THE DEVELOPMENT OF ONLINE MONITORING SYSTEM FOR WATER CONSUMPTION IN ABLUTION ACTIVITY CONSIDERING MALAYSIAN CULTURAL PREFERENCES

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Faculty of Mechanical and Manufacturing Engineering Technology

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A thesis submitted
in fulfillment of the requirements for the degree of
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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

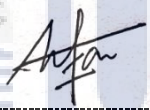
Faculty of Mechanical and Manufacturing Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2022

DECLARATION

I declare that this Choose an item. entitled " The Development of Online Monitoring System for Water Consumption in Ablution Activity Considering Malaysian Cultural Preferences" is the result of my own research except as cited in the references. The Choose an item. has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : 

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APPROVAL

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor of Manufacturing Engineering Technology (Process and Technology) with Honours.

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Supervisor Name : Dr. Ihwan Ghazali

Date : 18 January 2022

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DEDICATION

Alhamdulillah, my gratitude to Almighty Allah for enabling me to successfully completed this thesis. My gratitude and appreciation to all people who were always supported me to perform this report well truly from family. And finally, many thanks to my supervisor Dr Ihwan Ghazali, who were give effort, support and advice that guiding me also not forget for his chance that give me the title for final year project feel better to performed the progress. Thank you also for all my fellow friends who always support and encourage me.

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ABSTRACT

Water is an important resource for life and its existence and, unfortunately, large quantities of water are being wasted on daily basis especially on ablution ritual at mosques which is consumes large amount of water. Monitoring the consumption of water can control water usage, and smart technologies can play a useful role. In this paper, a smart system based on Internet of Things (IoT) has been proposed to monitor the water consumption in ablution considering Malaysia is country of many Islamic people. A water flow sensor, together with Arduino, continuously monitors the water that used and sends these data to a server through a Wi-Fi module. Using the data collected from the culture in Malaysia to find the preferences of the atributes of characteristic of online water monitoring with IoT system. The water can be monitor in real time the help of IoT system. The water consumption is predicted for each day for the user. An algorithm to monitor the flow of water consumption and can be used to detect leakage of water in the tanks has also been proposed. A web interface allows the user to visualize the water usage, monitor their consumption, and detect any leakage and leakage rate in the system through smartphone and laptop.

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ABSTRAK

Air merupakan sumber penting untuk kehidupan dan kewujudannya dan, malangnya, air dalam kuantiti yang banyak dibazirkan setiap hari terutamanya pada ibadah wuduk di masjid yang mengambil banyak air. Memantau penggunaan air boleh mengawal penggunaan air, dan teknologi pintar boleh memainkan peranan yang berguna. Dalam kertas kerja ini, sistem pintar berasaskan Internet of Things (IoT) telah dicadangkan untuk memantau penggunaan air dalam wuduk memandangkan Malaysia adalah negara yang mempunyai ramai umat Islam. Sensor aliran air, bersama-sama dengan Arduino, memantau air yang digunakan secara berterusan dan menghantar data ini ke pelayan melalui modul Wi-Fi. Menggunakan data yang dikumpul daripada budaya di Malaysia untuk mencari keutamaan atribut ciri pemantauan air dalam talian dengan sistem IoT. Air boleh dipantau dalam masa nyata dengan bantuan sistem IoT. Penggunaan air diramalkan untuk setiap hari untuk pengguna. Algoritma untuk memantau aliran penggunaan air dan boleh digunakan untuk mengesan kebocoran air dalam tangki juga telah dicadangkan. Antara muka web membolehkan pengguna menggambarkan penggunaan air, memantau penggunaan mereka, dan mengesan sebarang kebocoran dan kadar kebocoran dalam sistem melalui telefon pintar dan komputer riba.

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LIST OF SYMBOLS AND ABBREVIATIONS

IoT	-	Internet of Things
MIT	-	Massachusetts Institute of Technology
RFID	-	Radio Frequency Identification
GPS	-	Global positioning system
IBM	-	International Business Machines Corporation
PIC	-	Programmable Intelligent Computer
LED	-	Light-Emitting Diode
GUI	-	Graphical User Interface
VUI	-	Vector Distance Algorithm
PAA	-	Polygon Area Algorithm
ARM	-	Advanced Risc Machines
RF	-	Radio-Frequency
ADC	-	Analog Digital Converter
LCD	-	Liquid Crystal Display
GSM	-	Global System Mobile
SMS	-	Short Message Service
DC	-	Direct Current
OLED	-	Organic Light-Emitting Diode
IDE	-	Integrated Development Environment
MATLAB	-	Matrix Laboratory
PLS	-	Partial Least Squares
CFA	-	Confirmatory Factor Analysis
CR	-	Composite Realibility
AVE	-	Average Variance Extracted
HTMT	-	Heterotrait-Monotrait Ratio
VIF	-	Varience Infation Factor
HCM	-	Higher-Order Model / Hierarchical Component Model

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CHAPTER 1

INTRODUCTION

1.1 Background

There have been nearly 19.5 million Muslim believers in 2013, accounting for 61.3 percent of the total population which defining Islam as the most widely professed religion in Malaysia. Meanwhile, the population of other religions which are Buddhism (19.8%), Christianity (9.2%), and Hinduism were among the other religions practiced (6.3%) approximately (Department of Statistics Malaysia, 2020). In defining the cultural preference towards Muslim population, it can be stated that culture has a significant impact on certain facets of how an individual thinks, acts, and acts in various situations which most profoundly, one's culture influences the very essence of the "self" that is thought, experiencing, and acting (Wilken, Miyamoto, and Uchida 2011). Besides, religion is described as a cohesive set of beliefs and practices that pervades a society's value structure and, as a result, forms a core part of a country's cognitive or ideological elements in its cultural background. In Malaysia, Islam had the wide influence in determining people's behavior, practically among Muslim that need to follow the obligations in Islam. For example, it is a compulsory for a Muslim in performing prayer at 5 set times of day and other activities that involved in water consumption during the process of practices.

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While prayers can be performed anywhere on earth that is clean and pure, the mosque is important for communal prayer because it is the main religious building reserved for Allah's worship and typically has one or more minarets (Ebrahimi and Yusoff 2018). According to the individual's view, this will decide whether a Muslim can worship at home or in a place of worship. However, if there are no barriers that might affect the environment or public health,

certain rituals, such as Friday prayers, must be held in the mosque. Based on previous research by (Wilken, Miyamoto, and Uchida 2011), he has been discovered that people value expressing themselves through their preferences and desires differently depending on their cultural background and the level of beliefs on their religion.

For Muslims, the practice of ablution, or called as Wudhu, is a regular Islamic procedure that is repeated many times before performing the prayers or certain other activities such as reading the Al – Quran. Based on the previous research by (Mohd Aiman bin Mohd Fauzi, Jaanavee Devi a/p Sundaresan, and Abidin 2020), the ritual of ablution, which entails washing specific parts of the body with clean water, is a mandatory ritual for any Muslim before performing regular prayers. In general, ablution is accompanied by washing on a specific body part, with the washing ritual including the washing of the face, both hands, the forehead to the crown of the head, and both feet (Johari et al. 2013a). Due to this situation, the amount of water required is estimated less than 1L by per person. Besides, (Yusof et al. 2020) mentioned that the average Muslim uses 5L of water for ablution, but it is suggested that a Muslim needs up to 25L of filtered raw water for ablution and during Friday prayer will caused the amount of water consumption will be doubled. By using a manual closing tap water, the amount of water consumption during ablution could be determine based on the observation which is the period from when the water pipe is opened to when the process is completed without consumer awareness.

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Therefore, the water monitoring project is to measure the flow rate and monitoring the water of water supply and give the notification to user about the water that had been used in ablution. The Arduino is acts as a main microcontroller to control all activity in circuit. The input of this project is a flow sensor that sensed the flow rate in water. This information is sent to microcontroller to analyze the water flow when is used. When the sensor detects the water flow, the Arduino give a signal to Internet of Things (IoT) and send the information into the cloud based. Then the user can monitor the flow rate of water in website with phone or laptop

to know the amount of water that flow out from the pipe. So, the users are able to predict the cost and consumption of water and also this system can be used to detect any leakage from the tank.

1.2 Problem Statement

Since ablution ritual at mosque are more used amount of water. The old traditional faucet is commonly used for water dispensed from the tank which is lead more waste since people not using it efficiently. As for the monitoring system is by manually which is read the stat of water consuming by the flow meter from the main pipe. To tackle this problem, a smart system based on IoT is required to track how much water is being consumed in real time. Water usage is continuously monitored and data is delivered to a server using a water flow sensor and Arduino. The data is gathered by the IoT system, and the real time usage comsumption can be determined. It can also be used to detect water leaks in the tank as an alternative.

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1.3 Research Objective

The aim of this research is to design water flow device using IoT system for ablution considering the cultural in Malaysia. Specifically, the main objective of this study is to focus on the aspects indicated below:

a. To achieve any the attribute water monitoring using IoT system for ablution.
b. To design a system that monitor the water consumption using IoT based on cultural influences in Malaysia.
c. To develop prototype of water monitoring system.

1.4 Scope of Research

The scope of this research are as follows:

a. The study is conducted on how the water is being monitor in mosque in Malaysia.
b. The flow water sensor and Arduino are used in this project, which continuously monitors the amount of water used and communicates the data to a server via a Wi-Fi module.
c. The effectiveness of water monitoring will be evaluated in a real-world setting.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will explain about literature review that related to this study. The literature review is based on the theoretical framework which is to find the impact of. It first addresses the overview of Internet of Things (IoT) relevance in the water industry, and then the researchers amplify the significance of cultural preference in Malaysia. This chapter also present summary of previous research about the development of online monitoring system for water consumption in ablution activity considering Malaysian cultural preferences. Thus, it is devoted to exploring consumer's motivation on Hofstede's Cultural Dimension theory and ultimately leads to the hypotheses. A product development based of customer requirement need a depth research by analyzing the previous case study. Besides that, product development using Internet of Things (IoT) as base for producing the product based on the culture in Malaysia.

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2.2 Introduction Internet of Things (IoT)

The Internet of Things (IoT) is a vision in which the Internet extends into the real world, It represents a concept in which the Internet spreads into the actual world, engulfing everyday items and people with software. The Internet of Things (IoT) is a new network architecture that uses software to connect physical resources and people (Kramp, van Kranenburg, and Lange 2013). The Auto-ID Center at the Massachusetts Institute of Technology (MIT), which began designing and propagating a cross-company RFID infrastructure in 1999, popularised the phrase Internet of Things (IoT). The Internet of Things (IoT) is a self-configuring dynamic global network architecture with standards and

interoperable communication protocols that allows physical "things" to be effortlessly incorporated into the information infrastructure. The goal of the Internet of Things is to establish an environment where fundamental data from any networked object may be efficiently shared with others in real time. Such an approach is promising and capable of supporting advanced decision support systems by offering services in a more accurate, detailed, and intelligent manner, thanks to its more powerful and efficient data collection and sharing ability.

The fundamental characteristics of what the Internet of Things technology does were summarised in the previous work as follows: the Internet of Things is a global and real-time solution where the IoT technology is Internet-based or other wide-area network-based, and the scope of the IoT has no physical boundary. The Internet of Things can include any object that is connected to the internet. Furthermore, data communication across the Internet of Things is constrained by time and can be classified as real-time or near real-time. It is mostly wireless and capable of providing detailed information about their surroundings in both indoor and outdoor settings. For connecting with the physical world, wireless sensor networks (WSN) or RFID are used, and data collection is frequently done wirelessly (REF). This feature greatly enhances the information's richness. It provides the capacity to monitor environments remotely and trace or track items. RFID sensor networks provide the ability of wireless, real-time monitoring and tracking of any tagged objects in an indoor or outdoor environment to provide complete visibility of the resources by combining the use of RFID sensor networks with other technologies such as global positioning system (GPS) or infrared sensor detection.

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2.3 Malaysian Cultural Preference Muslim population in Malaysia

2.3.1 Overview of Cultural Preference Theoretical Calculations of Feeders

According to White (2013) (White 2013), the word of culture itself came from the Latin term culture has a clear history, since it is derived from the verb colo (infinitive colere),

which means "to tend," "to cultivate," and "to till," among other things. Thus, culture is a set of regular ways of thinking, feeling, and behaving that are acquired and transmitted mostly through symbols, and that characterise the distinctive achievements of human groups, including their representations in artefacts.: Traditional (i.e. historically generated and chosen) ideas, as well as their associated value, form the basic core of culture (Fuentes 2019). Culture also can be defined as a common system of information, beliefs, processes, attitudes, and artefacts within a community. It is certain that the cultures in which we interact have a significant impact on our actions (Gill 2013). In other words, culture refers to the way people communicate with each other and, a set of ideas and behaviors that everyone must adhere to in order to be considered a part of society. In the next subsection, the dimensions of culture will be discussed respectively according each of dimension in Hofstede (1980).

2.3.2 Cultural Dimension

The cultural value dimensions assist individuals or groups in comprehending and making sense of culture. These aspects provide people a particular viewpoint on culture including the view of how everyone understand their own culture. Besides, cultural dimensions also indicate how different cultural groups are discovered to be in terms of psychological characteristics such as values, beliefs, self-concepts, attitude, and actions in empirical studies. Thus, this study examines Hofstede's (1980) cultural dimensions theory, which finds overarching cultural practices or dimensions that have a major impact on human actions.

Hofstede (1980) gathered information from International Business Machines Corporation (IBM), a huge international company, and evaluated information from 40 various nations. He came to the conclusion that “organizations are culturally bound” based on his quantitative statistical analysis (Crèvecoeur-MacPhail et al. 2010). Power distance, uncertainty avoidance, individualism, masculinity, long-term orientation, and indulgence are

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the six dimensions that currently make up Hofstede's framework. (Agodzo 2014). In Figure 2.6, Hofstede's five cultural dimensions are represented, and explanations of each dimension are provided. In Figure 2.1, Hofstede's five cultural dimensions are represented, and explanations of each dimension are provided in the next subtopic.

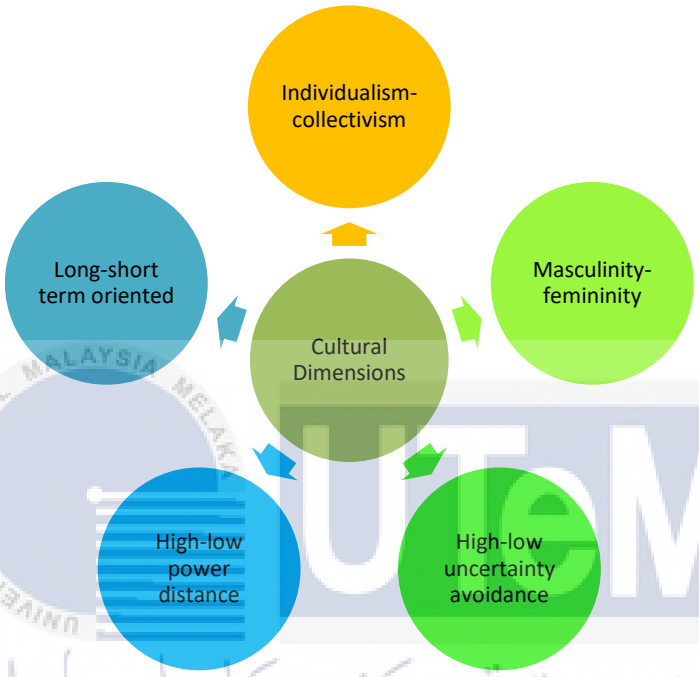

Figure 2.1: Hofstede's cultural dimension model (Hofstede 1993)

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2.3.2.1 Individualism-collectivism

The term of individualism may be defined as a self-sufficient individual who is unconcerned about not belonging to a group (Soares, Farhangmehr, and Shoham 2007). Individualism is a personality trait that describes individuals who are more concerned with their individual interests than with the interests of a community. Individualists, according to Hofstede (1980), are those who believe for themselves. On the one hand, there is individualism vs. collectivism, which refers to the degree to which individuals are linked into communities (Cordell 2019). Hofstede used a scale of 1 to 100 to determine if a country's culture is more oriented towards collectivism or individuality. As a consequence, nations scoring above 50