CHAPTER 2

LITERATURE REVIEW

2.1 Literature Review

Nowadays, people compete with each other to find the fastest way to get information about something they want to know with no delay. This is occurred to Muslims too when they need to know about the prayer time in order to show their respect to the Almighty. It is obligatory for Muslim to perform the prayer according to the five prayer time. So, many studied have been done by Muslims in this world to improve the way on getting the prayer time accurately and precisely.

Namaz (Salat) time software for mobile is developing to provide the pray time via mobile phone. It provides most accurate and reliable time table of Namaz (Salat) for millions inhabited and uninhabited locations globally, azan software for cell phone and Muslim prayer calendars. Pray in Time is also a rapidly growing global Muslim information portal. This Azan time service is location specific. The location on the map is needed to make sure the pray time is accurate. Use the interactive Map to setup a Namaz (Salat) time's calculation to every imaginable prayer spot on the Globe. The location should be remembered exactly or can be select from the list of countries and administrative in the internet [1].

'Salaat Time' is a multi-function Islamic application that calculates the prescribed five daily Muslim prayer times as well as Qiblah direction for anywhere in the world. At the prescribed times the Athan will sound and/or display visual alerts. Location is needed to be selected from a huge database included cities [2].

Al Fajr is just about the best prayer Azan clock on the market in terms of manufacturing quality and design. It keeps prayer times for over 250 cities (preset) around the world, and if the longitude and latitude is known, user can customize it to alert the prayer times for the area. The complete azan for all prayers can be played. The volume level can be easily adjusted by the dialer located at the back of the clock. The azan sound can also be switched to 3 beeps instead, or nothing at all (if you are traveling or simply do not want the alarm to produce any sound). Fajr and Isha times are calculated by either an angle of the sun below the horizon or by an interval of time. This clock is programmed to use the local taqweem (almanac) method [3].

From literature review, the concepts can be determined as below;

- The prayer time can be calculated if the location or the latitude and longitude for the place are known.
- The way to get the information of the position for a place can be determined by using map or searching from internet.
- Although the system is improved time by time but there is a need to put the location of a place manually

2.2 Research and Investigation

In developing this embedded pray time system using GPS, there are several factors and method should be considered such as the hardware and software used. Each of the method has their own structure approaches which guide the expert in creating the system.

2.2.1 Embedded System

An embedded system is a special-purpose system in which the computer is completely encapsulated by the device it controls. Unlike a general-purpose computer, such as a personal computer, an embedded system performs one or a few pre-defined tasks, usually with very specific requirements. Since the system is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product.

Embedded systems are often mass-produced, so the cost savings may be multiplied by millions of items. Handheld computers are generally considered embedded devices because of the nature of their hardware design, even though they are more expandable in software terms.

2.2.2 Prayer Time System

The five Islamic prayers are named as Fajr, Zuhr, Asr, Maghrib and Isha. The timing of these five prayers varies from place to place and from day to day. It is obligatory for Muslims to perform these prayers at the correct time.

The prayer times for any given location on earth may be determined mathematically if the latitude and longitude of the location are known. However, the theoretical determination of prayer times is a lengthy process. Many of them calculated the pray time using software which is embedded into microcontroller or computerized such as using C programming, Visual Basic and so on.

Normally, pray times are based on two theories which is depend on sun or solar system and the other one is depend on the moon. The constant used by these two theories more than thousand precise. All the theories are not easy to explain to the public. The calculation of the pray times are based on sun movement take place at dawn, midday, late afternoon, dusk and night. All the five times are based on astronomical position of sun therefore, the pray time are different from one to anther place depends on the longitude and latitude.

The prayer times can be determined such as:

- FAJR starts with the dawn or morning twilight. Fajr ends just before sunrise.
- ZUHR begins after midday when the trailing limb of the sun has passed the meridian. For convenience, many published prayer time tables add five minutes to mid-day (zawal) to obtain the start of Zuhr. Zuhr ends at the start of Asr time.
- The timing of ASR depends on the length of the shadow cast by an object. According to the Shafi School of jurisprudence, Asr begins when the length of the shadow of an object exceeds the length of the object. According to the

Hanafi School of jurisprudence, Asr begins when the length of the shadow exceeds TWICE the length of the object. In both cases, the minimum length of shadow (which occurs when the sun passes the meridian) is subtracted from the length of the shadow before comparing it with the length of the object.

- MAGHRIB begins at sunset and ends at the start of Isha.
- ISHA starts after dusk when the evening twilight disappears.

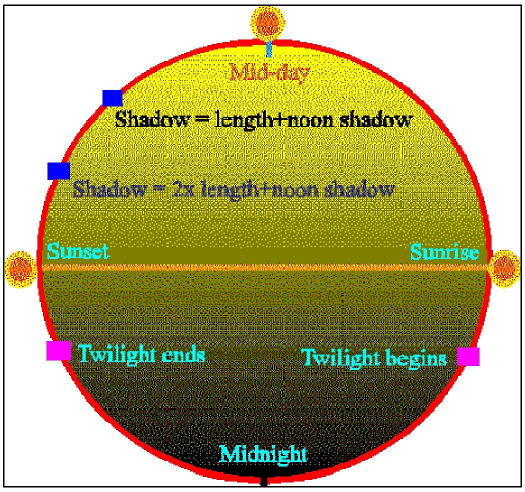

Figure 2.1: Prayer Time [4]

Table 2.1: Salat Time [4]

	Start	**End**
Fajr	When whitishness begins to appear on the horizon (dawn)	At beginning of sunrise
Zuhr	After sun's trailing limb crosses meridian	Start of Asr
Asr	When length of shadow =2x length of object + noon shadow (Hanafi) or When length of shadow = length of object + noon shadow (Shafi)	Before sunset
Maghrib	Sunset	Reddishness in the sky
Isha	After reddishness in sky (dusk) ends	Midnight (afzal), next fajr (makruh)

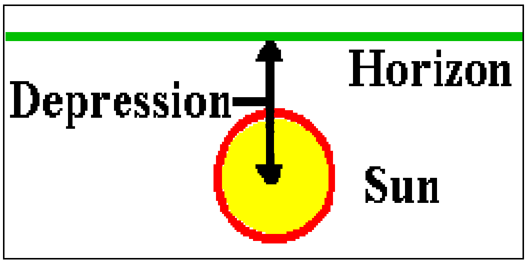

Figure 2.2: Twilight **[4]**

If the earth did not have an atmosphere, the sky would become dark immediately after sunset. The earth's atmosphere causes scattering of sunlight so that light reaches the observer before sunrise and after sunset. This scattered light is called twilight as shown in Figure 2.2. After sunset, as the depression of the sun increases the sky gets darker and darker until no scattered light reaches the observer. Conversely, in the morning light starts to appear in the sky even before sunrise. The morning twilight is called dawn whilst the evening twilight is known as dusk. The calculation method for the pray time system is in next chapter Methodology.

2.2.3 Global Positioning System (GPS)

Our ancestors had to go to pretty extreme measures to keep from getting lost. They erected monumental landmarks, laboriously drafted detailed maps and learned to read the stars in the night sky. The Global Positioning System is vast, expensive and involves a lot of technical ingenuity, but the fundamental concepts at work are quite simple and intuitive. When people talk about "a GPS," they usually mean a GPS receiver. The GPS is actually a constellation of 27 Earth-orbiting satellites (24 in operation and three extras in case one fails). The U.S. military developed and implemented this satellite network as a military navigation system, but soon opened it up to everybody else.

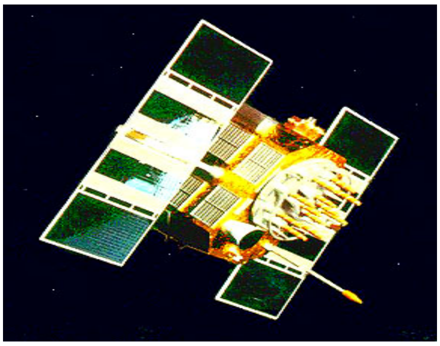

Figure 2.3: Photo Courtesy NASA:NAVSTAR GPS Satellite [5]

Each of these 3,000- to 4,000-pound solar-powered satellites circles the globe at about 12,000 miles (19,300 km), making two complete rotations every day. The orbits are arranged so that at any time, anywhere on Earth, there are at least four satellites "visible" in the sky.

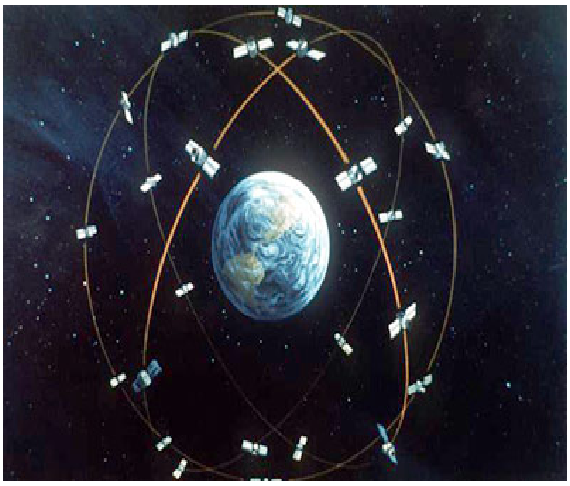

Figure 2.4: Photo Courtesy U.S. Department of Defense: Artist's Concept of the GPS Satellite Constellation [5]

A GPS receiver's job is to locate four or more of these satellites, figure out the distance to each, and use this information to deduce its own location. This operation is based on a simple mathematical principle called trilateration.

2.2.3.1 -D Trilateration

Fundamentally, three-dimensional trilateration is a little trickier to visualize. It is series of spheres. If measured thing are 10 miles from satellite A in the sky, it could be anywhere on the surface of a huge, imaginary sphere with a 10-mile radius. If it also knows that it is 15 miles from satellite B, it can overlap the first sphere with another, larger sphere. The spheres intersect in a perfect circle. If it knows the distance to a third satellite, it gets a third sphere, which intersects with this circle at two points. The Earth itself can act as a fourth sphere, only one of the two possible points will actually be on the surface of the planet, so it can eliminate the one in space. Receivers generally look to four or more satellites, however to improve accuracy and provide precise altitude information. In order to make this simple calculation, then, the GPS receiver has to know two things:

- The location of at least three satellites above measured thing
- The distance between measured thing and each of those satellites

The GPS receiver figures both of these things out by analyzing high-frequency, low-power radio signals from the GPS satellites. Better units have multiple receivers, so they can pick up signals from several satellites simultaneously. Radio waves are electromagnetic energy, which means they travel at the speed of light (about 186,000 miles per second, 300,000 km per second in a vacuum). The receiver can figure out how far the signal has traveled by timing how long it took the signal to arrive [6].

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2.2.3.2 GPS Calculation

A GPS receiver calculates the distance to GPS satellites by timing a signal's journey from satellite to receiver. As it turns out, this is a fairly elaborate process. At a particular time example midnight, the satellite begins transmitting a long, digital pattern called a pseudo-random code. The receiver begins running the same digital pattern also exactly at midnight. When the satellite's signal reaches the receiver, it is transmission of the pattern will lag a bit behind the receiver's playing of the pattern.

Figure2.5: Photo Courtesy U.S. Army: A GPS Satellite [5]

The length of the delay is equal to the signal's travel time. The receiver multiplies this time by the speed of light to determine how far the signal traveled. Assuming the signal traveled in a straight line, this is the distance from receiver to satellite. In order to make this measurement, the receiver and satellite both need clocks that can be synchronized down to the nanosecond (ns). To make a satellite positioning system using only synchronized clocks, it is needed to have atomic clocks not only on all the satellites, but also in the receiver itself. But atomic clocks cost so expensive which makes them a just a bit too expensive for everyday consumer use.

The Global Positioning System has a clever, effective solution to this problem. Every satellite contains an expensive atomic clock, but the receiver itself uses an ordinary quartz clock, which it constantly resets. In a nutshell, the receiver looks at incoming signals from four or more satellites and gauges its inaccuracy. In other words, there is only one value for the ‘current time’ that the receiver can use. The correct time value will cause all of the signals that the receiver is receiving to align at a single point in space. That time value is the time value held by the atomic clocks in all of the satellites. So the receiver sets its clock to that time value and it then has the same time value that all the atomic clocks in all of the satellites have. The GPS receiver gets atomic clock accuracy.

In order for the distance information to be of any use, the receiver also has to know where the satellites actually are. This is not particularly difficult because the satellites travel in very high and predictable orbits. The GPS receiver simply stores an almanac that tells it where every satellite should be at any given time. Things like the pull of the moon and the sun do change the satellites' orbits very slightly, but the Department of Defense constantly monitors their exact positions and transmits any adjustments to all GPS receivers as part of the satellites' signals.