



Faculty of Electrical and Electronic Engineering Technology

**DEVELOPMENT OF IOT BASED WUDHU WATER MANAGEMENT
SYSTEM USING ESP32 FOR GREEN MOSQUE**

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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Bachelor of Electronics Engineering Technology (Telecommunications) with Honours

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DEVELOPMENT OF IOT BASED WUDHU WATER MANAGEMENT SYSTEM USING ESP32 FOR GREEN MOSQUE

MUHAMAD ZULFAQAR BIN YA'AKUP

A project report submitted in partial fulfilment of the requirement for the degree of Bachelor of Electronics Engineering Technology (Telecommunications) with Honours



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Faculty of Electrical and Electronic Engineering Technology

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I declare that this project report entitled "Development Of Iot Based Wudhu Water Management System Using ESP32 For Green Mosque" is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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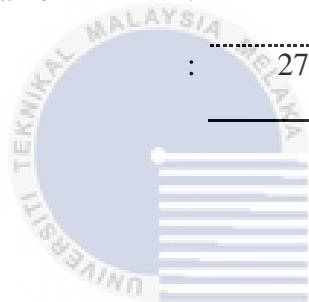
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APPROVAL

I approve that this Bachelor Degree Project 2 (PSM2) report entitled “Development of IoT Based Wudhu Water Management System using ESP32 for Green Mosque” is sufficient for submission.

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DEDICATION

This research is dedicated to my parents, Ya'akup bin Man and Noor Harfah binti Jali, who have always encouraged me. They have given me the encouragement and motivation that I need to not give up in doing this project. To my supervisors, Ts Fakhruallah bin Idris, I sincerely thank you for guiding me throughout the project. Without their love and support, this project would not have been possible.



ABSTRACT

Due to Muslims' need for ablutions, mosques consume a lot of clean to processed drinking water. During ablution, they usually use ten to twelve litres of water five times a day. By reusing post-ablution water in the ablution tub after the ablution procedure, the Wudhu Water Management System will reduce water consumption during the ablution process. During the ablution procedure, this device will regulate the flow and volume of water. The goal of this project is to design and construct a prototype ablution system that can reduce water usage during the ablution process by reusing post-ablution water after the ablution procedure has been completed. To manage the water flow, a ESP32 will be used as a controller. The ablution tub's water flow will be controlled by a water pump, and sensors will monitor the water volume in the storage and ablution tubs to ensure that there is adequate water for the ablution process. For monitoring purposes, all data is shared to the cloud. The system should only work at predetermined times based on prayer times and when users are recognised. In a Graphical User Interface (GUI), the results and analysis of data concerning the volume and flowrate of water during the ablution process will be shown.

ABSTRAK

Disebabkan keperluan umat Islam untuk berwuduk, masjid mengambil banyak air minuman yang bersih dan diproses. Semasa berwuduk, mereka biasanya menggunakan sepuluh hingga dua belas liter air lima kali sehari. Dengan menggunakan semula air selepas wuduk di dalam tab wuduk selepas prosedur wuduk, Sistem Pengurusan Air Wuduk akan mengurangkan penggunaan air semasa proses wuduk. Semasa prosedur wuduk, alat ini akan mengawal aliran dan isipadu air. Matlamat projek ini adalah untuk mereka bentuk dan membina prototaip sistem wuduk yang dapat mengurangkan penggunaan air semasa proses wuduk dengan menggunakan semula air selepas wuduk dimana prosedur wuduk selesai. Untuk menguruskan aliran air, ESP32 akan digunakan sebagai pengawal. Aliran air tab wuduk akan dikawal oleh pam air, dan sensor akan memantau isipadu air dalam simpanan dan tab wuduk bagi memastikan terdapat air yang mencukupi untuk proses wuduk. Untuk tujuan pemantauan, semua data dikongsi ke 'Cloud'. Sistem hendaklah hanya berfungsi pada waktu yang telah ditetapkan berdasarkan waktu solat dan apabila pengguna dikesan menggunakan sistem tersebut. Hasil dan analisis data tentang isipadu dan kadar alir air semasa proses wuduk akan ditunjukkan dalam GUI .

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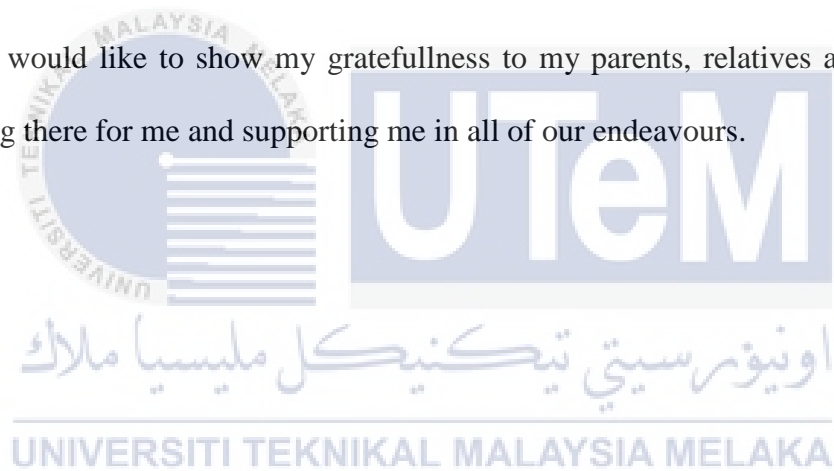


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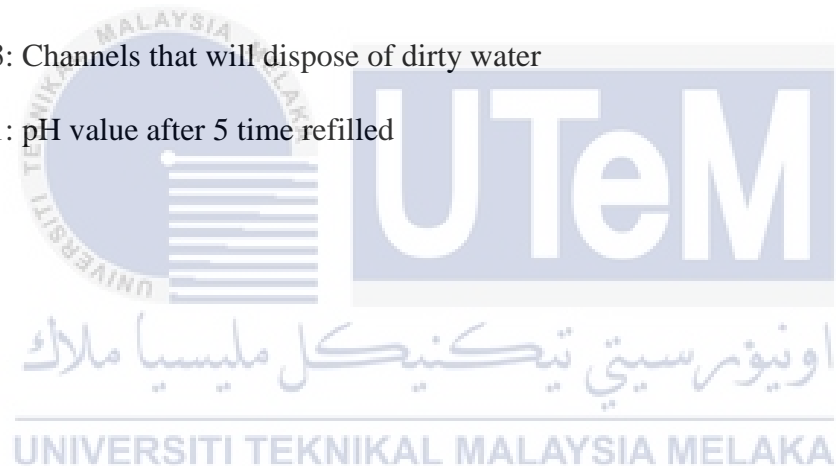
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LIST OF SYMBOLS

δ - Voltage angle



LIST OF ABBREVIATIONS

V - Voltage

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CHAPTER 1

INTRODUCTION

1.1 Background

As the tap is usually left running, much good water is wasted in the process. Considering the unnecessary wastage, a simple recycling system can be designed to collect, treat and reuse ablution water in this system so that the water can be reused for ablution. A simple ablution water output prediction model was next proposed to more accurately quantify the capacity and efficiency of this water recycling system.

1.2 Problem Statement

The mosque is a place of worship for Muslims. Mosques nowadays many facilities have been provided by the government. One of them is electricity, water for ablution and so on. But the facilities provided are not used properly. So the main problem for this study is the process during ablution where the use of water is widely used. Ablution is a process that Muslims need to do before performing prayers. However, excessive use of water during ablution is strongly discouraged. The water consumptions during ablution are range from 9 liters of water per day per ablution [3] for one worshipper will use 45 liter of treated water for one day. Hence, this study will discuss the amount of water consumption and how to deal with water wastage during ablution and this project will focus at Masjid Sayyidina Abu Bakar, University Technical Malaysia Malacca .

1.3 Project Objective

The aim of the study is to measure the amount of water wasted and disposed in the ablution process in the mosques of the study area, without any treatment for reuse, and to further investigate the way to reduce the water consumption during ablution :

- a) To survey the usage of water during ablution per person in mosque.
- b) To develop a system that can reduce water wastage during ablution.
- c) To investigate the methods and applications for recycling ablution water

1.4 Scope of Project

The major purpose of this study is to improve water demand management in general public buildings, such as mosques across the world but this project will focus on Sayyidina Abu Bakar Mosque, University Technical Malaysia Malacca. This project would reduce water consumption during ablution process by reusing post ablution water in ablution tub after finish the ablution process. This study calculates the potential savings that can be made by recommending regulations that encourage mosques to use proper equipment and procedures.

Among the equipment that will use in this project is ESP32 as a controller to control water flow. The ablution tub's water flow will be controlled by a water pump, and sensors will monitor the water volume in the storage and ablution tubs to ensure that there is enough water for the ablution process. For monitoring purposes, all data is shared to the cloud. The system should only work at predetermined times based on prayer times and when users are recognized. In a graphical user interface (GUI), the results and analysis of data concerning the volume and flowrate of water during the ablution process will be shown.

This study uses a simple way to measure the amount of water used in the mosque, including during ablutions, and it also indicates the savings that can be made. The study

proposes potential water-saving solutions, investigates the acceptability of reusing water in mosques, and finally presents rules for controlling water consumption in public buildings, such as mosques. The purpose of this project is to address the following research questions: 'How can water waste during ablution in the mosque be reduced?' The study's aims in this case study are summarised by the observed knowledge gaps.

1.5 Organization

Introduction, literature review, methodology, preliminary result, and conclusion and recommendation are five chapters of this study. All chapter will go over the research in greater depth.

1.6 Thesis Organization (Chapter 1-5)

The first chapter is about the project introduction. The project history, problem statement, objectives, and research scope are all included in this chapter. This chapter will review and give all of the summary facts pertaining to this project.

For chapter 2, it's regarding earlier research that's relevant to this study. It's also referred to as a literature review. The approaches and some of methods utilized by other researchers in their studies are discussed in this chapter. This is crucial information for studying and comparing the characteristics of the past research that could serve as a guideline for this project.

For chapter 3 focus on the methodology which is will comprise the project's flowchart, as well as the software and hardware that will be employed. At the same time, it's about understanding how the process works, as well as how to properly plan and implement a project.

For chapter 4 will focus on expected results and analysis where the predicted results will be the output before the project is fully completed. Expected result is very necessary to know the desired output and also the concept used. With a description of the expected result, the output and data obtained are easy to understand.

Lastly, chapter 5 is the conclusion and overall understanding of chapters 1 to 4.



CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Prayer is the second pillar of Islam, so it is obligatory for every Muslim around the world. Before performing the five daily prayers, there are things that need to be done which is ablution. Ablution is a process where a worshipper performs minimum 5 times daily at mosque, using water. Generally treated water are use as it professes the quality and perceptions of cleanliness. In order to exalt purity and cleanliness before each prayer, ablution is a must-do activity for Muslims.

2.2 Green Mosque

Significant global climate changes affecting humans and ecosystems directly or indirectly are now a hot topic to discuss. The concept of building sustainability is very useful for increasing efficiency in the use of resources such as water while reducing adverse implications to human health and the environment.

On 20 October 2009, the Ministry of Works was directed to ensure all new government buildings were integrated with the Malaysian green building index (GBI) criteria and this research worked on efforts to create conceptual sustainability for mosque buildings leading to the formation of the green mosque index (GMI)[1]. Water Efficiency is one of the sustainable practices is efficiency of water consumption [1]. Efficiency in using water is very important to get benefits such as long -term use of water. If the use of water is not practiced

so well then humans will experience a water crisis in the future. As the use of water in the mosque is very much used for Muslims to perform ablution to perform obligatory prayers.

On 11th November 2017, MUI (Indonesian Council of Ulama) and DMI (Indonesian Mosque Council) have launched the national program named eco masjid [2]. The purpose of establishing an eco-masjid is a sustainable mosque program through efforts to preserve natural resources such as water. Among the methods used is water conservation (WAC), water is the main use in mosques for ablution. The Azzikra mosque has used a water recycling system to recycle used water from ablution water and recycled water will be used for toilets, kitchens and watering flowers. Figure 2.2.1 is the water recycling system at Azzikra Mosque [2].



Figure 2.2.1: Recycling System. Adapted from [2]

Although green mosques have been established in some mosques to deal with water waste but this method still cannot be practiced by some communities. So the most suitable system is where recycling ablution water can reduce water waste.

2.3 Ablution water usage

Even though the prophet preach to save water during ablution process, in reality the water consumption are quite high. Based on study by multiple researchers, the water consumptions during ablution are range from 5-9 liters of water per day per ablution [3][4][5]. Table 1 shows the usage of water.

Table 1: Journal that related with water usage per ablution

Author	Area	Usage (liters)	Measurements method
N.H Johari et all [3]	Malaysia	9	- The way of measurement is field observation which is measure the ablution water at bucket.
Roubi A. Zaied [4]	Egypt	7	- Video recorded by total time of each group is computed for each case and the statistical calculation are used.
Ahmad Faisol Yusof et all [5]	Malaysia	5	- This measurement is using field observation and interview method.

So with the data given it shows the consumption of water during ablution. Each survey done has a difference of data obtained so with a range of 5-9 liters we can know how much consumption of water per day per ablution. Futhermore, it was discovered that 22.7–28.8% of ablution water is utilised for foot washing, with the biggest water waste occurring during