A Variety of Technology for Determining Prayer Times in Learning Falak in Islamic High Education

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This research was intended to provide an overview of the technological devices used in determining prayer times, the function of technology to determine prayer times in the astronomy learning process, and also the development of techniques to determine prayer times in the field of astronomy. It was conducted by using qualitative data, which is data collected through a process of observation, interviews, and reading documents. The data analysis was performed by reducing data, presenting data, and drawing conclusions. The results showed that technology used to determine prayer times has increased through the rapid development from manual to digital formats. Global Positioning System (GPS) technology has been developed in an android application. It is important to present technology as being easy to use to determine prayer times in learning, especially because the average student has a smart phone, which can be used to upload to an android application. Academically, the development of techniques which can determine prayer times continues to be carried out by conducting experiments in unusual natural conditions. In addition, this has led to the establishment of astronomy laboratories in the Islamic Higher Education setting.

Keywords: *Technology, Prayer time, Falak, Islamic higher education.*

Introduction

A development in science and technology has contributed to the ability to determine prayer times. Eventually, the determination of the initial prayer time will be able to be calculated astronomically, without seeing the phenomenon of a solar movement. Muslims no longer perform prayers by struggling to see or measure the shadow of a sun when the sun slips, see the length of the shadow on an object, see the sun rise and set or see the loss of the mega red. However, they can immediately see prayer times based on the results of calculations using equipment technology (Abdur Rachim, 1983).

Prayer times, which have become a reference for Muslims, besides being based on Sharia instructions, are also related to the position of the sun in the world. There are some that are calculated by the solar position which has been considered, especially height, peak distance, early phenomenon of dawn, sunrise, sun crossing the meridians, sunset, and evening phenomena. This effort is undertaken with the aim of facilitating Muslims in the implementation of prayer. The determination of prayer times with the above criteria is yet to encounter any complicated problems (Ahmad Musonnif, 2011).

The Al-Quran, and the Hadith of the Prophet have explained the five obligatory prayer times in cues, both about the beginning of time, and the end of time, as a Hadith narrated by Ahmad, An-Nasa'I, and Turmuzy. From the instructions of the Al-Qur'an, and the Hadith of the Prophet, it is clear that prayer time is closely related to the position of the sun. Subsequently, sky scholars or calculation experts have formulated it based on astronomical terms about the position of the sun, as referred to by the Al-Qur'an, and the Hadith of the Prophet. It is then also described according to the method or the initial prayer time formula (Ahmad Izzuddin, 2007).

Theoretical

Determination of Prayer Times

To determine the initial entry of the prayer time, Allah sent the angel Gabriel to give a briefing to the Prophet regarding the times of prayer, with reference to the sun, and the phenomenon of sky light, which incidentally is also caused by the sun's rays.

Some facilitate about the determination of an initial entry for prayer time. As such, we can use the calculation or reckoning, so that we do not have to see the sun at every time and can perform prayer. However, before we calculate (megghisab) the beginning of the prayer time, we must first know the criteria for entry at the beginning of prayer time. It has been determined by Allah, such as the term of prayer time in the sense of reckoning, which is an inclusion of prayer time. Prayer time can be completed or finish when the next prayer time arrives, except when a dawn prayer ends, when the sun rises in the Eastern horizon (Ahmad Izzuddin, 2012).

The Nautical Almanac is issued by the Indonesian Navy and is the Oceanographic Ocean Division for shipping purposes. However, it can also be used for the calculation (reckoning) of the beginning of prayer time because the data is related to the calculation (reckoning) of the beginning of prayer time, the beginning of the month, and so on. It contains information in this Almanac, such as pre-time data, declination data, latitude data, longitude data, Azimuth data, declination data, and so on. Thus, it is data related to the calculation (reckoning) of the beginning of prayer time, the same as was founded in Ephemeris. That is, it is presented based on the Greenwich Mean Time (GMT) and for a period of one year.

Therefore, to conduct the calculation (reckoning) of the beginning of prayer time, we must first change the data by changing the times from GMT to the time of Western Indonesia (WIB), with a longitude of 105o, based on the Presidential Decree No.41/1987; the Central Indonesia Time (WITA), with a longitude of 120o, based on the Presidential Decree No.41/1987; and the East Indonesia Time (WIT), with a longitude of 135o, based on the Presidential Decree No.41/1987 (Encup Supriatna, 2007). In addition to other data are solving, especially the equation of time, which absolutely must be interpolated (looking for data based on linear functions), as needed. This is done to help students, and the community who have a desire or willingness to learn and understand the early reckoning, when praying with the Nautika or Ephemeris system.

Examples of the initial calculation on the midday prayer in the Semarang City on 1 December 2011, which are based on regional data, are as follows:

a. Need: Grading times (e) = -0h 1m 44d
   Longitude Place = 110o 24m East
   Regional Longitude (WIB) = 105o

b. Duhur formula = 12.00 - e
   time based on local time (Semarang)
   12.00 - (- 0h 1m 44s) = 12h 1m 44s

c. Adjustment to WIB
   Semarang's longitude difference with WIB
   105o - 110o 24m = -5o 24s that used as hours: 15 = -0j 36m 0s +
   = 11h 40m 8s

d. Ihtiyath = 0h 02m 52m + = 11h 43m

Therefore, a prayer time in the City of Semarang on 1 December 2011 was at 11:43 WIB.

Astronomy or Falak Science

Based on information obtained from a newspaper, it can be founded for two surahs, such as Surah Al-Anbiya (QS.:21) verse 33, and in Surah Yaasiin (QS.:33) verse 40. In both verses, the word celestial is interpreted as a pathway, and the sun, and moon circulate on their respective track lines. Therefore, all trams or terms that carry the word celestial are links with the problem of a trajectory or orbit on heavenly bodies. So, based on the meaning of the word celestial, and also an understanding of celestial science, it is seen as a science that is related to the rules, and movements of heavenly bodies, the earth, and space (cosmography). By looking at this connection, it can also be referred to as astronomy, because it is about astronomy and space. As found from various literature, astronomers can formulate by the notions of astronomy and with different patterns or any complementary emphases. For example:

a. In a large of Indonesian dictionary like (Depdikbut: 1999), there was interpreting as a science of the states (circulation, calculation, etc.) on the stars.
b. Almanak Hisab Rukyat defined astronomy as a study of the trajectories on celestial bodies, such as a sun, moon, and stars, among others, in order to determine the position of other celestial bodies (Ministry of Religion of Republic of Indonesia, 1981: 14).
c. Based on the Encyclopedia of Islamic Law, astronomy is defined as the study of celestial bodies, and regarding their physicality, motion, size, and everything related to them (Dahlan, 1997: 304).
d. Muhyidin Khozin also defined astronomy as a science that studies for trajectories on celestial bodies, especially the earth, moon, and sun in their orbits, with the aim of knowing about any position on the slide objects between one another, so a time can be known on the surface in the earth (Khozin, 2004).
e. Susiknan Azhari formulated that the definition of Falak Science is the study of trajectories on celestial bodies, such as a sun, moon, stars, and other celestial bodies, with the aim of determining the position for these celestial bodies, and their position from objects, including another celestial body (Azhari, 2005).

Based on the definitions, which have been written and formulated by astronomers, all of them provide limits and representations that the terminology of ‘astronomy’ refers to the study of trajectories on objects, such as a sun, moon, stars, and other celestial bodies. This includes for all aspects on the study, and the importance of the discussion. For example, to calculate (reckoning) when a prayer time comes in, when the beginning of the month occurs, and how to position for the Qibla direction.

From the discussion above, astronomy is one of the oldest, most advanced, and valued of ancient exact sciences (Ahmad Dallal, 1999). Up and until now, astronomy continues to receive serious attention and to be developed in various parts of the world. Astronomy is also a branch of natural science or science which involves observing celestial bodies, such as stars, planets, comets, moons, suns, and galaxies, as well as natural phenomena that occur outside the Earth's atmosphere.

Generally, this science of some studies are various sides on celestial bodies, such as origin, physical / chemical properties, meteorology, motion, and also knowledge of these objects, and explains any formation and development on the universe (Nin Studio, 2006). To be more concise, astronomy is a study of celestial bodies, such as a moon, sun, planets, stars, the earth, physics, chemistry, mathematics, and the evolution of these objects. This serves in addition to phenomena which originates from outside the Earth's atmosphere, including supernova explosions, and gamma ray bursts.

Astronomy is the oldest branch of science that has received much attention from mankind throughout history, and which emerged and was developed long before Islam. This is apparent because astronomical activities are inseparable from natural observations of phenomena and celestial bodies, such as the phenomenon of sunrise, the sun, moons, planets, observing changes in wind (weather), and seasons throughout the year, to determine hunting schedules, farming, trade, and travel, as well as observe religious, and social ritual days.

Specifically, in Islam, astronomy or falak science is useful for determining any times of worship. This is because the time of worship is determined by a position for heavenly bodies. Celestial bodies are related and greatly studied in this science, which includes the sun, moon, and earth, especially about their position, as a result of their movements. It is a function of technology to determine prayer times in the learning process of astronomy.

Today, we are spoiled with technology that has provided a variety of features, such as prayer times, and Qibla direction, among others. Consequentially, for some people, they have become spoiled, and less eager to explore astronomy. So, any ordinary people ask? What is the importance of studying astronomy or falak science? After all, all information has been provided by current technology.

Some assumptions may include that we do not need to take it seriously. Muslims must still have a high spirit in the deepening of the science of astronomy. The purposes of how information technology can provide for astronomy needs, must be addressed wisely. Its presence spurs Muslims to dig deeper about astronomy or falak science in this modern era.

If we borrow the term, ‘usul fiqh’, and subsequently enjoy astronomy or falak science technology, then we are in the category of ‘taqlid’, because he uses or follows a product without knowing its origin. People who taqlid are encouraged to not feel enough with the atiqlidan. He must fight to go to the level above, which is doing ittiba', and such people are called muttabi’.

Muttabi is a technology user of astronomy, who knows where an origin of the technology was made. It would be phenomenal if continued to raise the level to do ijtihad, which people called by mujtahid, who have discovered or created something new in the field of astronomy or falak science.

As we know that the development of Islamic astronomy or falak science cannot be separated from an existence of equipment, both simple and traditional or complicated and sophisticated modern. Likewise, software is currently being developed offline, and online with various programming languages.

Advances in astronomy are supported by technological developments, which also originated from observing some of the instruments or equipment used. Islamic astronomy equipment has been created from the beginning of this science, such as classic astrolabe equipment, rubu’mujayyab. It is an equipment which continues to be used today, although it is used more to preserve treasures of the past, as there is a variety of modern equipment which can replace its function. These tools have contributed to various discoveries in the history of the advancement of astronomy. In addition to these tools, there is also new equipment which has been used through the concept of modern equipment, as outlined below.

Traditional

The astrolabe was a particularly important astronomical tool in the Middle Ages. Before the discovery of a telescope, it was the main tool to conduct observance on celestial bodies and determine time. These medieval legacy astronomical instruments can function as clocks, calculators, computers, telescopes, and GPS equipment, which exist today, at the same time. In ancient times, it was known as a sophisticated ancient astronomical tool used to measure a position of celestial bodies on a celestial sphere. This tool can also be used to determine a time and position on the sun, stars, moon, and planets. In Arabic, it was called ‘al-usthurlab’, whereas in Greek, it was called ‘astrolabio’, which means star, reconnaissance or measurement distancing (Muhammad bin Ahmad, 2004).

Rubu' Mujayyab

The rubu' mujayyab was a classic instrument that was very popular in his time because it was considered to have accurate results. It is an astronomical arithmetic for solving any spherical problems about astronomy or falak science. Even though it was passed through the centuries, the rubu' mujayyab is still used today. The development of various modern instruments was not able to eliminate rubu' mujayyab from a sphere on scientific astronomy. The uniqueness of the rubu' mujayyab means it is still used today, and this is also applied to other ancient astronomical tools, such as the astrolabe. The term, 'rubu' mujayyab', comes from Arabic; 'rubu' means a quarter, and 'mujayyab' means sine.

The rubu' mujayyab is useful for calculating, measuring, and containing astronomical tables, which is as the name means, 'a quarter'. This tool is very useful to help solve calculations related to spherical triangles and trigonometry, measuring the angle of the sky, knowing the time, determining the beginning of prayer times, the direction of Qibla, and the position of the sun in constellations during a year. This tool is also useful for calculating goniometric functions that can be used to project a circulation of celestial bodies on a vertical circle. While in Syria, this tool was used until the fourteenth century (Donald R. Hill, 2004). The rubu' mujayyab has two latitudes. There is an inside on a standard sign set on the front, which is useful for the Cairo latitude. Whereas, on the outside, non-standard devices are useful for the latitude of Damascus. In the development of this tool, Ibn Syatir, and Ibnu Saraj also recorded correspondence (Najmuddin al-Mishri, 2003).

The rubu' mujayyab continues to grow and spread throughout the world, including to Indonesia. The spread was partly thanks to Muslim astronomers who actively carried out observations. Against rubu 'mujayyab which developed in Indonesia is a type of Rubu' which has been developed by Ibnu Syatir [Howard, R. Turner: Science....: 111].

A good rubu' mujayyab is one that is quite large in size, has a more precise scale, a hole in the markaz which is just right for the thread (not loose), and the hole in the face is not too large and corresponds exactly with the magic side. To observe an object or celestial object, it should be used by a pole that can be locked and arranged. Thus, when the object can be targeted, its position does not change and the right thread will be shown for the actual thread.

Functionally, the rubu' mujayyab has several main functions, such as:

Calculate Tools

As a calculation tool, this rubu' mujayyab can be released from the stative and placed horizontally. Mathematically, the main function of the rubu' mujayyab is as a calculation tool, which is known as an orthogonal grid.

Measuring Instruments

As a measuring tool, the rubu' mujayyab collects physical data or observational data that can be processed by using certain equations which suit the needs of any user.

Astronomy Table

In rubu’, there are several lines which show astronomical data, such as the position of a sun in ecliptic longitude, and the declination of a sun. For example, the calculation of rubu' mujayyab in the trigonometry sine.

Sine was defined as the ratio of any sides on a triangle in front of an angle to the oblique side, provided that the triangle is a right triangle or one of the triangles on 90o (see W. M. Smart, 1980: 9). To identify the value of sine in rubu' mujayyab from an angle (CAB), it can be read directly on the al-Sittini side (Hendro Setyanto, Rubu' Mujayyab).

There are several calculation steps of the value of Sin 35o with rubu' mujayyab, such as:

a. Put khoit on Qous 35o.
b. Draw a straight line from Qous al-Irtifa' to as-Sittini.
c. Any position of khoith, from the beginning of the maskaz to as-Sittini, is worth 34.35.
d. Because the concept of rubu 'mujayyab is sexagesimal, the value was divided by 60 (radius of rubu'). Subsequently, the result of 34.35 divided by 60 is 0.5725. Moreover, the value of Sin 35o is 0.5725. It has been compared against calculations using a calculator, with the value of Sin 35o being 0.5735764364.

Kalkulatot

The study of astronomy requires a calculator as an essential tool because without calculating aids, the calculation of formulas will experience difficulty in setting sine, cotng, and so on. This is because if performed manually, it can take a long time and is prone to errors. At the beginning of its development, the calculating aids used in astronomy or falak science were logarithms, which later developed into calculators. This logarithm list is still used by some old astronomical or Indonesian astronomical literature. Whereas, in astronomy or modern astronomy literature, it utilizes calculator based calculations. As such, calculators are an integral part of astronomy or falak. For the time period and as human needs evolved, calculators were adapted to a scientific calculator, which can calculate certain mathematical formulas. Thus, the calculator also used in the calculation of astronomy or falak science is a scientific calculator.

Compass

In ancient times, people could identify the direction by observing any position of the sun when it rose in the East and set in the West. At that time, they also marked the point of sunlight against the earth from the morning to sunset. Subsequently, human knowledge developed by observing the constellations that can be used to show a direction of the North, such as any constellations of Polaris. By getting north-south, they can founded another direction, after that, they will mark a direction. However, this knowledge was sometimes considered impractical because it depended on the weather conditions. If the weather was cloudy and dark, then humans could not know the direction pattern. Moreover, it can founded any tool like a practical direction such Compass.

Global Positioning System (GPS)

In ancient times, humans could know the position and time by observing celestial bodies, such as the rising and setting of the sun, and the position of the constellations. Over time and through innovation, it could be known by the use of a tool to determine the position and time, such as an astrolabe or compass. However, to use these tools, one requires an understanding of astronomy calculations. Today, a sophisticated, easy, and practical tool can be used to find the right time and position, which is the Global Positioning System (GPS).

The GPS is a radio navigation and positioning system which uses satellites. The full name of the GPS is the Navigational Satellite Timing and Ranging Global Positioning System (NAVSTAR GPS), but people are more familiar with GPS. This system can be used by many people at once, in all weather conditions, and it is designed to provide precise three-dimensional position and speed, as well as continuous time information throughout the world (Hasanuddin Z, 2000). It is a system of direction guidance or navigation, which utilises the help of signals from several satellites orbiting the earth. With certain orbital positions of these satellites, the satellites that serve the GPS can be received throughout the earth's surface to provide position, altitude, and time information with a high accuracy.

Thus, a device was called the GPS, which is designed to identify the latitude and longitude of an area with the help of satellites. In addition, it can also be used to determine the altitude, compass, position from a sun and a moon, the map, the navigator, and its section. Therefore, any user segment also consists of GPS users, including receivers, and managers of GPS signals, and data. In this case, any segment also consists of GPS satellite users, whether on land, sea, air or in space. A GPS signal receiver is required to receive and process signals for use in positioning, speed, and time. Thus, the functions of the GPS are:

a. Show the position of latitude and longitude, and the direction of a point where we are on earth, whether on land, sea or in the air (space).
b. Determine the height of a place.
c. Determine the direction with a digital compass.
d. Determine the position of a sun, and a moon.
e. Display a map.
f. Navigate from one location to another place.
g. Count outside any area.
h. Measure distances.
i. Save and manage tracks and points or locations.
j. Display the right time.
k. Display maps for major roads, rivers, and so on.
l. Display battery strength, satellite position, and signal strength.
m. Be used as a theodolite.

Eventually, when mankind explored other tools that could be used to measure angles at a location or place, the theodolite arose as a further development of the astrolabe, and rubu' mujayyab. A theodolite is a tool designed to measure horizontal and vertical angles. This tool is widely used as a mapping tool in geological, and geodetic surveys, which is the science of mapping the earth. By referring to the position and movement on celestial objects, such as the sun as a reference or with the help of GPS satellites, the theodolite will become a tool that can determine the direction of the arc seconds 1/3600o scale.

With the advantages of the theodolite, and its adoption into astronomy, it is used to measure the angle of Qibla direction, the height of the sun, and observations of celestial bodies. In addition, this tool can be equipped by binoculars with varying lens magnifications to see celestial bodies. The theodolite, as a measurement tool for horizontal and vertical angles, has many functions that can be used in various sciences, including astronomy. These functions include:

a. Measuring the position (azimuth and height) of celestial bodies, such as the sun, and moon.
b. Measuring the true North point.
c. Measuring the Qibla direction.
d. Observing the new moon (rukyatul hilal)

e. Observing an eclipse.
f. Measuring some angles, distances, and height differences.

Telescope

The strengthening of celestial bodies has been performed by humans since the beginning of existence. The results of observations continue to be formulated in theory, along with any needs and interests of humans towards the obstruction of celestial bodies, as well as some of the tools used to observe and continue growth. In ancient times, people observed celestial bodies only with the naked eye, before creating the astrolabe that could measure the position of celestial bodies and time. Gradually, along with the development of technology in the field of science, such as the discovery of optics, it provided the inspiration to create a more sophisticated tool called the telescope. It was used to see objects at a great distance and to make them appear larger, and clearer to the eyes of observers. It is an optical instrument that functions to gather more light than the human eye, and can magnify distant objects (Robbin Kerrod, 2005). The telescope is also often called binoculars.

To see the new moon (rukyatul hilal), human eyes are not enough because the brightness of a crescent moon is inferior to the foreground light of the sun. Therefore, to help rukyatul hilal, an optical telescope was needed. In addition, to ensure what is seen is truly the new moon, a telescope was also useful in recording scientific data, and for the purpose of subsequent quality observation databases [Moedji Raharto:]. It is why the existence of the telescope plays an important role in the observation of astronomy or falak science.

Materials and Method

To find out the five times for fard prayer, there is a time of the Dhuhur which must be known in advance. Therefore, it was not in vain that the angel Gabriel came to teach the Prophet Fardhu prayer time, which first taught the time of the nobles. For more details, the formula can be seen as follows:

Dhuhur time = 12.00 - e (time grading) (Ahmad Izzuddin, 2012).

After calculating the time between the results of angle transfer that obtained by next step to adjust the regional time for the place in question. This time adjustment must be done because the determined time angle formula is for local time, and not regional time (Jamil A, 2009).

The next step is a final step, and to consider ihtiyath. In this case, ihtiyath needs to be done as a security measure, such to be truly sure (Haqqul Yakin) that a time for the prayer in question has really entered, and to avoid the nature of hesitation to pray outside of time. In addition, if the city or region is calculated at prayer times, which is large enough, the method is to add one to two minutes for all times, except for the time of syuruq (issuance time) reduced (Kadir, 2012).

Result and Discussion

The results show that technology to determine prayer has experienced a rapid development, moving from a manual method, which is the process of directly monitoring or counting manually to digitisation, with the help of an application founded on an android phone. Global Positioning System technology has been developed into the android application. In terms of presenting technology to determine prayer times, it is extremely easy. In today's world, the average student has a smart phone, which can be used to upload and cancel applications. Academically, the development of techniques to determine prayer times continues to be carried out by conducting experiments based on unusual natural conditions. In addition, this has encouraged the establishment of astronomy laboratories to serve as learning media in Islamic higher education.

To determine and make it easier to know the initial entry of prayer times, one can use calculations that are assisted with technological equipment, such as istiwa or miqyaas data from Ephemeris. Thus, it is no longer difficult for us to see the sun every time that we do or establish prayer (Depag, 1994). However, before we calculate the initial entry of prayer time, we must first know the provisions or criteria regarding the initial entry of prayer time that has been explained, both from the Qur'an, and from the Prophet's Hadith outlined by Allah SWT, and the Prophet Muhammad SAW. Therefore, the actual initial instruction to identify and determine the initial entry of prayer time, is to look at (Rukyat) the sun (Depag, 1981).

Thus, it is meant that by prayer in the perspective of calculation in the Al-Qur’an, and Hadith, it is the beginning of an entry of prayer times. Therefore, the prayer time runs out when the next prayer time arrives, except that the dawn prayer time will end when the sun rises in the Eastern horizon. Therefore, prayer times are determined based on the position of the sun when measured from somewhere on the earth (Al-Mishri et al., 2003). Basically, any calculation for prayer times can calculate for the sun's position, according to the criteria specified in the Al-Qur’an, and Hadith. In this study on Makassar City, which is used as a sample for the calculation of prayer times, this region can represent an area in the central part of Indonesia (Dahlan, 2010).

Based on the above example, it should be noted that:

a. All time calculations must always involved, which have not been fixed by regional longitude and ihtiyath. In other words, it always involves calculating the meridian's trajectory for the sun.
b. Especially for Asar, Magrib, and Isha time, it must always be added to the culmination time above.
c. For the dawn and rising time (syuruq), it must always be deducted from the culmination time above because in the second time, the culmination time is not over.
d. To adjust the regional time, such as Semarang City with West Indonesia Time (WIB), any time calculation results above are always added because the longitude of Semarang City (110o 24 'E) is located next to the longitude of WIB (105o East). If it is located to the East, the difference in longitude must be reduced.
e. For Ihtiyath, numbers are taken between one to three minutes, and at the same time for rounding seconds from the calculation results.

Conclusion

Based on better and in-depth search results from previous studies, it should be noted that ihtiyath for all times is always added to ihtiyath time figures, except for syuruq (up), which must be reduced. The published time must be reduced by ihtiyath, which is a purpose to secure and the end of dawn. Thus, any astronomy science or calculation can foster confidence in performing worship, so worship is more solemn.

In terms of a way to deepen, it was similar to other knowledge, which must master standards for competence relating to astronomy. Meanwhile, the role on the Sunnah in astronomy is as a foundation of theology, which underlies all components in the subject of astronomy.

Globally, the Al-Qur'an has established prayer times for Muslims, which are then clarified through the Prophet's Hadith. Prayer times are determined based on the phenomenon of any position on the sun. With this reference, the astronomical formula is developed for each initial prayer time. Dhuhur time is formulated with 12-e, and Ashar Time is formulated by cotg h = tg (p-d + 1). The sunset time starts when the sun position is -1^{o} below the horizon. The evening time starts when the sun's position is -18^{o} below the horizon, and the Fajr time is when the sun's position is -20^{o} below the horizon. In the perspective of Islamic astronomy, any position for the sun at dawn is rather a problem. The true dawn in astronomy (ilmy celestial sphere) is believed to be an astronomical twilight, where light begins to appear on the Eastern horizon just before sunrise (Depdikbut, 1999).

From prayer times, Syar'i's means that in the rules of astronomy, such as in the Journal of Islamic Law, there is a relationship between the syar'i foundation and astronomy about the determination of the initial prayer. However, for the Zuhr era, in-depth research needs to be undertaken because in Sharia, there are three sun conditions that cannot pray, such as before sunrise, when the sun peaks, and when the sun sets. For a period of time, the formula that was built (12-e), which is not in accordance with the shar'i foundation, was 12-e is when the sun peaks. Meanwhile, prayers are prohibited when they peak. Then, in the best solution, it can take at least two to four minutes. Therefore, an initial calculation for prayer times and Qibla direction is used by the round trigonometry calculation, as used by the Indonesian Ministry of Religion (Dallal, 1999).

Based on this description, it can be elaborated at length that the purpose of studying astronomy, and how to deepen it according to As-Sunnah instructions — at least from the description which further adds to our knowledge about the discipline of astronomy — is very closely related to the problem of Hadith, as its theological basis. On the other hand, in determining prayer times, it is getting easier to know these times due to the support of technological developments that are rapid. Thus, it can be easier to determine and know an exact prayer time. The development of technology has entered the era of the industrial revolution 4.0, which can make it easier for students to more easily understand and learn about astronomy science. In this case, we can compare a time of the prophet by using a manual or rukiyah calculation system, even with observation. Today, in this modern era, we can more easily determine the time by using equipment, such as an android application. In every smartphone at this time, we are can determine the time position for praying because each device has a GPS application, enabling calculation of the degree to which we are located to be known, thus encouraging students to learn astronomy more easily.

Astronomy is important to continue to develop and preserve, so it can be a means of effort to strengthen the worship of Muslims. Long before Muslim astronomy developed by any method of observation, with its theories that were very systematic and advanced, Muslims already had expertise in astronomy, to meet the demands of worship related to time and direction, such as fasting, zakat, and pilgrimage, which always required the determination of time, and place (Encup, 2007).

In its development, Muslims can also determine the methods and some of the theories of astronomy, which are not only based on previous observations and theories, but are also developed rapidly by using a technology system through the help of Android applications. Moreover, it can determine any prayer times, and identify the direction of Qibla or determine the beginning of fasting, even up to the calculation of zakat, infaq, and hajj. This development makes it easier for students to understand a time to carry out worship or calculations in astronomy because it was not complicated or as difficult as in the times before using technology systems or Android applications.

The results of this study are one of the information materials that can be used to expand the knowledge of astronomy, and to more easily study astronomy. In this paper, the problem of initial calculations during prayer was discussed. Therefore, people who run out of time and wrongly pray, can do so at other times; then in fact he has committed a big sin without a reason justified by Sharia (Hasanuddin, 2000).

The determination of the beginning on the month of Qamariyyah also occupies an important position against Muslims, in addition to Muslim holidays, as well as to establish the beginning, and end of the month of Ramadan, and Dhul-Hijjah for fasting, and pilgrimage, as Sharia worship in Islam (Hill, 2004).

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