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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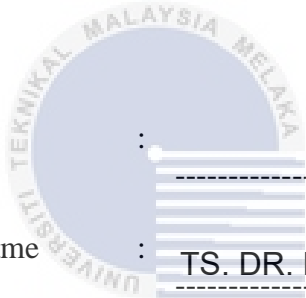
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DEDICATION

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.

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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

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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.
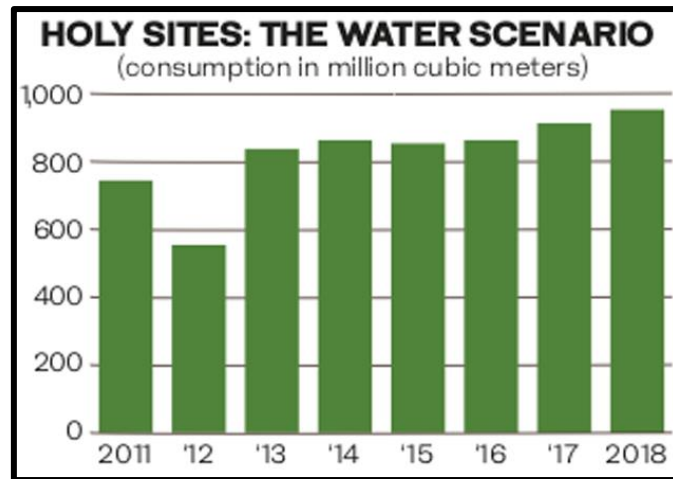
Figure 2. 1: The Water Scenario

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)

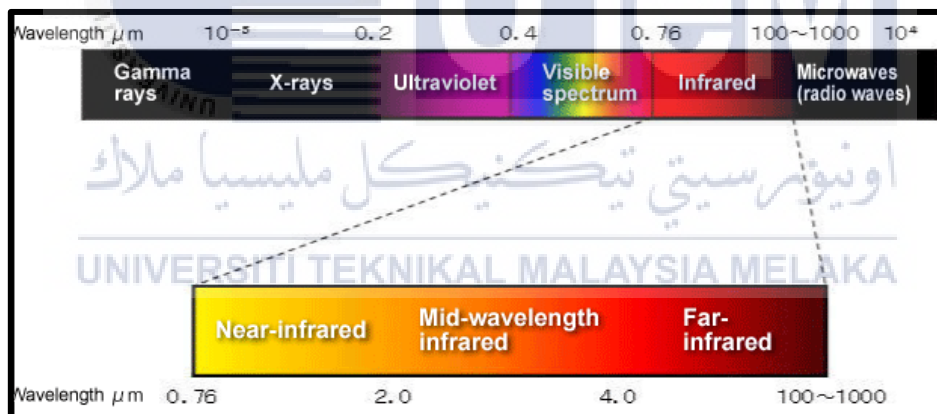- Far-infrared: higher than 6um (wavelength region)

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.

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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

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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

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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.
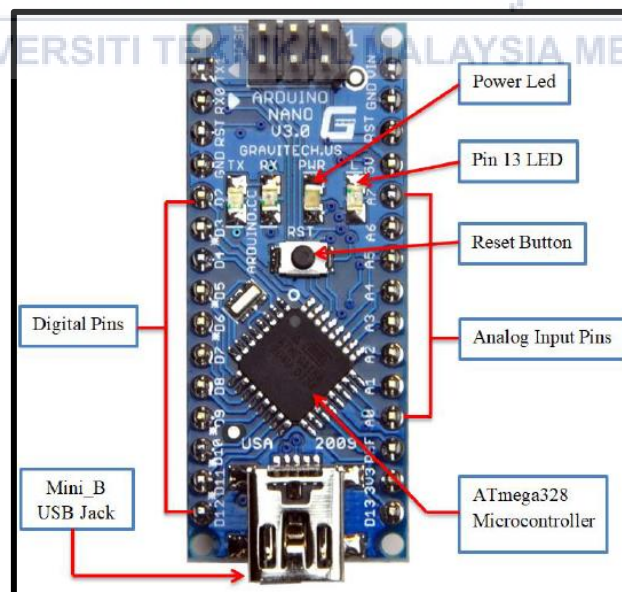

Figure 2. 4: Example of Arduino