FACULTY OF ELECTRICAL AND ELECTRONIC ENGINEERING TECHNOLOGY

DEVELOPMENT OF PORTABLE SEMI-AUTO ABLUTION KIT USING ARDUINO SYSTEM

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Bachelor of Computer Engineering Technology in Computer System (BEEC)

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

I declare that this project report entitled Development Of Portable Semi-Auto Ablution Kit Using Arduino System is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

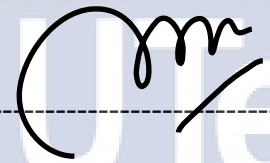
Signature : 

Student Name : AMIR FIRDAUS BIN MUHAMMAD FADZLI

Date : 26/01/2023

APPROVAL

I hereby declare that I have checked this project report and, in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Computer Engineering Technology in Computer System (BEEC).

Signature : 

Supervisor Name : TS. DR. ROSTAM AFFENDI BIN HAMZAH

Date : 26/1/2023

DEDICATION

To my beloved mother and father

and

To myself

ABSTRACT

In the Muslim religion, ablution is a hygienic obligatory act of purifying one's self before performing worship by washing some parts of the body. In addition, ablution is also to cleanse the spiritual and the physical that can contribute to the devotion factor in worship. The common way used for ablution is by using tap water and the usual spray bottle is used when doing outdoor activities. However, in performing ablution have been found as high waste of water rates when using tap water manually. Thus, the production of a portable water-saving system can help to solve the problem of water wastage. Although Muslims are aware of how to take ablution prior to worship, there is some lack of knowledge and attitude in the amount of water used for ablution. The main problem is wastage of water. In taking ablution, users often forget about the quantity of water that should be used. Based on the previous constructed constraints, the production of this portable semi-auto ablution system is intended to design a normal water tap into a semi-auto pipe that reduces the amount of water usage quantity. The design of this project is to save water by changing the normal water flow to the proper quantity of water for ablution and also controlling the flow of water using sensors. With this system, expected water conserved is 80% higher than the manual water tap. Additionally, the user-friendly features where the water can be monitored by using Liquid Crystal Display (LCD) and materials used make to ease users to use them and carry them anywhere. Overall, this project is expected to help the public, especially the Muslim community in the allocation of water while ablution and can educate themselves for a better attitude towards achieving the goal of worship.

ABSTRAK

Dalam agama Islam, wuduk adalah satu amalan yang diwajibkan untuk membersihkan diri sebelum melakukan ibadah dengan membasuh sebahagian anggota badan. Selain itu, wuduk juga untuk membersihkan rohani dan jasmani yang boleh menyumbang kepada faktor khusyuk dalam ibadah. Cara yang biasa digunakan untuk berwuduk adalah dengan menggunakan air paip dan botol semburan biasa digunakan ketika melakukan aktiviti luar. Namun begitu, berwuduk didapati kadar pembaziran air yang tinggi apabila menggunakan air paip secara manual. Justeru, penghasilan sistem penjimatan air mudah alih dapat membantu menyelesaikan masalah pembaziran air. Walaupun umat Islam sedar tentang cara mengambil wuduk sebelum beribadat, terdapat sedikit pengetahuan dan sikap terhadap jumlah air yang digunakan untuk berwuduk. Masalah utama ialah pembaziran air. Dalam mengambil wuduk, pengguna sering terlupa tentang kuantiti air yang sepatutnya digunakan. Berdasarkan kekangan yang telah dibina sebelum ini, penghasilan sistem wuduk separa auto mudah alih ini bertujuan untuk mereka bentuk paip air biasa ke dalam paip separa automatik yang mengurangkan jumlah kuantiti penggunaan air. Reka bentuk projek ini adalah untuk menjimatkan air dengan menukar aliran air biasa kepada kuantiti air yang sesuai untuk berwuduk dan juga mengawal aliran air menggunakan sensor. Dengan sistem ini, jangkaan penjimatan air adalah 80% lebih tinggi daripada pili air manual. Selain itu, ciri mesra pengguna di mana air boleh dipantau dengan menggunakan paparan kristal cecair dan bahan yang digunakan untuk memudahkan pengguna menggunakannya dan membawanya ke mana-mana. Secara keseluruhannya, projek ini diharap dapat membantu orang ramai khususnya masyarakat Islam dalam peruntukan air semasa berwuduk serta dapat mendidik diri untuk sikap yang lebih baik ke arah mencapai matlamat ibadah.

ACKNOWLEDGEMENTS

First and foremost, I would like to express my gratitude to my supervisor, Ts. Dr. Rostam Affendi Bin Hamzah for his precious guidance, words of wisdom and patient throughout this project.

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CHAPTER 1

INTRODUCTION

This section will describe the project background, problem statement, objectives, and also the scope of the project. The project background is discussing the background of the problem involved during ablution activity and states the method will be used to solve the water waste and improve a portable ablution system. Lastly, the objective focuses on the goals that should be achieved along the project process and the scope of the project included with what should be done in this project.

1.1 PROJECT BACKGROUND

Water is one of the cheapest resources on this earth. It totally has its own role and function to maintain the ecosystems on the planet. We can say that all living things must rely on water for their own life. In Islam, we have to consider that water is one of the important things in our daily life, especially during ablution. Other than that, the word "water" itself comes out around sixty-three times in Al-Quran [1]. Ablution or also called 'Wudu' is one of the religious routines for every Muslim before performing our prayers. It is an action where we need to wash thoroughly our hands, nose, mouth, face, arms, head, ears and feet every five times a day. Because of that, Islam had taught us about the obligation of water conservation and given us a guide on how to prevent water pollution. Yet, each one of us still takes it for granted.

The increasing number of the human population is the most critical factor in achieving sustainable development. [2] Research had been done in 2017 by Pew Research Centre and they said that Muslims are expected to grow from 1.8 billion in the year 2015 to 3 billion in the year 2060 where it will become the largest religious group in the world. For that reason, Muslims need a machine that can help them to preserve water every time they perform ablution. [3] Prominent Egyptian scholar Sheikh `Abdul-Khaliq Hasan Ash-Shareef once said, "There is nothing wrong with utilizing a machine as long as the fundamental pillars and ablution requirements are properly maintained in a right and accurate manner". Maybe we as Muslims

should not be distracted by every modern device but we need to remember that Islam asserted their Ummah to not waste any resources.

A programmed Ablution System is fabricated involving the camera as a motion sensor while the servo engine goes about as an actuator that is installed on a water tap. It means that whenever an object is placed under the water tap, the actuator will allow water to flow but when there is no object under the water tap, the actuator will be closed. In this research, a strategy needs to adjust to distinguish the amount of water that Muslims required while performing ablution. As we all know that there are many inventors already created this kind of the machine before but its price was too high and cannot be afforded by all. Therefore, this project will produce a cheap and friendly user ablution machine.

1.2 PROBLEM STATEMENT

The Prophet, peace be upon him always emphasizes that cleanliness is half of our faith. In Islamic hadith already written that Muslims need water to make their ritual ablution as much as half to two litres only. Furthermore, there is a prove that during ablution, every water usage is around 0.544 L or we can conclude that it is less than 1 L [4]. Almost every device in this world right now has its own automatic system in order to help humans to do their work easily such as washer machines and air-conditioning. Because of that, this ablution system will do the same. The main problem is the wastage of water. [5] Consumers use a large quantity of water in taking ablution. Consumers know about the wastage of water that occurs during ablutions but there are no specific steps to solve this problem. Most pipes have no limit to the quantity of water, so there is a waste of water during ablution. So that, this product will minimize the waste of water. Even though this product is available, unfortunately, it is rarely used in every mosque in particular because the price was too high. This product is intended to overcome this problem by making it portable. With an automatic embedded in the ablution system, the user will automatically preserve more water. Besides that, the existing system is costly, this product will focus on low cost, to make it available for everyone to own.

1.3 OBJECTIVE

In order to complete this project, there are several objectives that needed to be achieved in order to determine the success of the project. The main objective of this project in design an automatic Ablution System. The objectives are as stated as follows:

a) To design a semi-automatic ablution system
b) To develop a portable tool and water saving system
c) To analysis the functionality of the ablution system

1.4 PROJECT SCOPE

This project focuses on new product technology in accordance with current requirements. Additionally, this project is followed by designing product designs and conducting some analysis on water usage and ablution goals in Islam. In addition, this project focuses on the analysis of the flow rate that should be used during ablution. Therefore, this project follows the scope of the study below:

I. Design of portable semi-automatic ablution system.
II. This ablution system can be operated using a dry cell.
III. This ablution system can only allow water to flow water tap when the sensor is activated.
IV. Water quantities used are shown in the LCD display
V. Compare the efficiency of water-saving before and after using the automatic concept of the sensor.

1.5 PROJECT OUTLINE

The most important aspect of Chapter 1 is the project's introduction, which we must discuss in depth. This chapter also contains information on the project's origins, objectives, problem statement, the scope of work, and explanation.

In the meanwhile, Chapter 2 discusses and explains an existing product that is comparable to the one described in Chapter 1. Chapter 2 will go through all of the benefits of this project as well as the shortcomings of the current product. Then, in this section, we'll look at some alternative simulation methodologies used by various analysers.

The project technique will be covered in Chapter 3. In this chapter, the specifics of component selection and project functionality will be revealed, as well as how the interface will be performed. This chapter will also go through the installation of the flow chart measurement and the water usage analysis technique in greater depth.

The prototype of the product, as well as the predicted outcome and analysis, will be detailed in Chapter 4. Nonetheless, the technique for ensuring that this project is fully operational will be discussed.

Finally, the endeavour comes to a close in the last chapter. As a result, it will go into greater detail on the recommendations for future projects. Furthermore, the possibility to work on this project, as well as the implementation process, will be thoroughly outlined.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Water, as we all know, is one of the most valuable resources that has sustained humanity since we were born. A lot of water was wasted as a result of human activity, such as letting the water drain continually when cleaning teeth, washing hands, conducting ablution for Muslims, and so on. As a result, this Portable Semi-Automatic Ablution System was designed to reduce water waste.

2.2 IMPORTANCE OF WATER DURING AN ABLUTION

Muslims currently account for 25% of the worldwide population, 5% of the population are from the United Kingdom, and are the world's second-largest religion after Christianity. Wudu is an essential ritual in the Islamic religion, and the Wudu ablution procedure necessitates the correct method so that it becomes perfect before performing the prayer. During the ablution routine, a large amount of water was wasted, neither in the washroom nor in the mosque. Because the water is permitted to flow freely and drain away, this is the case. It is written in Dudley Industries, where the article supplied by Yass Al-Hassani MSc BSc, that all Muslims are required to pray five times a day [6]. Before spending time with Allah, all Muslims are dedicated to cleaning themselves. As a result, a lot of water is wasted only to conduct Wudhu. Handle taps were already been used for a long time so we can say that it was releasing more amount of water during the moments we open and close because of the manual process which is by using hands. Thus, we cannot get any benefit from the flowing water. The experts have confirmed it that when we use the mixer taps, we are able to waste about 30% amount of the water consumed [7]. To be honest, this product comes with an automated water sensor tap and an automatic hand. As a result, this gadget can assist in reducing water waste.

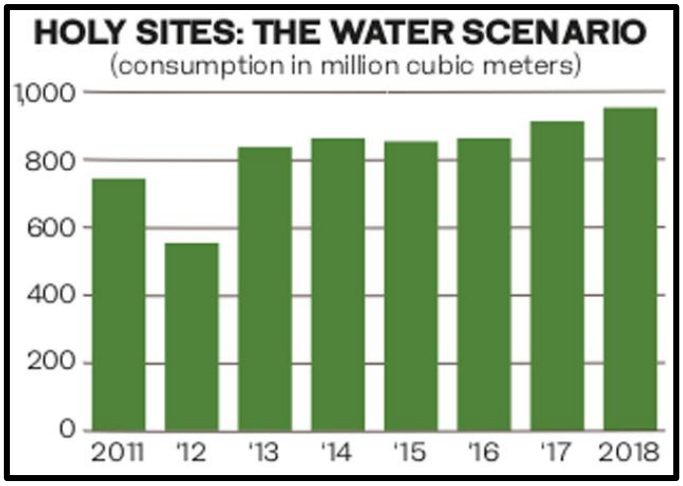


Figure 2. 1: The Water Scenario

According to statistics, there are over 1.7 billion Muslims around the globe, most of them are from Africa and the Middle East, where water resources are scarce. [8] Arab News had published an article said that the total number of Muslim pilgrims that will visit Makkah for Hajj and Umrah which is one of Islam's Five Pillars is expected to grow to 15 million by 2020 and 30 million by 2030. Based on that, they expected around 41 million cubic meters of water should be distributed during the Hajj season. Dr. Khalil Ammar who is the principal scientist in hydrogeology and water resources management at the International Centre for Bio saline Agriculture in Dubai said to Arab News that Saudi Arabia also there have limited resources such as groundwater where its quantities cannot satisfy the huge number of people come during Hajj and Umrah the rest of the year because the demands are not only to drink but it also involves cooking and ablution. The supplier's quantities are very important to keep every activity going on smoothly, especially on these religious sites. If this type of equipment is deployed, we can save 40 million litres of water every day.

2.3 BASIC SENSOR TAPS AUTOMATIC WORKS

Commonly these automatic sensor taps will be divided into four parts which are:

i. Infrared sensor
ii. Water pump motor
iii. Arduino Microcontroller
iv. Flow sensor

2.3.1 Infrared Sensor Concept

Nowadays, Infrared (IR) technology looks familiar in society because it is basically used in our daily life and also in industries where it can be used for many purposes of the process. IR sensor is one of the simple electronic devices that is able to remote control functions and also detect any object were involved from the surroundings. [9] An expert named Alexander Chilton come out with an Infrared Radiation theory which said that these infrared waves could not easily be seen by the human eye. We may deduce that this type of radiation can be discovered between the visible and microwave sections of the electromagnetic spectrum. These infrared waves basically contain wavelengths around 0.75 and 1000um. It also can be split into 3 parts which are: -

- Near-Infrared Region: 0.75 to 3um (wavelength region)
- Mid-Infrared Region: 3 to 6um (wavelength region)
- Far-infrared: higher than 6um (wavelength region)

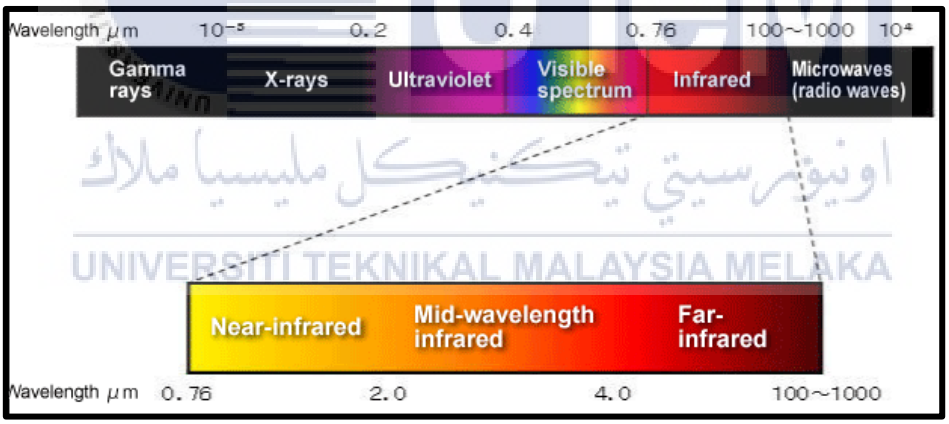


Figure 2. 2: Electromagnetic Spectrum

In 1800, an astronomer called William Herchel by accident discovered infrared radiation [10]. It happened when he was performing tests with a prism that can reflect sunlight back to the observer. As a result, he was able to detect the existence of unexplained infrared light beyond the visible spectrum's red region. The Active Infrared Sensor and the Passive Infrared Sensor are the two types of IR sensors available. This active sensor consists of a transmitter and receiver that can operate with, receive, and detect radiation. Passive sensors, on the other hand, are just detectors that can detect using infrared receivers.

Tabel 2. 1: Advantages and disadvantages of Infrared sensor

ADVANTAGES	DISADVANTAGES
▪ It uses less power	▪ Required Line of sight.
▪ These sensors are not affected by oxidation & corrosion	▪ These can be affected by fog, rain and dust
▪ Noise immunity is very strong	▪ Less data transmission rate

2.3.2 Water Pump Motor

Pumps and motors are known as mechanical devices that can be used in a varied range of engineering works. Both of the machines have their own role in various engineering fields such as civil, automobile and mechanical. [11] The pump is a common mechanical device whose primary job is to drive any liquid, chemical, or even gas to move forward through a pipeline. It means that the pump employs mechanical energy to pressurize and discharge them throughout the exit. Because this pump may be used for a variety of purposes, it comes in a variety of sizes and forms, ranging from household water pumping to rotary pumps to major manufacturing pumps. Aside from that, motors are electro-mechanical devices whose goal is to transform electrical energy into mechanical energy. The motor has ushered in enormous advances in engineering and technology since it provides such a substantial contribution to the global energy ecosystem. Alternative Current (AC) and Direct Current (DC) motors are the two types of motors (DC). Although these devices serve the same goal, their functioning principles are very different.

Figure 2. 3: Water pump motor

The basic objective of the water pumping system, was to convey any fluid substances from one location to another [12]. The pumps use a piston and a turbine to extract water from the well, which may generate a partial vacuum. The water pressure was also increased using the same manner. Despite the fact that there are many various types of water pumps, each one has its own set of benefits and drawbacks.

Tabel 2. 2: Difference between pump and motor

Category	**PUMP**	**MOTOR**
Function	▪ Other energy sources will be used by pumps, such as spinning compressors and the air's pushing force. These methods make advantage of the rotational shaft, which may be used to produce pressure.	▪ The electric motor will interact with the motor's magnetic field and winding current where it can be used to produce power to generate mechanical to electrical
Types	▪ Classified based on: - - displacement method into gravity - impulse - velocity - valve less - steam pumps	▪ generally categorized: - - Alternating Current (AC) - Direct Current (DC)
Applications	▪ water treatment plants ▪ paper mills ▪ car washes	▪ fans ▪ conveyor systems ▪ compressors

2.3.3 Arduino Microcontroller

Arduino is a simple gadget to operate, and it is suggested for everyone with a basic understanding of electrical. Because the gadget is an open-source microcontroller board, this is the case. Arduino is made up of two parts, a physical programmable circuit board and software called the Integrated Development Environment (IDE), which allows you to create and upload code to the board. [13] Noted that the Arduino does not require any additional hardware to load fresh code onto the board because the computer and the gadget will be

connected through a wire. Furthermore, the Arduino makes use of a simplified version of C++ that makes learning easier. We can read inputs and change them into outputs using Arduino boards because we can send a set of instructions to the microcontroller using the Arduino programming language, which is referred to as wiring, and the IDE software, which is based on processing.

At the very least, an Arduino development board will include: -

- Contains 9 digital pins for Input / Output channels.
- analog input channels
- 1 serial port

Hernando Barragan was one of the persons involved in the creation of a platform named "Wiring" in 2003 as his master's thesis in Italy at the Interaction Design Institute Ivrea (IDII), which was tied to Arduino [14]. The goal of his study was to make microcontrollers that include sophisticated operations easier to access by simplifying them. The project started in 2005, when Massimo Banzi, Barragan's thesis advisor, and two of his students, David Mellis and David Cuartielles, established another project called "Arduino." The name of the project was inspired by the name of the pub Banzi had visited, Bar di Re Arduino. Nowadays, we can say that this Arduino became the most popular microcontroller board that is always preferred by many people to use in their projects.

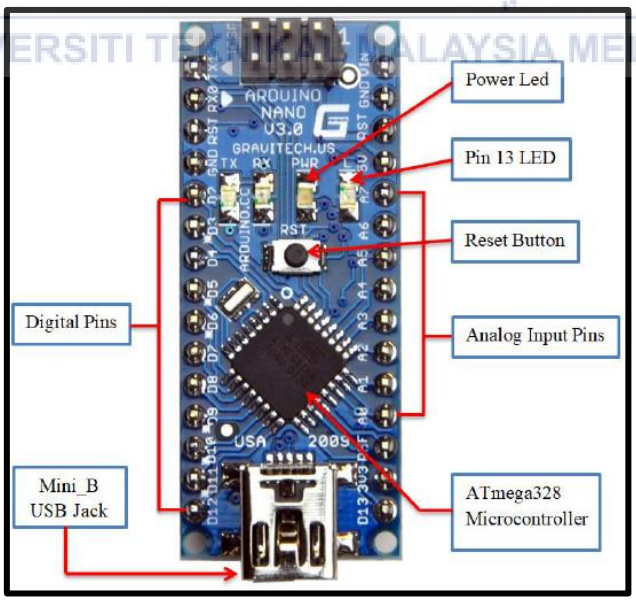


Figure 2. 4: Example of Arduino

2.3.4 Flow Sensor

Nowadays, sensors are an essential component of automated systems. This type of equipment grew with its purpose and size as a result of the age of modern technology. A flow sensor, often known as a flow metre, is an electronic device that aids in measuring or controlling fluid flow in a variety of manufacturing systems, including the fuel system of a car, the infrastructures for distributing gas and water, and many more. [15] The physical characteristics of the fluid, such as whether it is gaseous, liquid, or non-Newtonian, must be taken into consideration while measuring these types of substances. As a result, the techniques we should employ to gauge their flow must also change. Numerous flow sensor varieties may be categorised into two groups: -

- Contact Flow Sensors : when it is not anticipated that any liquid or gas that has to be monitored would block the pipe when it comes into touch with the moving portions of the sensor
- Non – Contact Flow Sensors : employed when contact with moving parts may otherwise taint or physically affect the liquid or gas being monitored.

Figure 2. 5: Example of Flow sensor

2.4 PREVIOUS RELATED PROJECT

To have a better knowledge of the project, there was some research on prior analogous projects that mostly focused on ablution systems. This information will aid in the implementation and achievement of the project's goal. As a result, this part will provide some background information on a comparable project as well as a similar goal to solve the major challenge encountered during ablution.

2.4.1 Automatic Ablution Machine using Vision Sensor

Adnan Rachmat Anom Besari, Ruzaidi Zamri, Ahmad Yusaeri, Md Dan Md Palil, and Anton Satria Prabuwono worked on this project. The authors used the Logitech Quick Cam E-3500 Plus PC Camera as their infrared sensor, the Hi-Tech HS-322 as their servo motor, and the Atmel ATMega8535 microcontroller as their project's controller [16]. When the sensor detects any skin caught during ablution, the servo motor turns on and off the crane, allowing the water to pass through. This gadget can detect the amount of water used in each area of the body, such as the hands, arms, elbows, and feet, while the procedure is taking place. This machine may be used in a variety of settings, including the kitchen and bathroom, to aid in water conservation for our environment.

Figure 2. 6: Sample of capturing Human Skin

2.4.2 SmartWUDHU': Recycling Ablution Water for Sustainable Living in Malaysia

According to Azeanita Surathon, Chee Ming Chan, and Tengku Syamimi Tuan Ab Rahman, by establishing a simple recycling system, it will be possible to collect, purify, and reuse the wastewater generated during the ablution process [17]. Because the majority of Malaysians are Muslims, the bulk of ablution procedures include the use of water taps to transport greywater to the main sewers. When the tap is left running, more excellent water is usually squandered. This type of project is not only based on engineering solutions but is also linked to the Islamic ideal of cautious use of natural resources, as instructed by our Prophet. The research was done to design the SmartWUDHU ablution water recycling system. The inventor of this project wanted to create the portable ablution machine that uses the solar system as its primary source of energy and saves water during the process. This device will regulate the flow of water in a specific area and maximize water use in our everyday lives. An infrared sensor is also included in the project, which will detect the existence of any obstacles and allow the water to flow freely. This project is powered by 12V lead-acid batteries, which allow the system to work even at night.

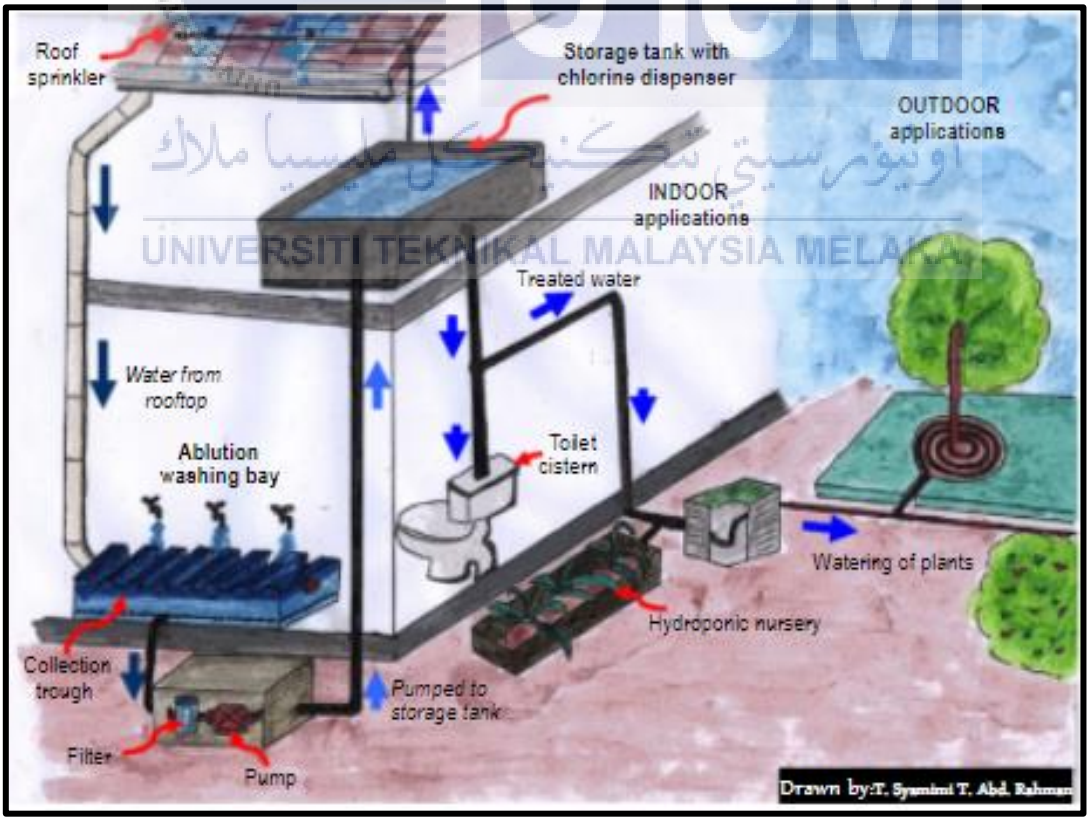


Figure 2. 7: SmartWUDHU' incorporated in a mosque

2.4.3 ReWudhuk: A Sustainable Device to Reuse Musta'mal Water for Ablution Purpose

According to Misbahul Muneer Abd Rahman, Masiri Kaamin, Mahmod Abd Hakim Mohamad, and Mohamad Hanif Mohmad Omar, most of the water created after ablution is either poured down the drain or reused for plant irrigation, but only a few individuals indicated it may be utilised for ablution [18]. As a result, a recycling system called ReWudhuk should be built, which is capable of filtering and treating the water so that it may be reused in the next ablution procedure. A sample of treated and untreated Musta'mal water was provided for testing, and the findings reveal that the water quality meets Malaysian Drinking Water Quality Standard (DWQS) criteria.

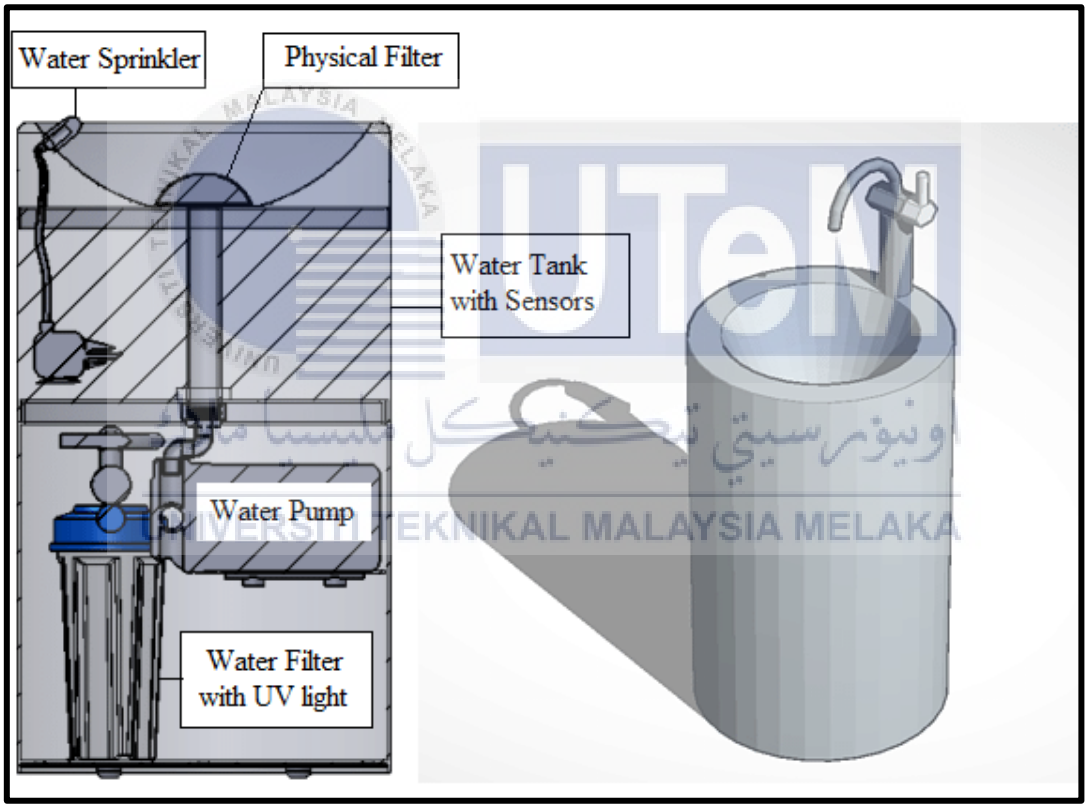


Figure 2. 8: A small scale model of ReWudhuk

2.4.4 A Prototype of Solar-Powered Automatic Ablution Tap

The creators of a prototype of a solar-powered automated ablution tap are Stephan Adriansyah Hulukati, Tri Pratiwi Handayani, Risman Jaya, and Syahrir Abdussamad [19]. The existence of ablution taps in all mosques nowadays is well known in society for its inability to manage the amount of water used. As a result, a lot of water goes down the drain that isn't needed. This prototype will be created in order to solve that problem. The Arduino, which employs ultrasonic sensors as an input to identify an item in front of it, controls all systems in the prototype. The sensors may transmit "ON" and "OFF" commands to the controller, and the relay will activate the solenoid valve, allowing water to flow. The water flow will be more efficient with this system, as demonstrated during system testing in Indonesia, where the quantity of water saved by employing this prototype was significant.

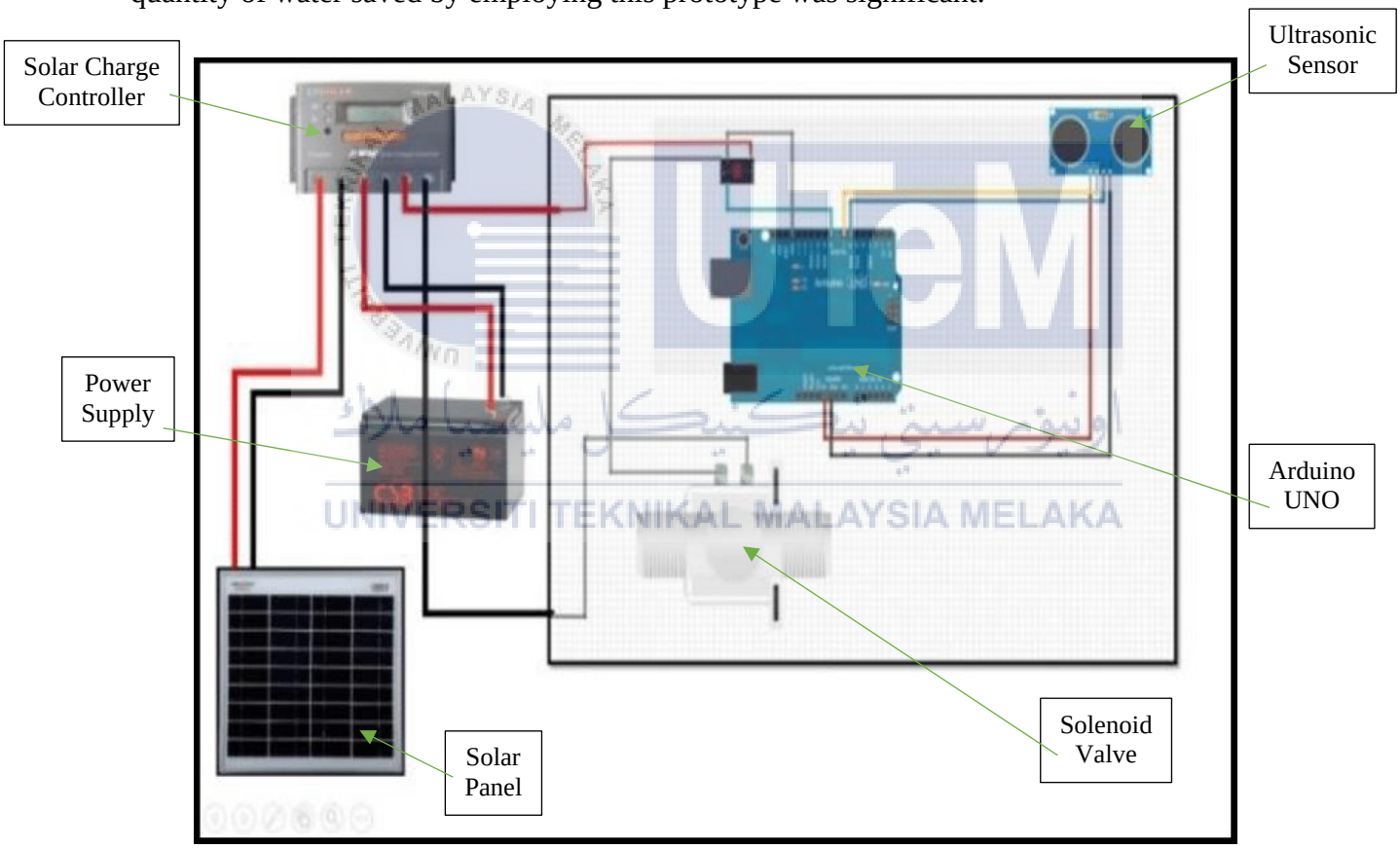


Figure 2. 9: Schematic Diagram of Solar-Powered

2.4.5 Development of A Portable Ablution System for Muslims from Ergonomics Approach

The authors Mohd Fariduddin Mukhtar, Nur Aiman Hanis Hasim, Mohd Idain Fahmy Rosley, Amir Abdullah Muhamad Damanhuri, and Adam Samsudin devised a portable ablution system that was based on ergonomics [20]. Because ergonomics is safe and productive when it comes to human and gadget interaction, this new design strives to build a user-friendly system that can be utilized by people of all ages. Aside from that, this strategy suggests a method of conserving water during ablution. We can claim that practically all ablution areas in our mosque do not take into account all sorts of Muslim individuals, including those with health issues or those who are elderly, and instead rely on pipe systems that require more water during ablution. As a result, this project will provide portable ablution equipment that is easy to transport, especially for tourists. This project also employs Rapid Upper Limb Assessment, or RULA, which analyses every posture, such as upper and lower arm, legs, and neck, using Catia V5 software to produce a single score representing Musculoskeletal Disorders (MSD), which aids us in identifying all risks that may arise after the evaluation is completed.

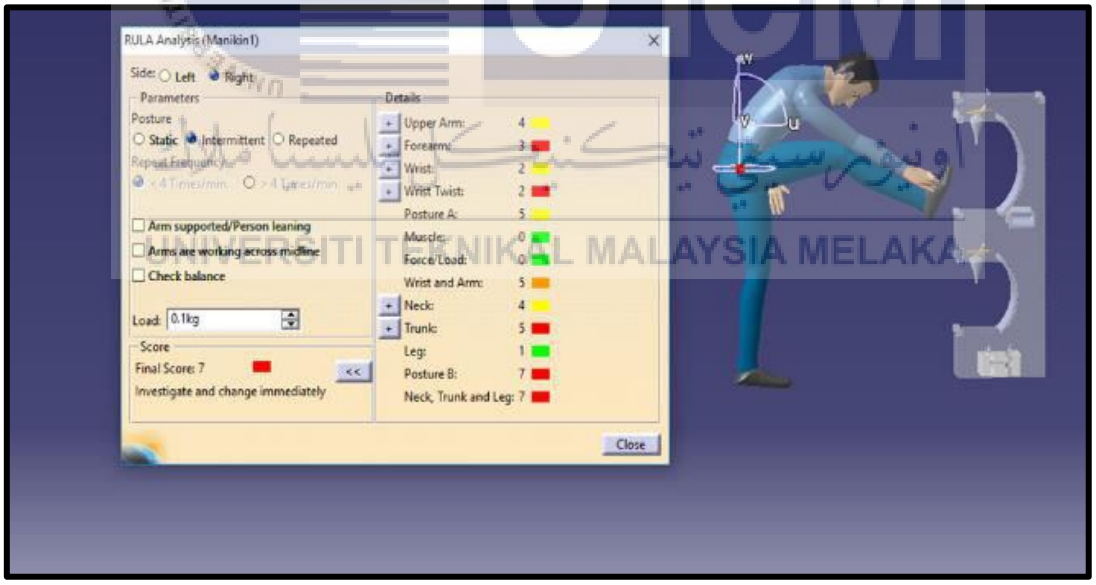


Figure 2. 10: RULA analysis for leg

2.5 COMPARISON OF PREVIOUS RELATED PROJECTS

We may deduce that there is a difference between such projects in terms of component utilization and implementation based on the prior similar project that has been mentioned. As a result, the table below compares the study publications in terms of technique application, benefits, and drawbacks.

Tabel 2. 3: Comparison of previous project

No.	Reference	Method	Advantages	Disadvantages
1.	[16] 2009	Used the Logitech Quick Cam E-3500 Plus PC Camera as their infrared sensor, the Hi-Tech HS-322 as their servo motor, and the Atmel ATMega8535 microcontroller as their project's controller. When the sensor detects any skin caught during ablution, the servo motor turns on and off the crane, allowing the water to pass through	Multipurpose system where it can be use in every field that related to protect water and environment	Hard to implement to all mosque
2.	[17] 2014	Uses the solar system as its primary source of energy. An infrared sensor is also included in the project, which will detect the existence of any obstacles and allow the water to flow freely. This project is powered by 12V lead-acid batteries, which allow the system to work even at night.	We can use it whenever we want and it is user-friendly system	Limited space provided to certain place and high cost needed
3.	[18] 2016	Capable of filtering and treating the Musta'mal water so that it may be reused in the next ablution procedure	We can keep using the water from ablution while it will maintain filtering	Not much of society can accept to use of greywater from the ablution process

4.	[19] 2019	Use ultrasonic sensors as an input to identify an item in front of it. The sensors may transmit "ON" and "OFF" commands to the controller, and the relay will activate the solenoid valve, allowing water to flow	Using solar panel that can regulates the electricity to battery source for microcontroller	There no Wi-Fi module that can send data online so can the water flow can be monitored in real time
5.	[20] 2021	Provide portable ablution equipment that is easy to transport, especially for tourists. This project also employs Rapid Upper Limb Assessment, or RULA, which analyses every posture, such as upper and lower arm, legs, and neck, using Catia V5 software to produce a single score representing Musculoskeletal Disorders (MSD), which aids us in identifying all risks that may arise after the evaluation is completed	Can identified the suitable position in making the ablution process by using RULA	RULA require several assessments for just one task to finish

2.6 SUMMARY

Based on the prior relevant projects, there are several strategies that may be adopted for conserving water not just during ablution based on the study and observation that has been done. Throughout the project's life cycle, the information gathered can assist in attaining the key objectives. Many factors must be examined, including the sort of components utilised, their cost, and how they will be implemented. As a consequence, we can see that every project has advantages and disadvantages, but as long as it is beneficial to society, it should be used.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

There are typically specifics of how the researcher approached the topic and the methodologies and procedures they utilized in a thesis or other official pieces that related to research. A technique describes how a researcher approaches a study in order to get reliable, legitimate results that meet the researcher's goals and objectives. It covers what data they'll gather and where they'll get it, as well as how they'll collect and evaluate it. Because of that, this kind of method was beneficial to us as a creator to understand more about the research methodology and the available techniques and tools which suitable for our project.

3.2 STUDY DESIGN

The purpose of this project was to produce a portable semi-auto ablution system which able to change a normal water tap to a semi-auto pipe which includes with infrared (IR) sensor that can reduce the amount of water usage quantity during ablution. Usually, all creators preferred to use Arduino as the microcontroller or brain for their project so, the type of Arduino that is used in this project is Arduino Nano. Other than that, there will be an infrared (IR) sensor included which can detect any motion of our body. Then, based on the presence of the motion, the water will flow through the submersible pump mini where it attaches to the flow sensor so it is able to calculate the quantity of water used during the ablution process. The software used in this project is Arduino IDE to verify and upload the code to the hardware while Proteus software was used to construct the simulation circuit.

Various phases have been made in the process of finishing this project, as illustrated in Figure 3.1, to guarantee that the project's workflow is adequately planned.

3.3 PROJECT FLOWCHART

3.3.1 Project Implementation

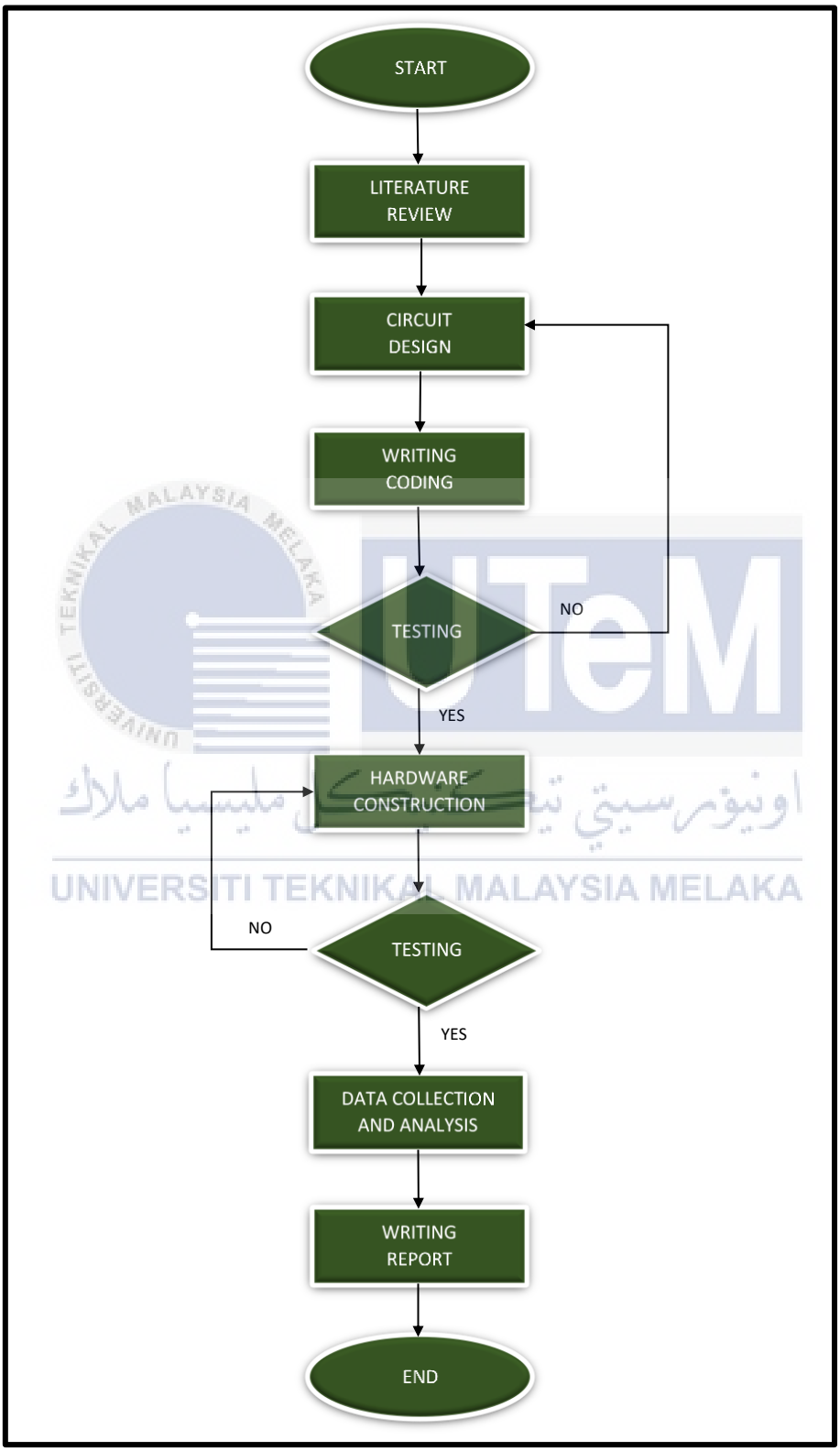


Figure 3. 1: Flowchart of project implementation

- A literature search of the existing systems

  To complete this final year project, each student must develop a concept that they must present to their supervisor. The goal of this project was for the student to conduct research on the chosen subject in order to have a better grasp of it. The various materials and equipment have been thoroughly investigated. For further detail, nearly all of the components utilized in this project were mechanical-electrical components that worked along with the software program to show the reading. As a result, an extensive study has been conducted to verify that the operation of electrical device components is appropriate for this project. It may also get expertise in the research throughout the development procedure.

- Implementing data collection

  Based on all of the research done throughout the literature study, these methods can be adopted. It may be shown by constructing the circuit and creating the computer code, both of which can assist in determining whether or not the desired results were accomplished. As is customary, the quickest approach to design a simulation circuit was to use the Proteus 8 program, with the output code written in the Arduino IDE. When the effective outcomes have been achieved, they may be used in the real project.

- Observe and evaluate the data analysis

  The data analysis is one of the most significant aspects of any research project since it summarises all of the data obtained from the simulation as well as the code created, which can be utilized to make a choice or solve an issue. In order to get the desired result, the circuit diagram and coding should be carefully examined and analysed.

3.3.2 Project Development Flowchart

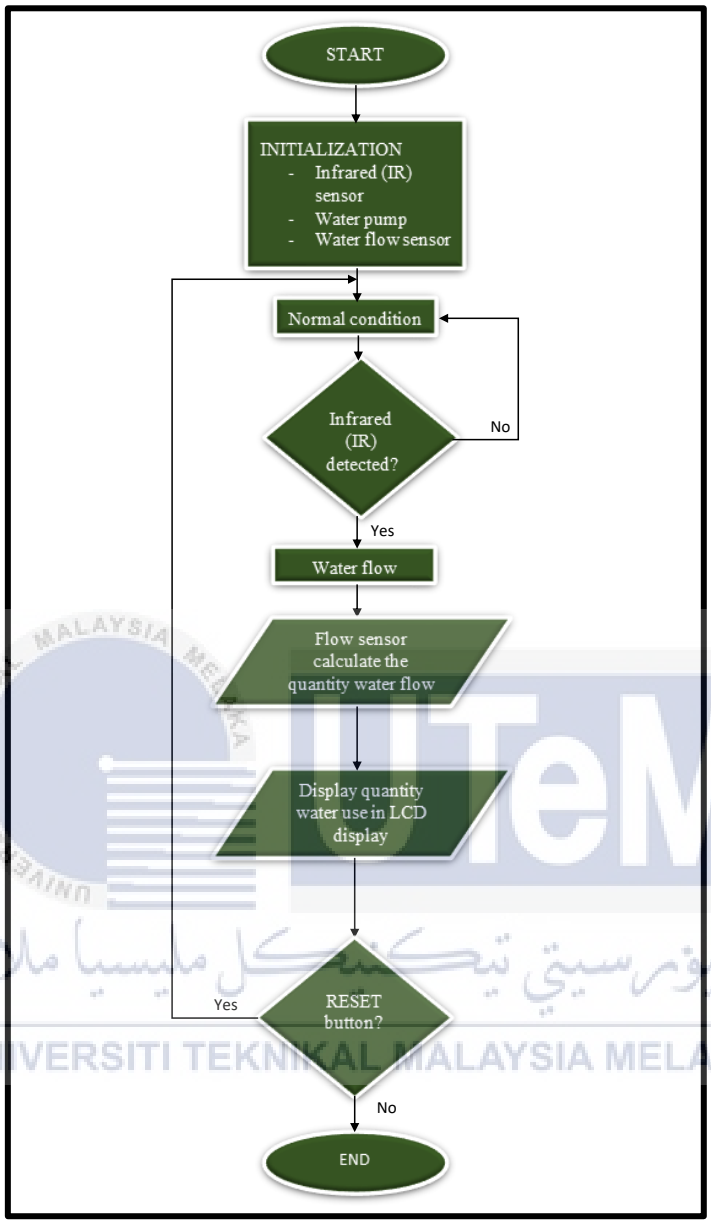


Figure 3. 2: Flowchart of Portable Semi-Auto Ablution Kit

The flowchart was designed, as illustrated in Figure 3.2, to guarantee that the ablution system was running in accordance with the ideology. When the main switch is turned on, an infrared sensor and a water pump motor are ready to operate when a hand or other item passes across the sensor range. When the infrared sensor detects motion, it sends a signal to the Arduino Nano microcontroller, which activates the water pump motor and drains the water through the flow sensor. The data obtained from both sensors will be displayed on the LCD that already placed on this portable semi-auto ablution kit.

3.3.3 Project Block Diagram

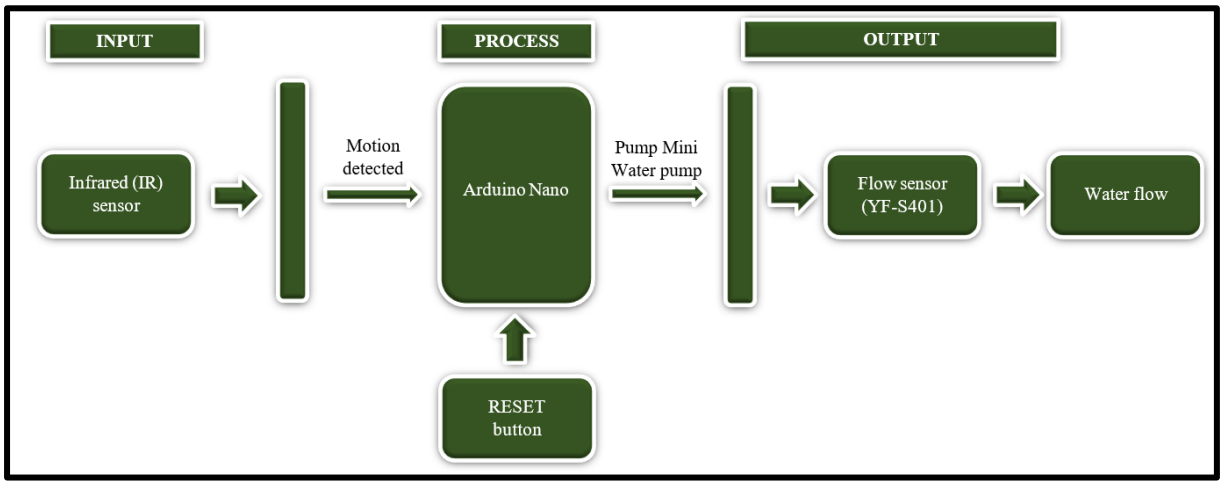


Figure 3. 3: Block Diagram of Portable Semi-Auto Ablution Kit

There was a distinction between the two diagrams, which were a flowchart and a block diagram, as seen in Figures 3.2 and 3.3. In other words, the flowchart was a graphical representation that could show the project's sequence from beginning to conclusion. The block diagram, on the other hand, was a layout of all of the project's components, which were separated into three parts: input, process, and output. Using this strategy, you might be able to find the proper hardware component to help you reach your goals. In terms of software, the Arduino IDE was a popular choice that was always utilized by all innovators across the world due to its user-friendly and simple to comprehend interface.

The project starts with the detection of an infrared (IR) sensor, which is a type of sensor that detects any motion in front of it. The water will flow out through a tube depending on the situation.

Furthermore, the main controller used in this project was Arduino which was able to connect multiple devices to each other and the data obtained will be processed to send to any database required in the project. In this project, we more depend on the flow sensor because we want to save more water from being used during the ablution process happen. After the IR sensor detection, the mini water pump will flow the water inside through the flow sensor which will automatically calculate the quantity of water used by the user at that time. If there another user wants to use this product, they can use the RESET button to restart back the calculation for getting the new one.

3.4 HARDWARE SPECIFICATION

3.4.1 Arduino Nano

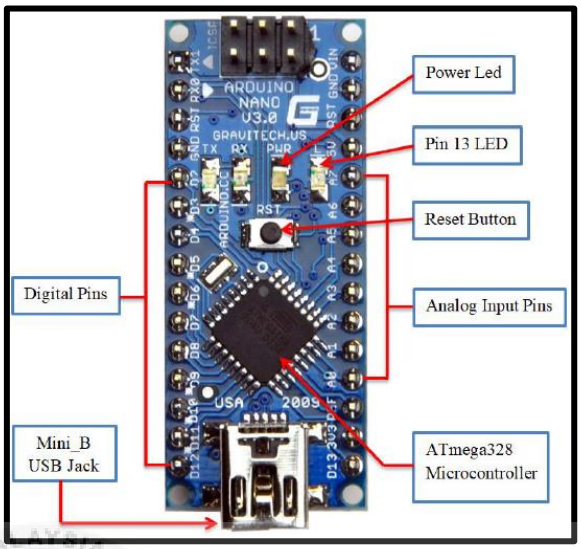


Figure 3. 4: Arduino Nano

The Arduino Nano is a small, comprehensive, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.0) or ATmega168 microcontrollers (Arduino Nano 2. x). [21] It is almost identical to the Arduino Duemilanove in terms of functionality however, it comes in different packaging. It just has a DC power connector and uses a Mini-B USB cable rather than a conventional one. Arduino Nano is distinct from previous Arduinos in that it is extremely compact, making it suitable for little measurement jobs. It also underpins breadboards, allowing it to be linked to several elements with only a single breadboard. Arduino Nano will be the microcontroller of this project where it can represent as a brain which will control all component used.

Table 3. 1: Arduino Nano specification

Microcontroller	▪ Atmel ATmega168 or ATmega328
Operation Voltage (logic level)	▪ 5V
Input Voltage (recommended)	▪ 7-12V
Input Voltage (limits)	▪ 6-20V

Digital I/O Pins	▪ 14 (of which 6 provide PWM output)
Analog Input Pins	▪ 8
DC Current per I/O Pin	▪ 40 mA
Flash Memory	▪ 16 KB (ATmega168) or 32 KB (ATmega328) of which 2 KB used by bootloader
SRAM	▪ 1 KB (ATmega168) or 2 KB (ATmega328)
EEPROM	▪ 512 bytes (ATmega168) or 1 KB
(ATmega328) Clock Speed	▪ 16 MHz
Dimensions	▪ 0.73” x 1.70”

3.4.2 Infrared (IR) Sensor

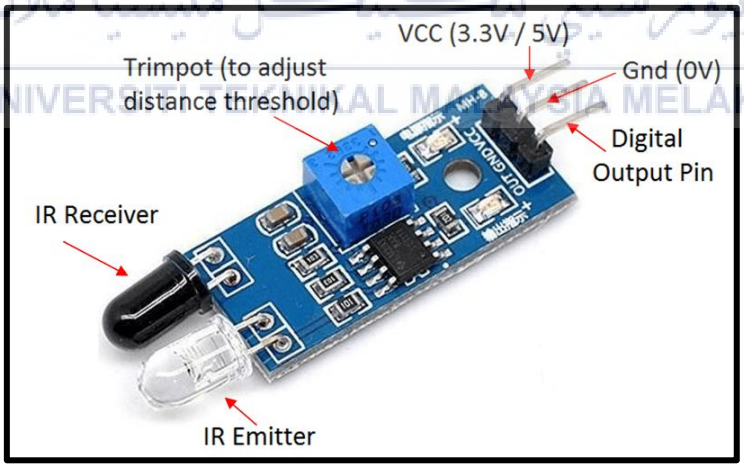


Figure 3. 5: Infrared (IR) sensor

An infrared (IR) sensor was an electronic component that could detect any characteristic that went through IR radiation, whether it was emitting or detecting it. This type of sensor was similarly analogous to a human visionary who might detect an impending hazard or impediment. Because this IR sensor is classified as a passive sensor, it can only detect infrared radiation. [22] Only three pins are available on this sort of sensor: VCC, OUT, and

GND. The VCC and GND provided electricity to the sensor, allowing it to function. Then there are the OUT pins, which are digital output signals where if the sensor detects an obstruction, the value will be LOW depending on the information received from the Arduino microcontroller. This IR sensor module is unique in that it includes two built-in LEDs, one of which turns on when power is available and the other of which turns on when the circuit is activated. In this project, this sensor will operate as an input where it detected any motion passed through it like human's hand.

Table 3. 2: Infrared (IR) sensor specification

Detection distance	▪ 2-10cm
Power supply	▪ 3.3 to 5VDC
Signal	▪ Active low
Size	▪ 30mm x 14mm x 5mm
Detection angle	▪ 35 °
Technology	▪ Analog
Interface	▪ LM393
Operating Temperature	▪ +85 °C (max) ▪ -40 °C (min)

3.4.3 YF – S401 Water Flow Sensor

Figure 3. 6: YF – S401 Water Flow sensor

One of the straightforward flow sensors that may be used by everyone, regardless of age, is this one. The flow rates of the YF-S401 have been tuned to a lower level while including a larger pulse per litre count, making it distinct from the YF-S201. A PVC body serves as the cover for this particular type of water flow sensor, which also includes a water rotor and a half-effect sensor. [23] When water runs into the rotor and causes it to roll automatically, the sensor is initialised and begins to function. Flow rates that vary can alter its speed. The half-effect sensor generates a matching pulse signal that is more suited for detecting flow in a coffee or water dispenser.

Table 3. 3: YF – S401 Water Flow sensor specification

Operating Voltage	▪ 4.5V DC
Operating Current	▪ 15mA
Water Resistant	▪ 0.35MPa
Flow Rate Range	▪ 1 ~ 5L/min
Liquid Temperature	▪ ≤ 120°C

Water Pressure	▪ ≤ 1.75MPa
Internal Diameter	▪ 1.2mm

3.4.4 Micro Submersible Water Pump DC 3V – 5V

Figure 3. 7: Micro submersible water pump DC 3V - 5V

Submersible pumps were developed with high power in mind since they were typically used to pump sewage. There is also a smaller variant known as a micro submersible pump that uses less energy and is lighter than the other. This type of water pump functioned by sucking water through its intake and releasing it through the output. Even though the water pump was modest, it could nevertheless pump up to 120 liters of water per hour using just a lower current of 220mA [24]. The mini water pump will operate the flow of water where it depended on the infrared sensor condition.

Table 3. 4: Micro submersible water pump DC 3V - 5V specification

Input Voltage	▪ 3V-5V DC
Flow Rate	▪ 1.2-1.6 L/min
Operation Temperature	▪ 80°C
Operating Current	▪ 0.1-0.2A
Suction Distance	▪ 0.23 m (max)
Life of Pump	▪ 500 hours
Size	▪ 38(L)x24(W)x45(H) cm
Weight	▪ 30g
Wire Length	▪ 200 mm

3.5 SOFTWARE SPECIFICATION

3.5.1 Arduino IDE

Figure 3. 8: Arduino IDE

The Arduino Integrated Development Environment (IDE) is a cross-platform software created in the Java programming language. It allows you to build a program and upload it to the Arduino board to control any mechanical or electrical device. The Arduino IDE supports the languages C and C++ and employs unique code organization conventions. It also includes a software library derived from the wiring project, which has a number of common input and output operations.

Table 3. 5: Arduino IDE requirement

Developer	▪ Arduino Software
Written in	▪ Java, C, C++
Operating System	▪ Windows, macOS, Linux
Platform	▪ IA – 32, x86 – 64
Type	▪ Integrated Development Environment
License	▪ LGPL or GPL

3.5.2 Proteus 8

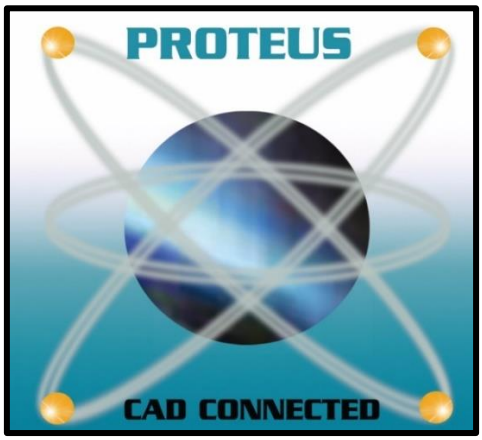


Figure 3. 9: Proteus 8

One of the programmes used largely for automating electrical design is the Proteus Design Suite. This programme may be used for a variety of tasks, including printed circuit board design, simulation, and schematic capture (PCB). This may be found in a variety of combinations, but it all relies on how big the final design will be and how realistic the microcontroller simulation needs to be. [25] This programme was primarily used by all engineers and technicians to produce electronic prints and schematics for printed circuit board manufacture (PCBs).

Table 3. 6: Proteus 8 requirement

Operating system version	▪ Microsoft Windows 7/8/10 (64-bit)
Random Access Memory (RAM)	▪ 2 GB of RAM required
Hard Disk Space	▪ MB of free space required for full installation
Processor	▪ Intel Pentium 4 Dual Core GHz or higher

3.5.3 Solidworks

Figure 3. 10: Solidworks

Solidworks is a solid modelling Computer – Aided Design (CAD) and Computer – aided engineering (CAE) that runs on Microsoft Windows. It uses the principle of parametric design and generates three kinds of interconnected files which is the part, the assembly and the drawing. [26] Solidworks can helps you to perform 2D and 3D modelling. This CAD software is known for its ease – of – use and intuitiveness.

Table 3. 7: Solidworks requirement

Developer	▪ Dassault System
Initial Release	▪ November 1, 1995
Operating System	▪ Microsoft Windows
Available In	▪ English
Type	▪ CAD and CAE
License	▪ Proprietary, Term

3.6 SUMMARY

The process for 'Development of a Portable Semi-Auto Ablution Kit Using Arduino System' is described in this chapter. This approach was typically a set of tools and techniques that were required prior to managing the project, and it was easier to handle by following the correct sequence of project methods. By referring to the project implementation, project development, and project block diagram, this project was able to be finished and the goal was met. The key goals of this chapter were to analyse and identify all of the components and software that were appropriate for the project so that it could function properly as required.

CHAPTER 4

RESULTS AND ANALYSIS

4.1 INTRODUCTION

This chapter demonstrates the outcome of the suggested strategy described in Chapter 3. According to the literature research, this invention was based on an existing product. The final results of this assessment and evaluation serve as a benchmark for determining if the project's objectives have been met.

4.2 PROJECT SCHEMATIC DIAGRAM

The schematic diagram is drawn in Proteus Software. Figure 4.1 shows the schematic diagram of this project. The Portable Semi-Auto Ablution Kit consists of two power supplies which are 9v batteries where the first battery uses to power up the Arduino Nano with other components like the IR sensor, LCD display, RESET button and ON/OFF button while the second battery uses to supply the mini water pump and flow sensor only. The monitoring part of the project has two kinds of sensors used where the first one is the Infrared sensors that have 3 pins. The first Vcc pin is connected to 3.3V from the Arduino. Next, the GND pin is connected to the Ground and the OUT pin from an infrared sensor is connected to the digital input D7 pin on the Arduino board. The other sensor is the flow sensor which contains 3 pins. The first 5V pin is connected to the second 9V battery. The next pin is the GND pin connected to the Ground of that supply. The last pin is connected to the digital input D2 pin on the Arduino Nano. Therefore, the positive terminal of the water pump motor is connected to the positive wire of the second 9V battery while the negative terminal of the water pump motor is connected to the Collector pin from the transistor. The transistor itself will be connected to the analogue input A0 pin on the Arduino using the Base pin. Besides that, for the display part of the project, the LCD display will be placed on this circuit construction to display the quantity of water used during the ablution process happened.

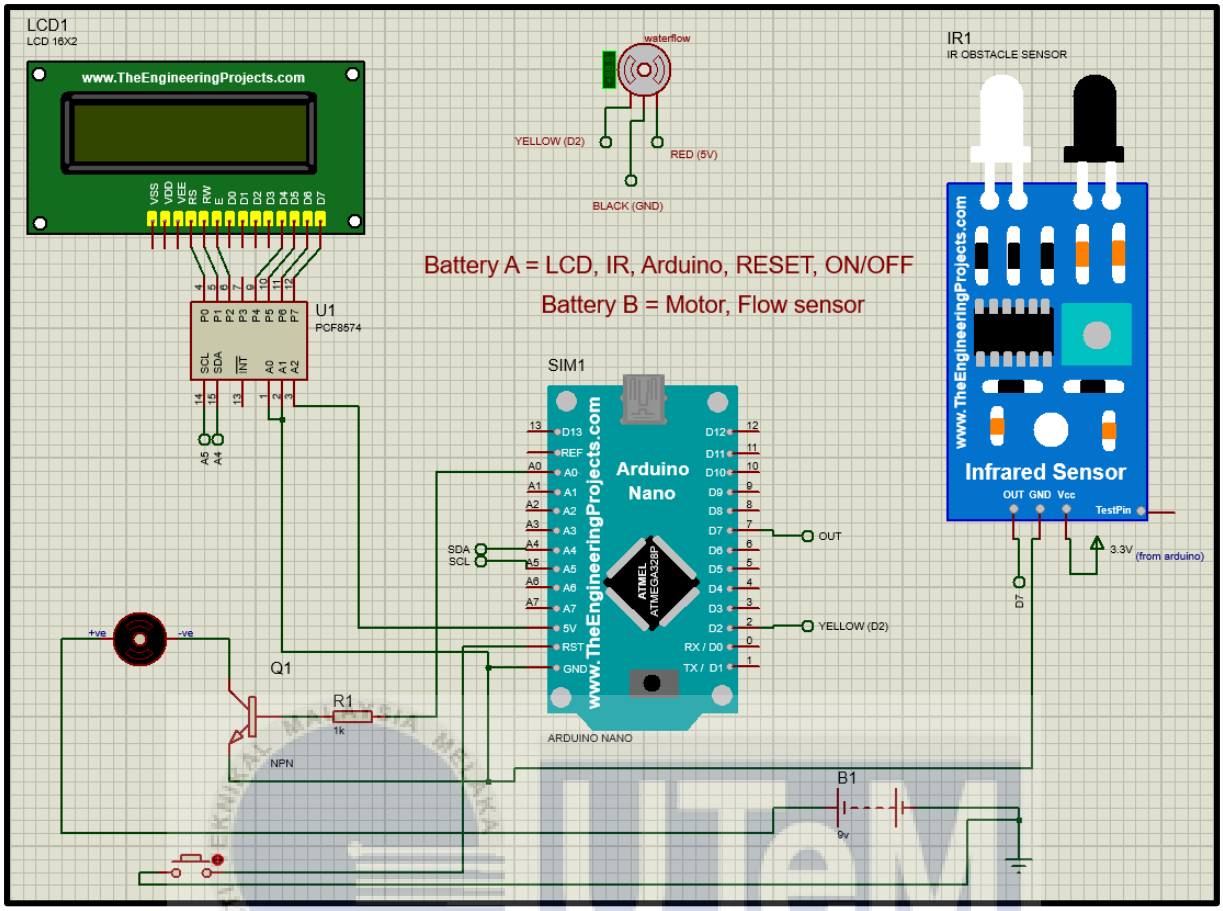


Figure 4. 1: Schematic diagram of the project in proteus software

4.3 HARDWARE DEVELOPMENT

The lists of hardware that needs to use for making this project successful are Arduino Nano, IR sensor, 1k resistor, SS-9013 transistor, 5V Mini Water Pump, YS-F401 Water Flow sensor, Liquid Crystal Display (LCD), ON/OFF button and RESET button. There will be two 9V batteries used to make this project run as the user want.

- Battery A : Arduino Nano, LCD display, IR sensor, RESET button and ON/OFF button
- Battery B : 5V Mini Water Pump, YS-F401 Water Flow sensor

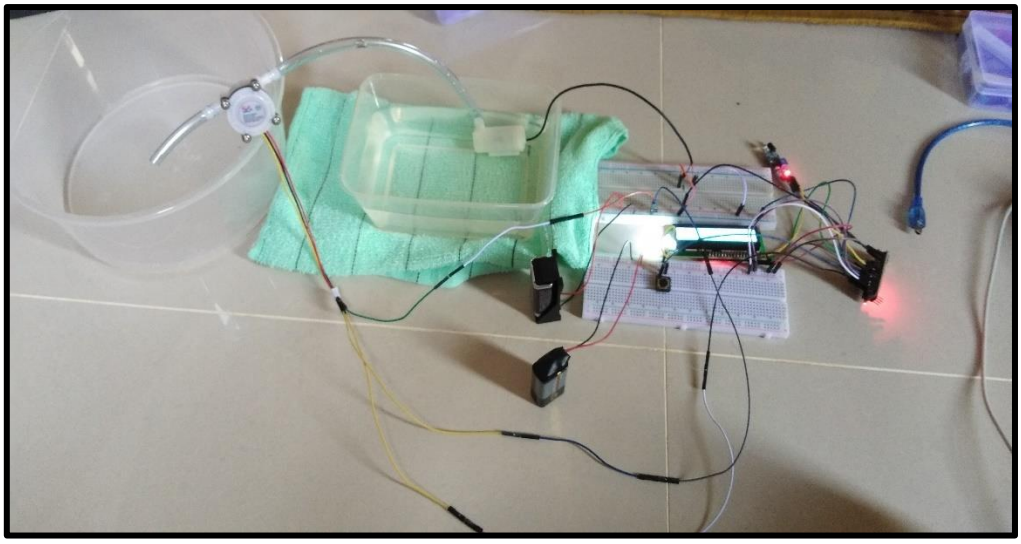


Figure 4. 2: Hardware construction

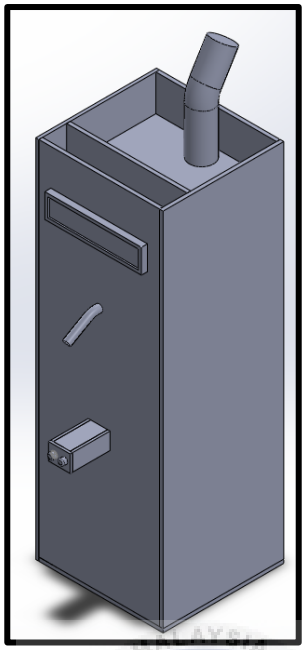
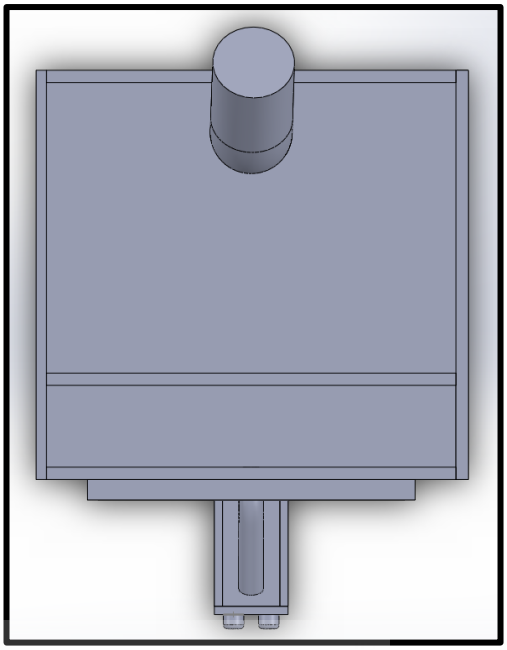
The IR sensor and the ON/OFF button will be the two input devices for this project, as shown in Figure 4 . The user can start the procedure before usage and stop it after use by pressing the ON/OFF button. The two LEDs on the IR sensor allow it to serve as an infrared transmitter and receiver. This means that if an item, like as a hand, approaches the sensor's range, the infrared light from the LED bounces off of the object and is recognised by the receiver, which then sends the information to the Arduino Nano microcontroller. The tiny size of this microcontroller will be advantageous during circuit design, particularly to save space. The Mini Water Pump will then be turned on by the microcontroller, causing water to flow through the tube connecting to it. The YF-S401 Water Flow Sensor, which can estimate how much water is consumed by the user throughout an ablution procedure, will be in contact with the water as it passes through it. The LCD display will show every piece of information that sensor sends, allowing the user to keep track of everything as it happens. Finally, the user has the option of RESETING the procedure for the following user.

4.4 PROTOTYPE DESIGN

In this project, the design is most important thing that should do first to identify how the system works. Then, Solidworks software is used as the drafting tool in this project development and presents the real image in three dimensional (3D). The design was made by sketching first to make easier to design into the Solidworks software. Table 4. , shows the view of the design on four sides which are the Isometric view, the Top view, the Front view and the Right side view. Each view has its own importance to the project itself where it is able to help during the prototype design process happen.

- Isometric View : able to clearly depict the project's dimensions and proper ratios to each other for simple reference when designing the prototype
- Top View : after the front view's location is known, display the design's top.
- Front View : a projection view created by creating perpendicular lines connecting each point on the part's edges to the projection plane
- Right Side View : projected onto the projection plane's profile, which is a plane parallel to the object's right side.

Table 4. 1: The view Portable Semi-Auto Ablution Kit using Solidworks design

 Isometric View	 Top View
 Front View	 Right View

The whole size of prototype is used in centimetre to make easier to measure with ruler. The dimension gets from sketching first before made the prototype. Figure 4 . below shows the dimension of prototype in length x width.

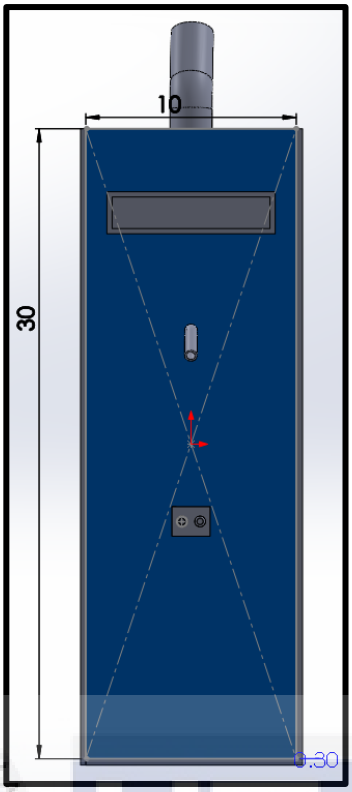


Figure 4. 3: The dimension of length x width for prototype.

There is one part of designing this project which is external part. Figure 4 . show the external part for Semi-Auto Ablution kit design.

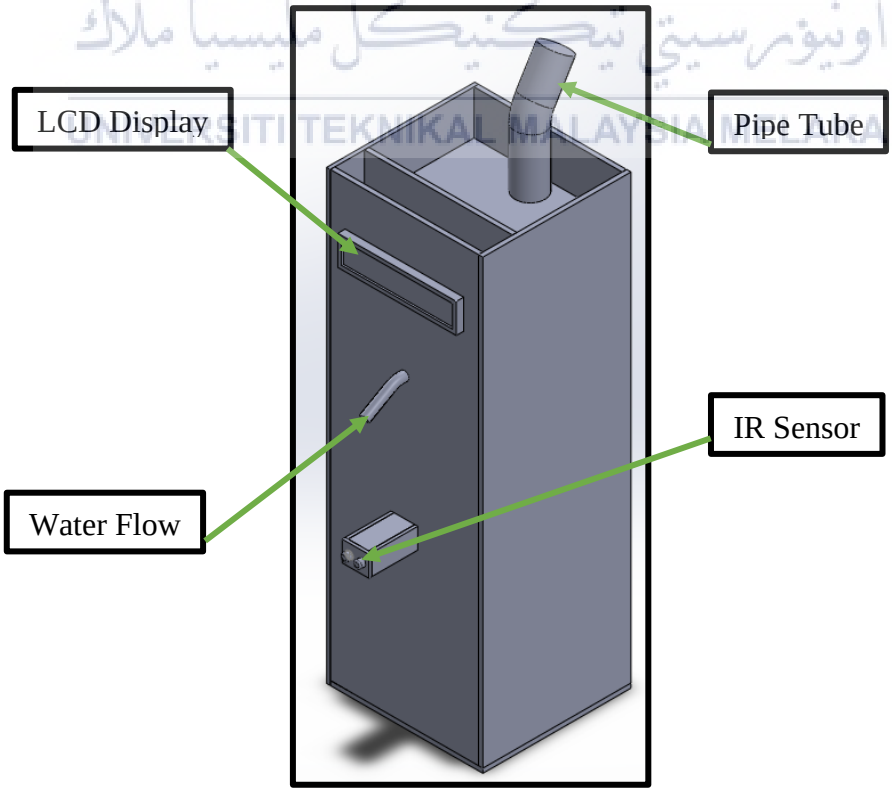
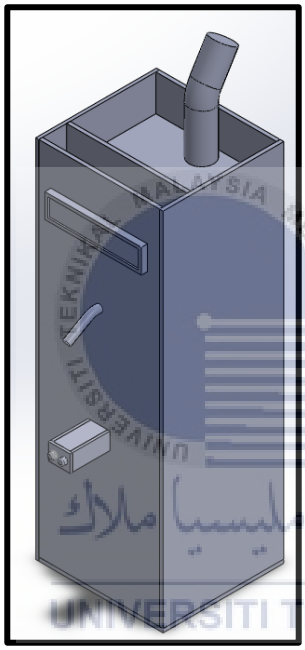


Figure 4. 4: External part of device.

4.4.1 Review of The Project Based on The Design

Table 4 . below shows the review of Solidworks design and real image. The entire prototype designed in Solidworks is show by real image constructed.

Table 4. 2: The review of Solidworks design and real image

Actual Design	**Real Image**
Prototype of Semi-Auto Ablution kit	
	

4.5 PROJECT INTEGRATION

All Muslims worldwide are welcome to utilise the Portable Semi-Auto Ablution Kit using Arduino System when doing their ablution before prayers. As is common knowledge, prayer is an essential part of Islam and is required five times every day. As a result, a lot of water will be consumed throughout the ablution ritual, and as Muslims, we are taught not to waste anything in our daily lives, including food and water. Muslims just only a little under 1 litre of water to accomplish their ceremonial ablution, according to a hadith. This project is one of the solutions to that issue, allowing users to keep track of how much water they consume and prevent waste throughout the ablution procedure.

If the Ablution Kit has any empty spaces, the user must first fill them with water. Since water is a crucial component of this project, it is vital to examine this component before proceeding. According to Figure 4 , the Ablution Kit has the following dimensions: LxH, which indicates that it can hold 2000mℓ of water. This should be sufficient to accomplish an ablution, which involves washing our hands, nose, mouth, face, arms, head, ears, and feet thoroughly.

Figure 4. 5: Fill the prototype with water

The user should then press the button to turn it ON and begin the process. The Ablution Kit cannot function if the button is not pressed prior to the procedure since there is no power source going through it. As previously indicated, two 9V batteries will be used to power this project. The microcontroller used is an Arduino Nano, and as it can accept voltages between 7V and 12V, this sort of battery may be utilised. Because we want to prevent the battery from draining, the supply source is not directly linked to it, which is why the button is positioned in

between the battery and the microcontroller. The microcontroller, sensor, RESET button, LCD display, and ON/OFF button are all powered by one of the batteries.

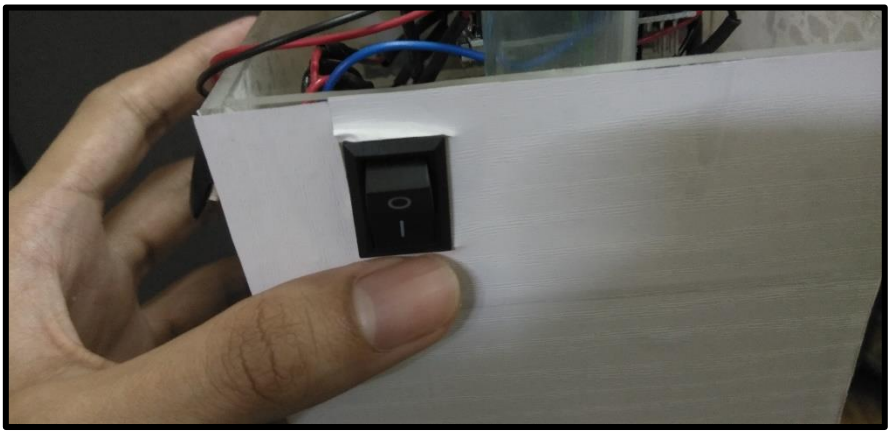


Figure 4. 6: Turn ON the prototype

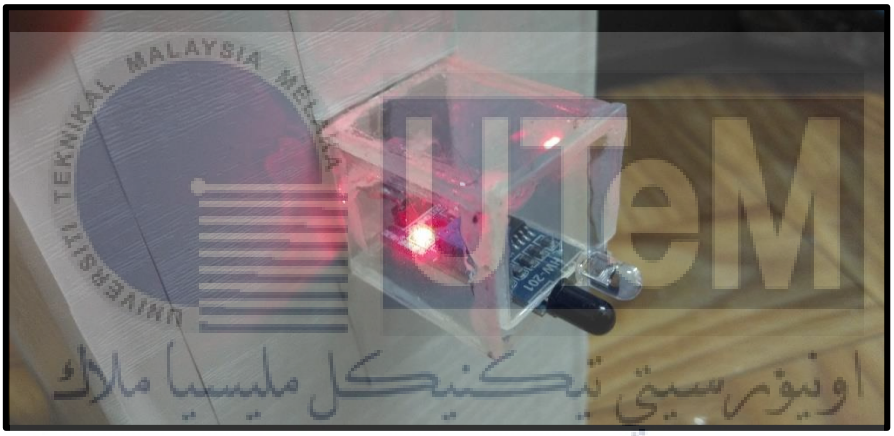


Figure 4. 7: IR sensor in ON stated

Figure 4. 8: LCD display in ON stated

Then, after pressing the button, every element is prepared to begin the procedure. The IR sensor will serve as this Ablution Kit's primary component. This sensor will sense any item in front of it, which should be the user's hands or feet because it is an electrical device that

monitors and detects infrared radiation in its surrounding environment. The transmitter and receiver of this sensor, two Light Emitting Diodes (LEDs), are mounted atop it. When the transmitter releases radiation, it implies that part of the radiation reaches the target and then reflects back to the receiver, where its output is sent to the microcontroller, which serves as the circuit's brain.

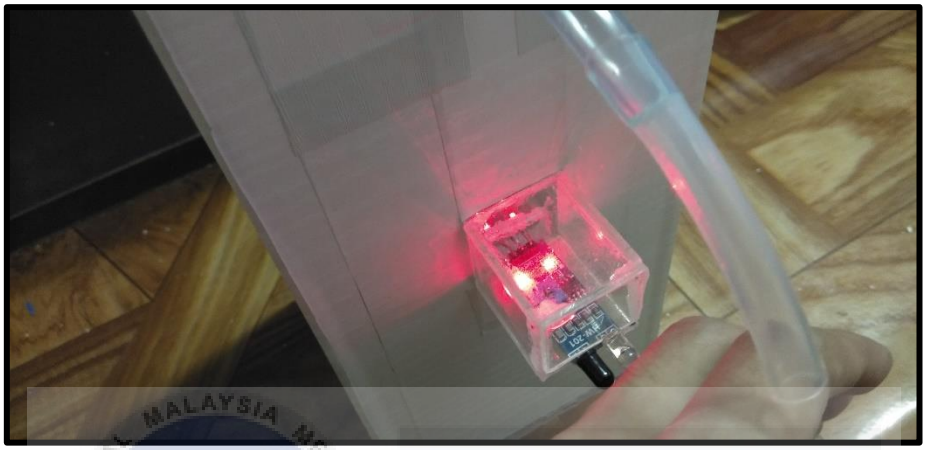


Figure 4. 9: IR sensor sense obstacles

The Mini Water Pump is then instructed to start working by the microcontroller when it gets the output from the IR sensor. According to the software published in the Arduino IDE, the motor will also be HIGH if the IR sensor is HIGH, and vice versa. This implies that the motor will continue to operate each time the sensor picks up hands or feet in front of it. The water will flow through the tube while the motor is working.

Water flowing through the tube must pass via the YF-S401 water flow sensor, which will compute the amount of water consumed during the ablution procedure automatically. The computation uses millilitres as the measurement unit (ml). The datasheet states that the calibration factor's value is 300. This number is crucial for this calculation since it can reduce measurement error by guaranteeing the accuracy of test equipment. Following that, a certain amount of water will be released for use in the ablution procedure.

Therefore, the purpose of an LCD display is to create a viewable image using liquid crystal. This indicates that this component will serve as a display for the user, providing all the information they require to understand how this procedure has progressed. In order to examine the differences between using a regular tap and this ablution kit, the information shown for this project is the amount of water utilised during an ablution. The sort of LCD that is being utilised is 16x2, which means that there will be two lines of text with 16 characters each.

Figure 4. 10: Volume of water used display

Finally, there is also a RESET button, whose purpose is to restart the circuit. This implies that if a different user wishes to use the Ablution Kit, they must first RESET the process; otherwise, the monitoring process will be worthless and resume from the previous value.

4.6 DATA ANALYSIS

4.6.1 Infrared Analysis

An infrared sensor circuit is one of the basic and popular sensor modules in an electronic device. This sensor is analogous to human's visionary senses, which can be used to detect obstacles and it is one of the common applications in real-time. The basic concept of IR sensor obstacle detection is to transmit the IR signal (radiation) in a direction and a signal is received at the IR receiver when the IR radiation bounces back from the surface of the object. The IR LED transmits the IR signal onto the object and the signal is reflected back from the surface of the object. The reflected signal is received by an IR receiver. The IR receiver can be a photodiode/phototransistor or a readymade module that decodes the signal.

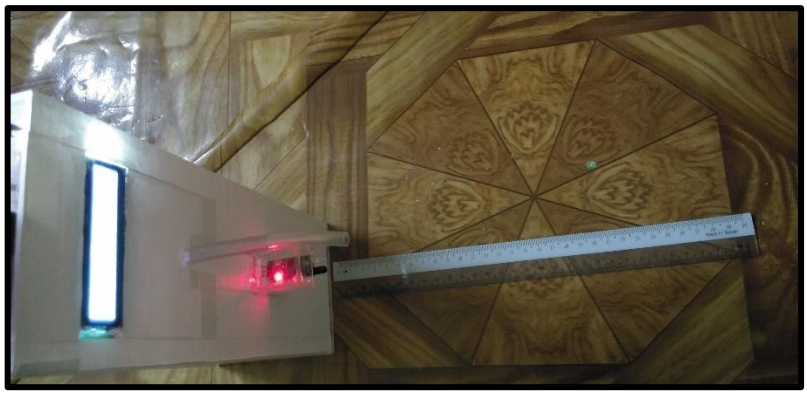


Figure 4. 11: Infrared analysis testing

Table 4. 3: Infrared analysis result

Distance (cm)	2	4	6	8	10	12	14	16	18	20
Condition of IR sensor	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF

The infrared distance analysis is displayed in Table 4 above. This investigation was done to determine the minimum and greatest distance at which impediments may be detected by infrared sensors. The positioning or location of an object that can have an impact on an infrared sensor's ability to identify obstructions. This project claims that the hands and feet of the user while they are doing their ablution are that object. The ability to identify barriers in front of the IR sensor is considerably easier if the item is closer to the sensor. The ability to identify barriers in front of the IR sensor becomes difficult when the item is placed distant from the sensor.

However, if the user's hands or feet are not in line with the IR sensor, it will not be able to detect any obstacles in front of it, regardless of how close or how far away the location is. The analysis's conclusion is that the infrared sensor can identify obstructions at a distance of up to 8 cm.

4.6.2 Water Conservation Analysis

Table 4. , which follows, contains the analysis for water conservation. Ten persons who were doing ablution were subjected to this test in order to compare the water usage of manual pipe and sensor knock. Next, achieving the Sunnah-recommended water intake of 1250 millilitres or less.

Table 4. 4: Water conservation analysis result

No	Name	Manual Taps (mℓ)	Sensors Taps (mℓ)	According to the Sunnah for sensor taps	Water Saving (mℓ)	Percentages (%)
1	Amir	5000	581	Yes	4419	88.38
2	Asymawi	4200	612	Yes	3588	85.43
3	Aiman	4580	604	Yes	3976	86.81
4	Syamim	8600	594	Yes	8006	93.09
5	Afif	3700	556	Yes	3144	84.97
6	Amirul	7750	574	Yes	7176	92.59
7	Iqmal	5100	635	Yes	4465	87.55
8	Asyraf	3250	586	Yes	2664	81.97
9	Syahmi	6567	622	Yes	5945	90.53
10	Khairul	5486	598	Yes	4888	89.10

- Formula for Water Usage

$$\textit{Volume of water saving} = \textit{Volume of water using manual water tap} - \textit{Volume of water using sensor tap}$$

$$\textit{Percentages of water saving} = \frac{Manual\ tap - Sensor\ tap}{Manual\ tap}\ x\ 100\%$$

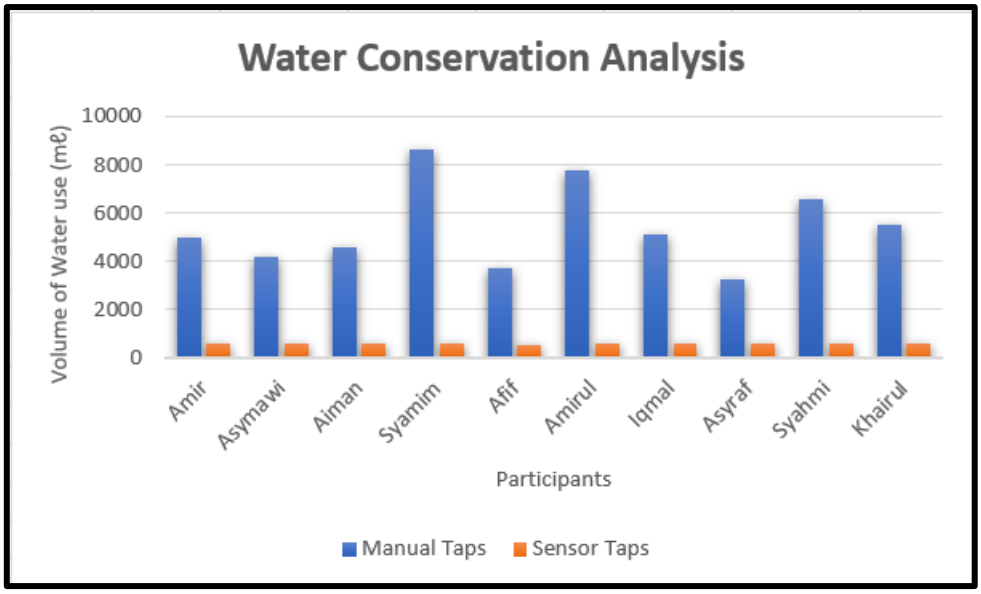


Figure 4. 12: Water conservation analysis graph

4.7 SUMMARY

This chapter will be summarized the preliminary result of 'Development of a Portable Semi-Auto Ablution Kit Using Arduino System'. By doing this simulation, the connection for every component used can be determined so the output or objective of the project can be achieved.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

The last chapter of a report or thesis is generally the conclusion. Its main goal is to summarise the findings and make any recommendations for further study.

5.2 CONCLUSION

Water made up over 70% of the Earth's surface, but pure or fresh water is currently a scarce resource. As a result, it has become one of the most valuable resources, particularly for those who must survive. Aside from that, Muslims, who make up the majority of Malaysia's population, have disclosed that ablution water waste accounts for roughly 30% of total water waste, particularly during face washing. It contradicts the teachings of the Holy Quran. As a result, water conservation is something that must be followed in order to keep water pure while also safeguarding the ecosystem. Therefore, a technique of water saving while usage is devised by implementing the portable semi-auto ablution kit utilising the Arduino system. Although this portable is designed for use in restrooms, it may also be utilised in other areas such as the kitchen and bathroom. It was made with the intention of being simple to use and affordable to everyone.

5.3 PROJECT POTENTIAL

Because of the low cost for completing this project, this product can encounter the cost of the ready make semi-auto water tap. In addition, this low-cost ablution system can get high demand from consumer as it is affordable yet easy to use. With this project, expected water conserved is greater than the manual water tap.

5.4 RECOMMENDATIONS

For the future planning, a lot of improvement can be made up. For example, this ablution system not only targeted to mosque, but also at any water tap. With a system supplied, it can be portable and supply will be charge by just only using portable power bank or system solar charger. In addition, a speaker can be attached and added to recite Doa.

REFERENCES

[1] Jah, C. A. (2020, February 29). Water in Islamic culture. Water in Islamic Culture from https://www.ecomena.org/water-islam/#:~:text=Thus%2C%20the%20word%20al%2Dma,century%20recently%20discovered%20by%20science.

[2] Lipka, M., & Hackett, C. (2020, May 30). Why Muslims are the world's fastest-growing religious group. Why Muslims are the world's fastest-growing religious group from https://www.pewresearch.org/fact-tank/2017/04/06/why-muslims-are-the-worlds-fastest-growing-religious-group/

[3] PIMEasianews. (2006, August 6). Quick, "approved" ablutions with first Islamic Washing Machine. Quick, "approved" ablutions with first Islamic washing machine from https://www.asianews.it/news-en/Quick,-approved-ablutions-with-first-Islamic-washing-machine-6392.html

[4] Zaied, R. A. (2016, April 12). Water use and time analysis in ablution from Taps - Applied Water Science. Water use and time analysis in ablution from taps from https://link.springer.com/article/10.1007/s13201-016-0407-2

[5] Amery, H. A. (2009, January 22). Islamic Water Management from https://www.tandfonline.com/doi/abs/10.1080/02508060108686949

[6] Al-Hassani, Y. (2020, February 6). About Wudu - questions on Wudu answered. About Wudu - Questions on Wudu answered from https://www.dudleyindustries.com/news/about-wudu-questions-on-wudu-answered?hsLang=en

[7] Yusof, A. F., Mohd Zaki, M. Z., Abdul Hamid, H., Husain, F. H. (2020, April 28). A study of mosque water consumption using self-closing tap. A Study of Mosque Water Consumption using Self Closing Tap from https://www.researchgate.net/publication/344335278_A_Study_of_Mosque_Water_Consumption_using_Self_Closing_Tap

[8] Malek, C. (2019, August 11). How Saudi Arabia plans to meet the water needs of holy sites from https://www.arabnews.com/node/1538541/saudi-arabia#:~:text=Water%20consumption%20in%20Makkah%20rose,Makkah%20and%20the%20holy%20sites.

[9] Alexander Chilton. (2014, October 15). The working principle and key applications of infrared sensors. The Working Principle and Key Applications of Infrared Sensors from https://www.azosensors.com/article.aspx?ArticleID=339

[10] Jost, D. (2019, October 7). What is an ultrasonic sensor? from https://www.fierceelectronics.com/sensors/what-ultrasonic-sensor

[11] iSeekplant. (2019, July 1). What is a water pump? from https://blog.iseekplant.com.au/blog/what-is-a-water-pump

[12] Khillar, S. (2018, July 23). Difference between pump and Motor. Difference Between Similar Terms and Objects from http://www.differencebetween.net/technology/difference-between-pump-and-motor/

[13] Brennan, E. (2014, January 27). What is a microcontroller? - programming an Arduino board from https://turbofuture.com/computers/What-is-an-Arduino-Programming-Microcontrollers

[14] DevicePlus Editorial Team. (2020, November 23). Arduino: The popular microcontroller board! its history and to how to use it. Arduino: The Popular Microcontroller Board! Its history and to How to Use It from https://www.deviceplus.com/arduino/arduino-the-popular-microcontroller-board-its-history-and-to-how-to-use-it/

[15] Tarun Agarwal (2019, August 17) Water flow sensor - working principle, applications & examples from https://www.elprocus.com/a-memoir-on-water-flow-sensor/

[16] Anom Besari, A. R., Zamri, R., Yusaeri, A., Md Palil, M. D., & Prabuwono , A. S. (2009, October 4). Automatic ablution machine using vision sensor - researchgate. Automatic Ablution Machine using Vision Sensor from https://www.researchgate.net/publication/236865549_Automatic_Ablution_Machine_using_Vision_Sensor

[17] Surathon, A., Chan, C. M., & Tuan Ab Rahman, T. S. (2014, November 23). SmartWUDHU': Recycling ablution water for sustainable living in Malaysia from https://www.researchgate.net/publication/286521190_SmartWUDHU'_Recycling_Ablution_Water_for_Sustainable_Living_in_Malaysia

[18] Abd Rahman, M. M., Kaamin, M., Mohamad, M. A. H., & Mohmad Omar, M. H. (2016, September). Rewudhuk: A sustainable device to reuse musta'mal water for ablution ... ReWudhuk: A Sustainable Device to Reuse Musta'mal Water for Ablution Purpose from https://www.researchgate.net/publication/311161374_ReWudhuk_A_Sustainable_Device_to_Reuse_Musta'mal_Water_for_Ablution_Purpose

[19] Hulukati, S. A., Handayani, T. P., Jaya, R., & Abdussamad, S. (2019, July). (PDF) a prototype of solar-powered automatic ablution taps. A Prototype of Solar-Powered Automatic Ablution Tap from https://www.researchgate.net/publication/334375830_A_Prototype_of_Solar-Powered_Automatic_Ablution_Tap

[20] Mukhtar, M. F., Hasim, N. A. H., Rosley, M. I. F., Muhamad Damanhuri, A. A., & Samsudin , A. (2021, January). Development of a Portable Ablution System for Muslims from Ergonomics Approach from https://www.researchgate.net/publication/349942699_Development_of_a_Portable_Ablution_System_for_Muslims_from_Ergonomics_Approach

[21] Aqeel, A. (2021, December 13). Introduction to arduino nano. Introduction to Arduino Nano from https://www.theengineeringprojects.com/2018/06/introduction-to-arduino-nano.html

[22] Components101. (2020, August 30). IR sensor module from https://components101.com/sensors/ir-sensor-module

[23] BC Robotics (2022, December 22). Liquid flow meter - YF-S401 - for Arduino and Raspberry Pi from https://bc-robotics.com/shop/liquid-flow-meter-yf-s401/

[24] MYBOTIC. (n.d.). Micro submersible water pump DC 3V-5V from https://www.mybotic.com.my/water-pump/micro-submersible-water-pump-dc-3v-5v

[25] NIT Warangal EA & HAM Club (2021, October 14). What is proteus? from https://ea-ham-nitw.medium.com/what-is-proteus-6d408f5d2d5c

[26] Carmel (2022, January 31) SolidWorks: 3D modelling software with parametric construction from https://www.sculpteo.com/en/glossary/solidworks-definition/#:~:text=SolidWorks%20is%20computer%2Daided%20design,reflected%20in%20the%20other%20two.

[28] (n.d.) Challenge 3 - strip board circuit design - bourne to invent from https://bournetoinvent.com/index.php/10-year-8/156-challenge-3-strip-board-circuit-design

[29] Michael James (2018, October 31) Programming Electronics Academy - How to use an external reset button with Arduino: Viewer question #6 from https://www.programmingelectronics.com/how-to-use-an-external-reset-button-with-arduino/#:~:text=All%20you%20have%20to%20do,and%20your%20Arduino%20will%20reset.

[30] Admin (2022, August 21) How to Electronics - IOT water flow meter using esp8266 & water flow sensor from https://how2electronics.com/iot-water-flow-meter-using-esp8266-water-flow-sensor/

[31] Chris @ BCR (2021, November 21) BC Robotics - Using a flow sensor with Arduino from https://bc-robotics.com/tutorials/using-a-flow-sensor-with-arduino/

[32] Lambsoft (2018, June 6) Arduino Forum - Simplest battery power to Arduino Nano Solution? from https://forum.arduino.cc/t/simplest-battery-power-to-arduino-nano-solution/530242/2

[33] Shojaei (2022, January 11) Electropeak - Interfacing I2C 16x2 character LCD with Arduino from https://electropeak.com/learn/interfacing-i2c-16x2-character-lcd-1602-display-module-with-arduino/

[34] Admin (2022, December 18) How to Electronics - Arduino water flow sensor to measure flow rate & volume from https://how2electronics.com/arduino-water-flow-sensor-measure-flow-rate-volume/#Source_CodeProgram

[35] (n.d.) Water level indicator and pump controller using Arduino – Hackatronic from https://www.hackatronic.com/water-level-indicator-and-pump-controller-using-arduino/

[36] Santosh Ambekar (2020, May 30) Hackster.io - IOT hand sanitiser / soap Dispenser from https://www.hackster.io/santronix/iot-hand-sanitiser-soap-dispenser-367594

[37] (n.d.) ElectroVigyan - Automatic hand sanitizer using IR sensor for covid-19 from https://www.electrovigyan.com/electronic-projects/automatic-hand-sanitizer/

[38] Admin (2022, August 22) How to Electronics - Stopwatch using Arduino & LCD - Start Stop Reset button from https://how2electronics.com/stopwatch-arduino-lcd-start-stop-reset-button/#Source_CodeProgram

[39] AcoptexCom (2020, April 1) GitHub - Arduino/FC51pro1.ino at master · ACOPTEXCOM/Arduino from https://github.com/AcoptexCom/arduino/blob/master/FC51pro1/FC51pro1.ino

[40] (n.d.) Robotique Tech - Control a water pump by Arduino from https://www.robotique.tech/robotics/control-a-water-pump-by-arduino/

[41] Roland Pelayo (2019, May 5) Microcontroller Tutorials - Building an Arduino water flow meter from https://www.teachmemicro.com/arduino-water-flow-meter/

[42] (2022, August 29) Hobby electronic soldering and construction - Cutting veroboard tracks from https://www.bestsoldering.com/cutting-veroboard-tracks/

[43] (n.d.) zkl doc - blog.zerokol.com - Water pump with Arduino from https://blog.zerokol.com/2013/03/water-pump-with-arduino.html

[44] (n.d.) VERTECO - Water efficient taps for ablution areas from https://www.verteco.com/what-we-do/water-saving-solutions/for-ablution-taps#:~:text=The%20Prophet%20Muhammad%20(peace%20be,slightly%20more%20than%203%20litres).

[45] Abu Amina Elias (2021, September 26) Daily Hadith Online - Hadith on water: Conserve water even by a running stream from https://www.abuaminaelias.com/dailyhadithonline/2013/08/19/conserve-water-flowing-stream/