our prototype already test this prototype many times to find and know the problem before we explain to student or everyone. The example problem that we can get from this objective was we detect that the water level detector should use 9V battery to compare with battery 6V that we buy.

The cost to spent on developing this prototype are cheaper to compared with existing prototype. In addition, the necessary manpower in developing this prototype until completion is 4 people. Overall, with this availability of smart water tank can make it easier for users with consume only minimal energy and environment friendly.

5.3 RECOMMENDATIONS

The smart water tank with water level detector, is a prototype that can supply water resource in whatever situation and supply electric energy power by using solar panel by keep the energy into the power bank kit. In addition, this smart water tank also provide water level detector to show at the user about the water level condition in the water tank and give a pre warning if the water in the tank nearly full.

Here are few suggestions or recommendations for enhance and improve the research done on the smart water tank with water level detector to obtain complex and more useful combination prototype.

i. Ensure that the smart water tank system allows for remote monitoring and control.
ii. Add water pump motor on the water tank to easily find the water source for example there a project in the forest.
iii. Be able to detect the pH level of incoming water and water turbidity.
iv. When the water level reaches full level, the buzzer will noise and the water intake will automatically stop.

5.4 SUMMARY

Based on the search results, water tanks are commonly used on construction sites to store and transport water. Water tanks play an important role in providing temporary water supply to construction sites, especially in areas where water supply is inaccessible, unsuitable or insufficient. Water it is used for various purposes, including mixing concrete, dust suppression, grouting, drilling, and piling, among others. Water is also used for worker hydration and cleaning equipment and tools.

Water level indicators are electronic circuits that indicate the water level in a tank and help to save water. The water level indicator is used to show the level of water in an overhead tank, which keeps the user informed about the water level at all times and avoids the situation of water running out when it is most needed. The presence of a water level indicator in a reservoir can help control wastage and water inadequacy in such a reservoir.

Solar energy can help supply electricity in on-site building use. Solar panels harness energy from the sun to power electric for construction site. Solar energy can be used to power generator for tool solar mobile power units can supply electricity to both light- and heavy- duty tools used on building sites, as well as serve as a backup emergency power source. Solar energy also can be stored in batteries, providing a reliable power source for construction sites.

In summary, smart water tanks can help construction sites in many ways. The tank is equipped with sensors and software that allows for water level monitoring and solar panels that can provide power for use by workers in the process of doing construction work.

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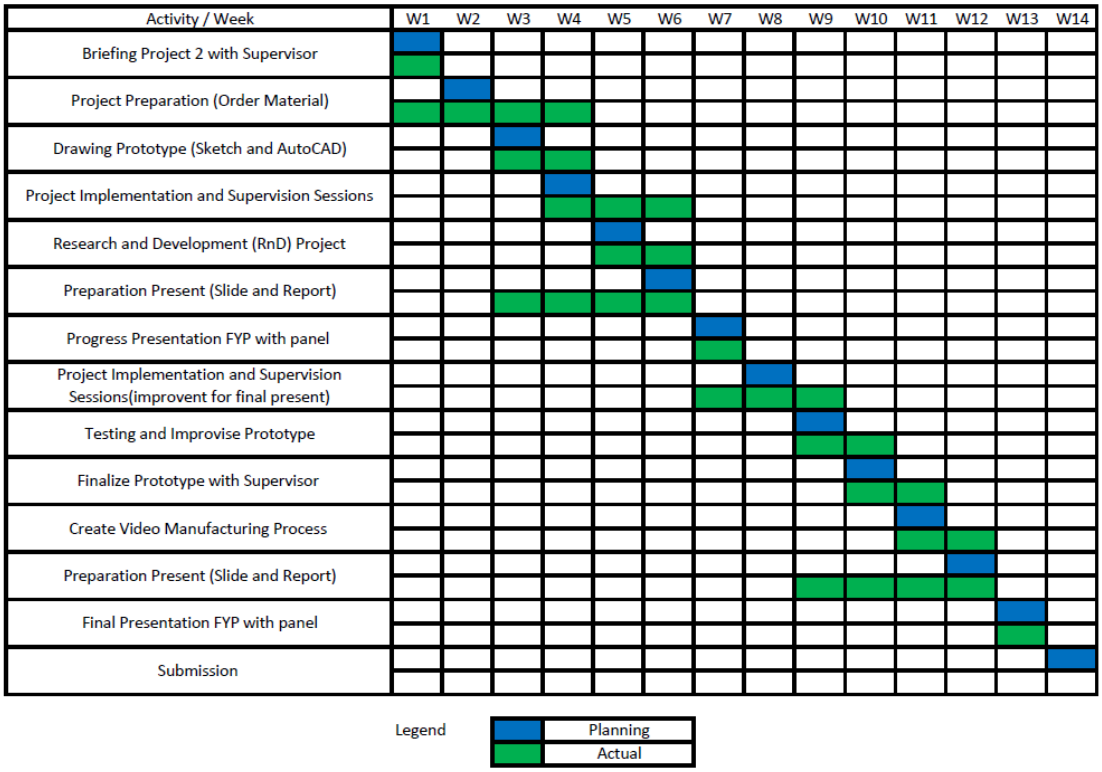
APPENDIX 1

Gantt Chart



APPENDIX 2

Estimated Cost

	MATERIALS	QUANTITY	PRICE PER UNIT(RM)	TOTAL(RM)
1	Solar panel	1	31.90	31.90
2	Water tank	1	54.00	54.00
3	Water level detector	1	31.00	31.00
4	Battery holder	1	5.00	5.00
5	Battery	5	2.00	10.00
6	Buzzer	1	3.00	3.00
7	Solar charger power bank	1	55.00	55.00
8	Hot glue gun	1	15.00	15.00
9	Test pen	1	2.00	2.00
10	Pipe 1’ + connector	1	3.60	3.60
11	Float valve	1	8.50	8.50
TOTAL(RM)				RM223.50

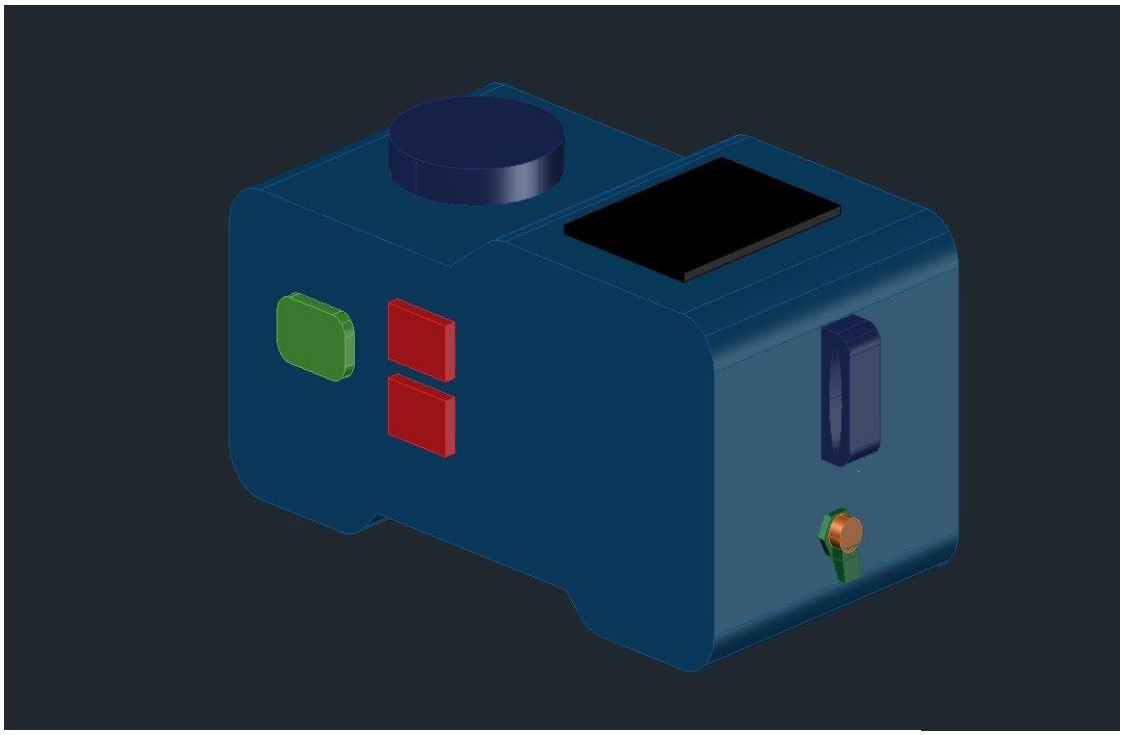
APPENDIX 3

Specifications And List of Materials and Equipment

MATERIAL	EXPLANATION
Solar panel	Solar panels absorb the sunlight as a source of energy to generate electricity or heat.
Hot glue gun	A hot glue gun is a very useful tool for joining modelling materials and even more substantial materials can be fixed together with it.
Water tank	A water tank is a container used to store and hold water.
Solar charger power bank	A solar charger power bank is a portable device that typically combines the functionalities of a power bank (a portable battery) with solar panels to harness solar energy for charging.
Water level detector	A water level detector is a device used to monitor and indicate the level of water in a tank or a container.
Buzzer	A buzzer is an electronic device that produces a loud, audible sound.
Battery	It is used to supply energy turn on water level detector.
Cooper wire	It is used to make electrical contacts.
Test pen	Test Pen is one of the most common tools used by Electricians in doing their work. Its relatively small shape and similar to a pen makes it very easy to carry everywhere.
Pipe and connector	They are durable and able to withstand the water pressure without tearing or cracking. Fixing PVC leak is much easier than fixing coppxer leaks, which is another reason plumbers prefer them.

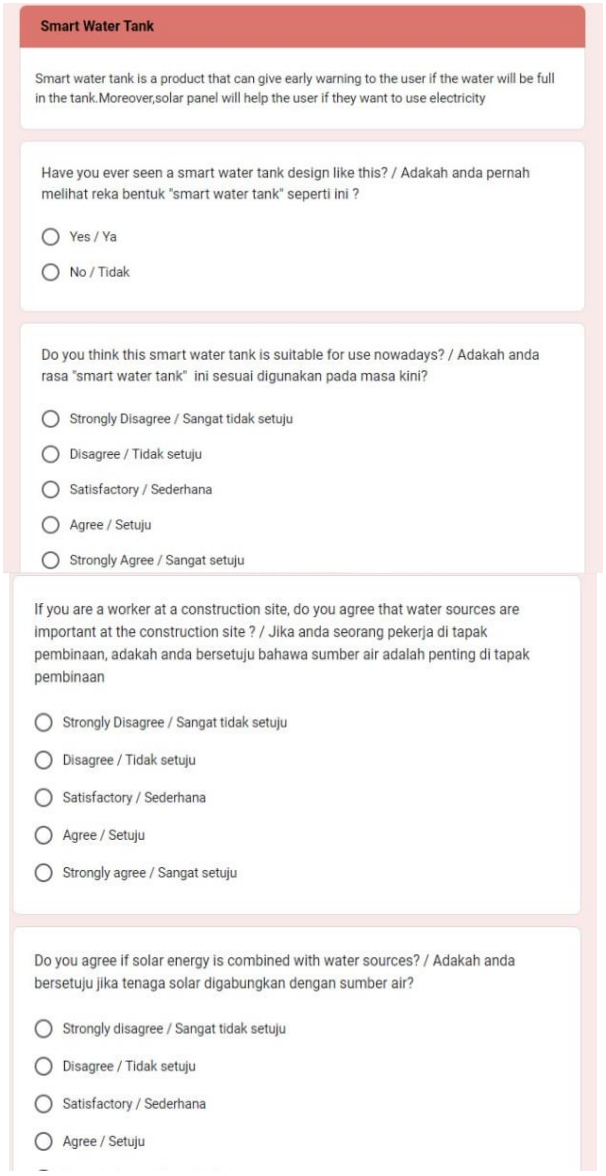
APPENDIX 4

Design



APPENDIX 5

Questionnaire Google Form



Smart Water Tank

Smart water tank is a product that can give early warning to the user if the water will be full in the tank.Moreover,solar panel will help the user if they want to use electricity

Have you ever seen a smart water tank design like this? / Adakah anda pernah melihat reka bentuk "smart water tank" seperti ini ?

- ◯ Yes / Ya
- ◯ No / Tidak

Do you think this smart water tank is suitable for use nowadays? / Adakah anda rasa "smart water tank" ini sesuai digunakan pada masa kini?

- ◯ Strongly Disagree / Sangat tidak setuju
- ◯ Disagree / Tidak setuju
- ◯ Satisfactory / Sederhana
- ◯ Agree / Setuju
- ◯ Strongly Agree / Sangat setuju

If you are a worker at a construction site, do you agree that water sources are important at the construction site ? / Jika anda seorang pekerja di tapak pembinaan, adakah anda bersetuju bahawa sumber air adalah penting di tapak pembinaan

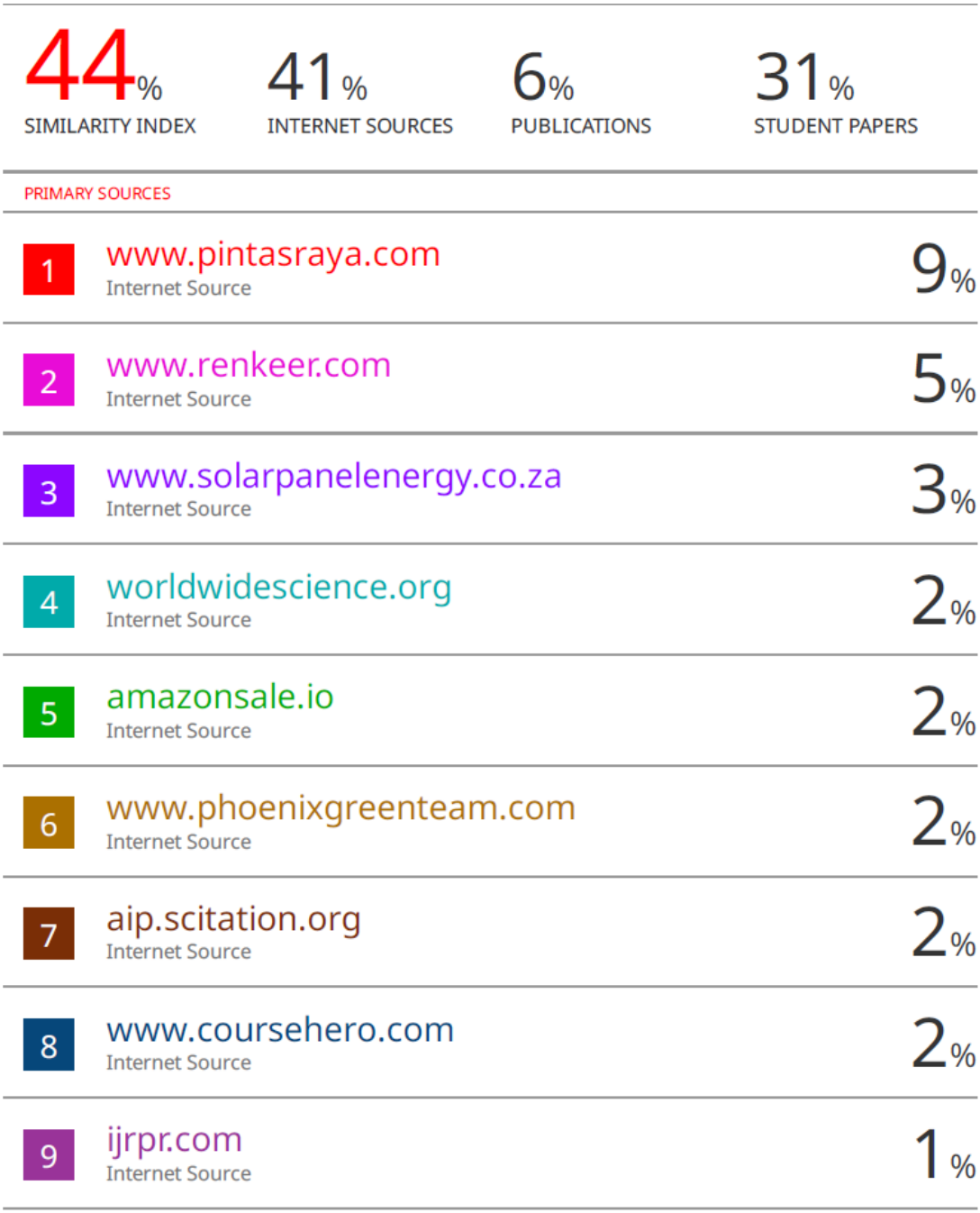
- ◯ Strongly Disagree / Sangat tidak setuju
- ◯ Disagree / Tidak setuju
- ◯ Satisfactory / Sederhana
- ◯ Agree / Setuju
- ◯ Strongly agree / Sangat setuju

Do you agree if solar energy is combined with water sources? / Adakah anda bersetuju jika tenaga solar digabungkan dengan sumber air?

- ◯ Strongly disagree / Sangat tidak setuju
- ◯ Disagree / Tidak setuju
- ◯ Satisfactory / Sederhana
- ◯ Agree / Setuju

APPENDIX 6

Plagiarisme Checker



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