e-SAJADAH

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STUDENT'S DECLARATION

"I hereby declare that this report is the result of my own work except for quotes as cited in the references"

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"I acknowledge that I have read this report and in my opinion this report is sufficient in terms scope and quality for the award of Bachelor of Electronic Engineering (Wireless Electronic) With Honours"

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To beloved parents, lecturers, friends and all Muslims

ACKNOWLEDGEMENT

ABSTRACT

Muslims are obligated to perform prayer five times a day. One of the conditions to perform the prayer is to face towards Qibla direction which in Islam it is point towards Kaabah in the city of Mecca. Therefore, in this project, a Sajadah (praying mat) that has the function to show the direction of Qibla has been designed. Using the combinations of embedded system, microcontroller, digital compass, gps module and LED indicator, the Sajadah have the function to show the correct direction of Qibla from any place in the world. The Sajadah which called e-Sajadah have five LEDs (green/red) that will tell users if he/she has the right direction of Qibla. This device finds the direction of Magnetic North through digital compass (HMC588L) and gives output heading which will be sent to the microcontroller. Arduino Uno R3 is used which it is a microcontroller board based on ATmega328P microcontroller that are using Arduino software to write the algorithm. With the GPS module readings of the user's current location, Qibla direction is determined using solution of spherical triangle. The solution involves longitude and latitude of user's current location and Kaabah. The methods of determining the deviation of distance if there is one degree deviation from the exact angle towards Kaabah also were studied.

ABSTRAK

Umat Islam mempunyai kewajiban untuk melaksanakan solat lima kali sehari. Salah satu syarat untuk menunaikan solat adalah melakukannya dengan menghadap ke arah Kiblat yang mana ianya bererti menghala ke arah Kaabah di kota Mekah. Oleh itu, dalam projek ini, Sajadah (tikar sembahyang) yang mempunyai fungsi untuk menentukan arah Kiblat telah direka. Dengan gabungan sistem terbenam, pengawal mikro, kompas digital, modul GPS dan indikator LED, Sajadah ini mempunyai fungsi untuk menunjukkan arah Kiblat yang tepat dari mana-mana tempat di dunia. Sejadah yang dipanggil sebagai e-Sajadah ini mempunyai lima LED (hijau/merah) yang akan memberitahu dia mempunyai arah Kiblat yang betul. Alat ini mendapatkan arah Magnet Utara melalui kompas digital (HMC5883L) dan memberikan pengarahan yang akan dihantar kepada pengawal mikro. Arduino Uno R3 digunakan yang mana ianya adalah sebuah papan pemograman yang menggunakan pengawal mikro ATmega328P yang menggunakan perisian Arduino untuk menulis algoritma. Dengan bacaan semasa lokasi pengguna oleh modul GPS, arah Kiblat ditentukan menggunakan penyelesaian segi tiga sfera. Penyelesaian melibatkan longitud dan latitud lokasi semasa pengguna dan juga Kaabah. Kaedah menentukan sisihan jarak jika terdapat satu darjah perbezaan dari sudut yang tepat ke arah Kiblat juga telah dikaji.

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CHAPTER I

INTRODUCTION

This project mainly focuses on design, simulate, fabricate and testing e-Sajadah that has the function to show correct direction of Qiblah below than 2.5 degree deviation from the exact angle towards Kaabah. In this chapter, problem statement, objectives, scope of the project and methodology were explained.

1.1 Introduction

Nowadays, people love to travel in any places around the world. During travelling, they need to bring their maps to find places and especially for Muslims, they need to bring their own Qiblah finder as they still have to perform prayer five times a day wherever they are. The Qiblah word origin from from Arabic language which means the direction that faced to Kaabah building located in Mecca, Saudi Arabia.[1] This direction is used by the Muslims to perform prayer as well as other religious obligations such as an animal slaughtering procedure where the head of an animal should be aligned to the Qiblah direction and the Muslims are buried with their body are turned right towards Qiblah.[2] It is a must for a Muslim to face the Qiblah when praying as stated in the Holy al-Quran in chapter two, Surah al-Baqarah verse 149, ―So from wherever you go out (for prayer, O Muhammad) turn your face toward al-Masjid al-Haram, and indeed, it is the truth from your Lord. And Allah is not unaware of what you do". Muslims need to sincerely make an attempt to find the correct direction of Qiblah.

Before modern era technology arrived, there are few conventional methods of finding the direction of Qiblah especially for those who are far away from Mecca. Sun and stars are used as a base guideline and during these days, the Muslims that live far away from Makkah just face to any direction with confidence due no scientific way to locate Qiblah direction accurately. Sunset direction is one of the conventional and popular ways to locate Qiblah. Sunset provides a general guidance to Qiblah, however, it is very important for people to be aware that this technique does not give 100% of accuracy since in Malaysia, the degree for Qiblah falls from 290 degree to 293 degree, but the sunset degree throughout the year falls from 235 degree to 295 degree. Another popular theory to find the direction of Qiblah especially in Malaysia by following the direction of Astro plate (Astro is a name brand of direct broadcast satellite service).[3] This method is totally not reliable because scientifically Astro plate do not faced towards the direction of Qiblah but face toward satellite in order to receive signal. It is just coincidence that Astro plate has the same direction of Qiblah because it not installed to be faced towards Qiblah direction. As technology developed, there are few scientific approaches have been introduced to determine the direction of Qiblah in more accurate

way such as arithmetic method, trigonometry method, star sphere method and star disc method. These methods involve specific computation and require mathematical formulas.

In our modern era of technology, Qiblah determination methods has evolved into much more simpler way to use and do not need complicated computation or calculation due to invention of devices and applications such as Qiblah compass, mobile phone application that can automatically detect the direction of Qiblah wherever you are as well as non-mobile web-based applications. The most chosen one is mobile application because it is easy to use especially when travelling and when there is no access to mosque but the reliability of the applications were doubted. This is because there is a study on a mobile application to find Qiblah direction in a few prayer rooms found that in some prayer rooms, the Qiblah direction shown on the mobile application did not match to the Qiblah directions provided in the rooms. In Malaysia, JAKIM is considered as a reliable source and reference on the Islamic matter.[4] Furthermore, the development of mosque and prayer rooms in Malaysia has obtained an approval from Department of Survey and Mapping Malaysia (JUPEM) and others religious constitutional to ensure accurate Qiblah direction is determined.

In this project, e-Sajadah is designed to have below than 2.5 degree of angle deviation from the true direction of Qiblah. The GPS module on e-Sajadah will read the longitude and latitude of user's current position and send it to microcontroller to calculate the angle of the Qiblah using the algorithm developed using the Arduino software. Then the latitude and longitude of Qiblah direction will send to the digital compass and as the user move the e-Sajadah the green LED will be ON indicate that the right direction of Qiblah are obtained.

1.2 Objectives

Objectives of the project:

- To design and fabricate e-Sajadah that has the function to show correct direction of Qiblah at anywhere around the world.

1.3 Work scope

This project consists of three parts, which is design, fabricate and measure. The scope of this project is to design e-Sajadah that has the function to show the correct direction of Qiblah which have below than 2.5 degree deviations. e-Sajadah is like a normal Sajadah with a small Qiblah indicator at the top side of the Sajadah which have two LEDs to show the user whether he/she has the right direction of Qiblah. The GPS module use in this project is to read the current longitude and latitude of the user's current position which is needed in order for microcontroller to calculate the direction of Qiblah. After the direction has been calculated, the value of the direction will be send to digital compass and the green LED will be lighted if the e-Sajadah has the right directions of Qiblah according to the calculated value. The compass module must have low value of angle deviation because more than three degree angle deviations could led to more than 300km misdirect from Kaabah. Therefore, choosing the right GPS module and digital compass is very essential because it will effect on accuracy of the Qiblah direction.

To program the microcontroller, software must be used to write the coding for GPS module, digital compass and also LEDs. The easiest and inexpensive way to learn and write the coding is by using Arduino board and software. It is an open source program available on the internet and the programming board cost less than RM 80 and the instructions set are also available free on the internet.

1.4 Problem statement

For centuries, Muslims all over the world face Mecca (towards Qibla or Ka'bah) and perform prayer, five times a day. It is hard to determine the Qiblah direction and know the prayer of each prayer time. In the old days, people use stick and sees it shadow to know the prayer times and Qiblah direction.[5] Nowadays, researches and findings in astronomical help much in computing the prayer time and direction of Qiblah automated. There are certain applications in the website that are available to the user to know the Qiblah direction. They have to insert information on current location and the Qiblah and prayer information will be given.

As the technologies grow, various mobiles company gives Qiblah direction services. The problem is that the application itself is not portable and self-generated rely on the service itself. Services from websites need the user to have internet connections making it not practical for daily use. People commute every day, moving from one place to another place and they need to know the Qiblah direction in the current place they go. There is a device like _Qiblah Finder' that can help travellers by showing direction according to the latitude and longitude. The problem is this application does not really portable and cannot be used anywhere you like. To determine Qiblah direction, users are limited to have the Qiblah direction in certain places in Malaysia that the latitude and longitude has been pre-installed in the device. This method is quite troublesome to travellers since the person has to know the latitude and longitude of the current location.

e-Sajadah is a device that shows the correct direction of Qiblah and there are few similar product available on market. One of them is called Ell Sajjadah which manufactured and available in Pakistan. It has beautiful art pattern on the mat that when the user turn the sajadah facing towards the Qiblah direction, it will glow. Although it is beautiful and practical device, the price of each Ell Sajjadah is around 500 dollars. This is expensive for an average person to have a sajadah that has Qiblah indicator and people may not consider buying one. The other products on market have the same characteristic as Ell Sajjadah which is high in price.

1.5 Methodology

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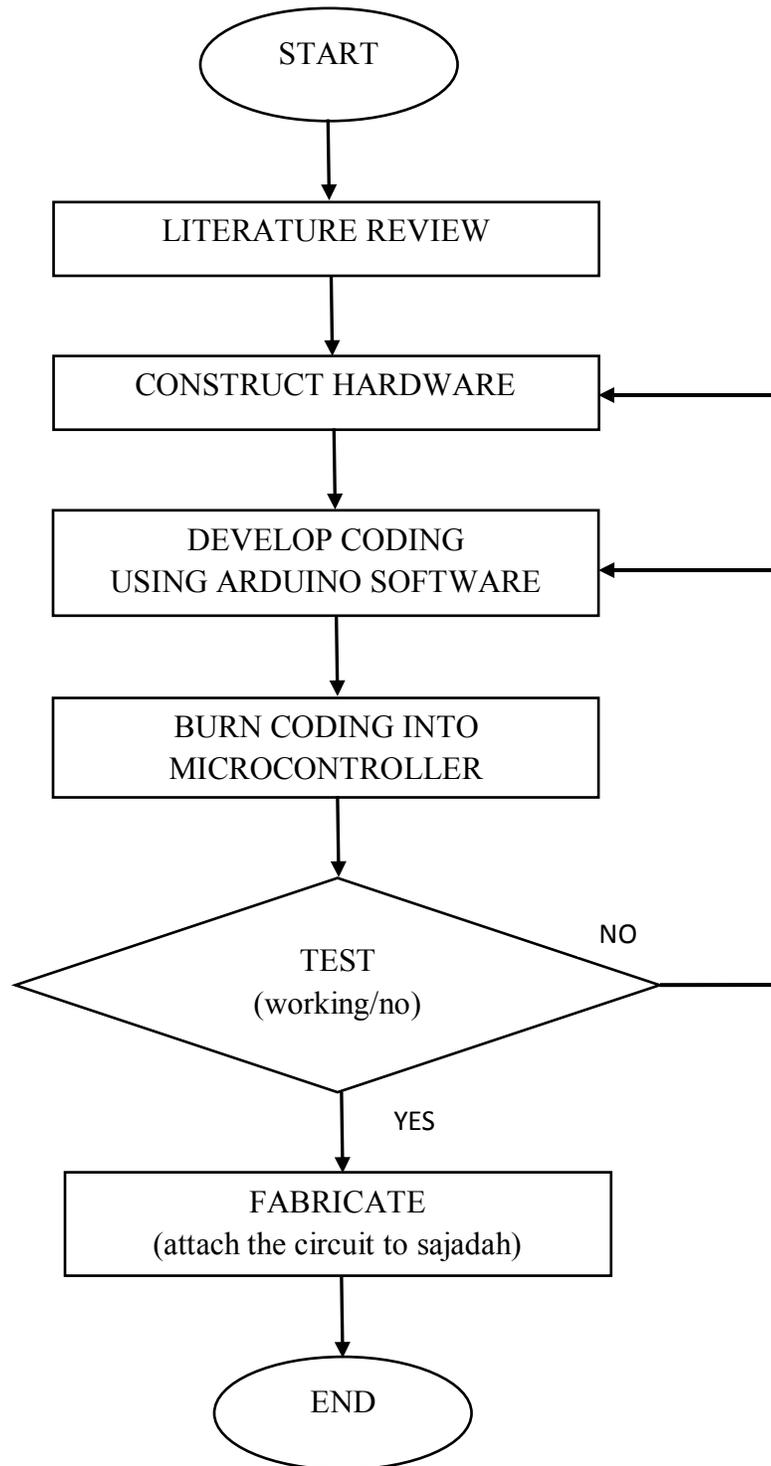
Figure 1.1: Project Methodology

This project begins with acquiring the information related to the digital Qiblah compass in literature review part. The information are obtained mainly from previous research paper which is journals, others are from reference books, e-Books and also the internet. The information obtained will be based on methods to determine Qiblah direction, instruments used, construction of the device, advantages, disadvantages, and also cost to make it. When the information is fully covered, then the process of constructing the circuit begins. The circuit consists of microcontroller, digital compass, GPS module, and LED and assembled on bread board first for testing purposes. After the circuit is functions according to the plan, than it will be solder to the strip board.

The coding for microcontroller is done using Arduino software. All the required information and knowledge about the software on how to write the instructions set, to compile the coding and to burn it into the microcontroller are learned at Arduino website. The construction of the coding consists of the instructions set for the GPS module to read the user's current longitude and latitude and send it to microcontroller to calculate for the Qiblah direction from the user's location, digital compass to indicate the direction of Qiblah which connected to two LEDs as it indicator. After the coding has been developed, it is burned into microcontroller using Arduino board.

Next, after the coding is successfully burned into the microcontroller, the Qiblah indicator circuit is tested for the user current position of Qiblah direction. The Qiblah direction is referred from mosque to see whether it will have the same direction or not. If he result is not from what is expected, then the hardware and coding needs to be checked whether there is problem on that part. The circuit must be checked for its connection and power supply and the coding must be checked for its functionality and the instructions set for GPS module, digital compass, and also formula to calculate the Qiblah direction.

Lastly, after the Qiblah circuit can manage to show the correct direction of Qiblah, expected to be below than 2.5 degree deviation, the circuit are solder onto strip board so that it acquire as less space as possible. When the circuit fabrication is done it is place into a casing with two holes on top of it to put the LEDs indicator. Then the casing is attached to a sajadah on the top side of it so that it will not disturb user's concentration while performing prayer.

CHAPTER II

LITERATURE REVIEW

In this chapter two emphasizes about the project's background and other relevant input and information which is related to the project. The theoretical and outline details concerning the project have taken as guidance to complete this project. All the input and information were gathered from previous research paper (journals), internet and etc.
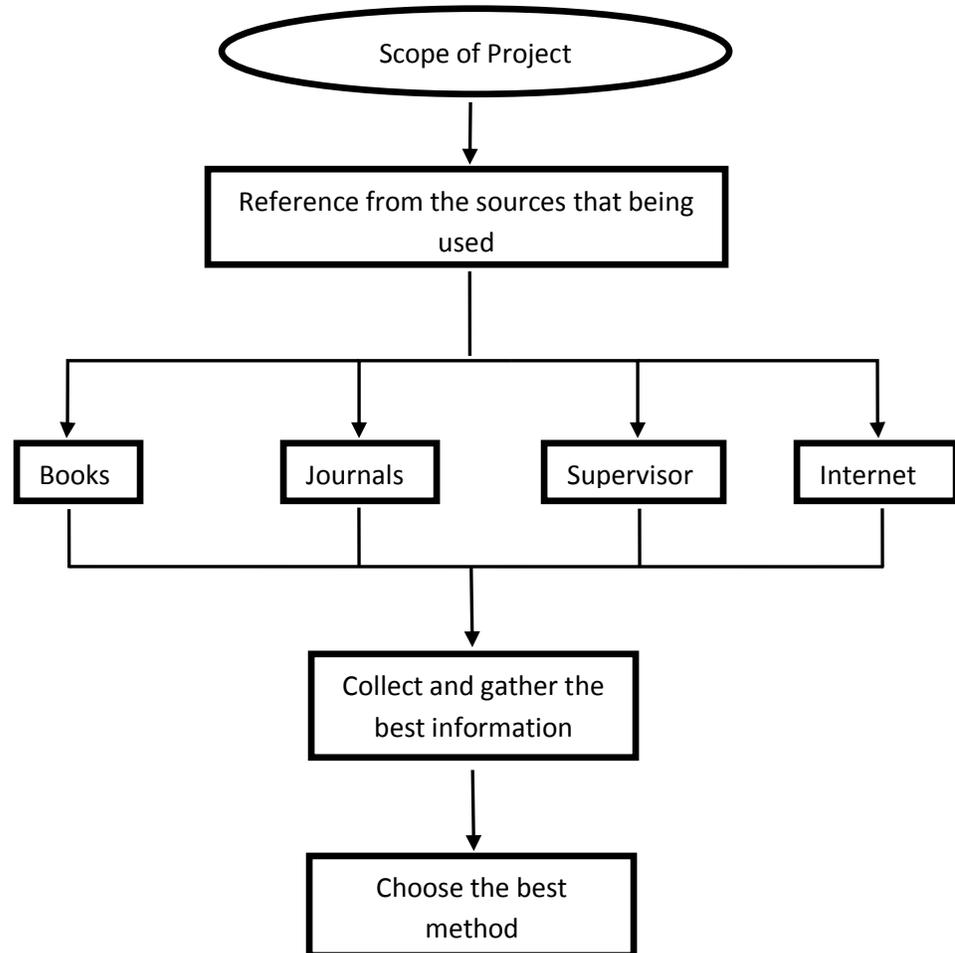
2.1 Method of literature review

Figure 2.1: Method of Literature Review

2.2 Introduction

The Qiblah is the direction to the Ka'bah, but what precisely is that direction? Sheikh Muhammad S Al-Munajjid (2011, 19 july, _They discovered that their mosque deviates from the Qiblah by 17 degrees').[6] A source _Islam question and answer' website stated that the one who is close to the Ka'bah is required to face it head on, but the one who is far away from it must face its direction according to the majority of Islamic scholars. However, if one does not have any information about the direction of the Qiblah, the direction is between west and east. If there is any guidance or a village nearby, one must ask and find out about the Qiblah direction.[7] It is our obligation to face the Ka'bah because it is one of the conditions of the prayer.

Ibn Qudamah Rahimullah (may Allah have mercy on him) said in al-Mughni (the most widely known textbook of Hanbali fiqh), facing the Qiblah is a condition of prayer being valid, and there is no difference between both in compulsory prayer or Sunnah prayers.[8] Hence, finding the Qiblah accuracy is crucial for Muslims to face the correct direction and to fulfill our worship to Allah.

A Qiblah compass or is a modified compass used by Muslims to indicate the direction to face to perform ritual prayers. While the compass, like any other compass, points north, the direction of prayer is indicated by marks on the perimeter of the dial, corresponding to different cities, or by a second pointer set by the user according to their own location. Al-Biruni wrote his book (Kitab Tahdid al-Amakin, or the demarcation of the coordinates of cities) to determine the Qiblah. To determine the proper direction, one has to know with some precision both the longitude and latitude of one's own location and those of Mecca, the city toward which one must face. Once that is determined, the values are applied to a spherical triangle, and the angle from the local meridian to the required direction of Mecca can be determined. The problem admits of more than one method of solution. Qiblah indicators were made after al-Kindi in various forms.[9] The indicator usually comprises a round brass box with a hinged lid and an inset magnetic compass. A list of important Islamic places with their longitudes, latitudes, is inscribed in Arabic on all sides of the box. The compass has a blued steel needle with an open circle to indicate north. It is surmounted by a brass pyramidal pivot and a glass plate