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Transformation of Prayer Time Schedules: From A Static-Passive to A Dynamic-Variative Perspective

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Abstract

Prayer times are extremely important for Muslims, as they serve as a guide for the beginning of prayer times. However, there are still people who do not fully understand the impact of changes in the position of the Sun, which causes the start of prayer times to change daily. Additionally, some people still use perpetual prayer time schedules. Although they use the term "perpetual," in reality, prayer time schedules are not everlasting, as they cannot be used over long periods. This research is a library study with a phenomenological-astronomical approach. The results of this study show that prayer times change every day. Someone who believes that the start of Maghrib prayer is always at 18:00 WIB and the start of Fajr prayer is always at 04:30 WIB may find that on some days, their prayer or fasting is invalid, as the start of Maghrib prayer may occur between 18:01 and 18:08 WIB and the start of Fajr prayer may occur between 04:31 and 04:34 WIB. These changes can serve as an understanding for the community that the correctness of prayer time schedules is not static-passive but dynamic-variable. This means that the start of prayer times each day and year is not always the same as the following days and years, and the changes vary. Therefore, this study provides a scientific guide for the community to better understand and be cautious in using prayer time schedules, considering that the beginning of prayer times determines the validity of a Muslim's prayer.

Keywords: Prayer Time Schedule, Static-Passive, Dynamic-Variative.

Abstrak

Jadwal waktu salat menjadi sangat penting keberadannya bagi umat muslim, karena dijadikan sebagai panduan masuknya awal waktu salat. Namun masih ada masyarakat yang belum memahami betul mengenai pengaruh adanya perubahan pergerakan posisi Matahari yang menyebabkan awal waktu salat berubah setiap harinya. Selain itu juga masih ada yang menggunakan jadwal waktu salat abadi. Meskipun menggunakan kata "abadi" sejatinya jadwal waktu salat tidak lah abadi, karena jadwal waktu salat ini tidak akan bisa dimanfaatkan dalam waktu yang panjang. Penelitian ini termasuk dalam penelitian kepustakaan (*library research*) dengan pendekatan fenomenologis-astronomis. Hasil penelitian ini menunjukkan bahwa Setiap hari waktu salat selalu mengalami perubahan. Seseorang yang menganggap bahwa awal waktu salat Magrib selalu terjadi pukul 18.00 WIB dan awal waktu salat Subuh selalu terjadi pukul 04.30 WIB, maka ada beberapa hari yang salat atau puasanya tidak sah, karena awal waktu salat Magrib ada yang baru terjadi pukul 18.01 – 18.08 WIB dan awal waktu salat Subuh ada yang baru terjadi pukul 04.31 – 04.34 WIB. Perubahan yang terjadi dapat dijadikan sebagai pemahaman bagi masyarakat bahwa kebenaran jadwal waktu salat bukan bersifat statis-pasif melainkan bersifat dinamis-variatif. Artinya, awal waktu salat setiap hari dan suatu tahun tidak selalu sama dengan hari dan tahun-tahun berikutnya serta perubahannya pun bervariasi. Sehingga penelitian ini menjadi pedoman ilmiah bagi masyarakat supaya bisa lebih memahami dan berhati-hati dalam penggunaan jadwal waktu salat, mengingat masuknya waktu salat menjadi penentu sah dan tidaknya salat seorang muslim.

Kata Kunci: Jadwal Waktu Salat; Statis-Pasif; Dinamis-Variatif

Introduction

The schedule of prayer times is very important for Muslims, as it serves as a guide for the beginning of prayer times. In the study of Islamic jurisprudence (fiqh), the entry of prayer times is considered a condition for the validity of the prayer. If a prayer is performed outside its designated time, it can affect the legitimacy of one's prayer. The Quran, as a guide for Muslims, indicates the times of prayer, but it does not provide detailed specifications regarding these times. Therefore, the existence of the Hadith of the Prophet (PBUH), one of whose functions is to clarify the Quran, explains when and how to perform these prayers.[1]

History records that in the early days of Islam, the muezzin had a dual role: determining the entry of prayer times by observing astronomical phenomena related to the Sun before calling the adhan. If the Sun's astronomical phenomena could be observed at a certain time, it signified the beginning of the prayer time. However, if it was cloudy or raining, the muezzin would estimate the Sun's astronomical phenomena from the previous day as a reference for that day's prayer time.[2] The Sun's shadow was used to mark the entry of Dhuhr and Asr prayer times, sunset signaled the beginning of Maghrib, and the presence of sunlight's refraction indicated the start of Isha and Fajr prayer times.[3]

These astronomical phenomena of the Sun occur due to the apparent motion of the Sun, which is caused by the Earth's rotation and revolution. The Sun consistently moves in a regular pattern from one place to another and eventually returns to its original position. On March 21, the Sun is at the equator and begins its journey northward. The Sun reaches its farthest point north on June 21, then moves southward, reaching the equator again on September 23. Subsequently, the Sun continues its movement and reaches the farthest point south on December 22. From this farthest point south, the Sun moves northward back to its original position.[4] This apparent motion of the Sun results in dynamic data values for the Sun's declination and the equation of time.

Public knowledge about the changes in the apparent motion of the Sun, which affect astronomical data such as the Sun's declination and the equation of time in calculating prayer times, is very limited. The daily apparent movement of the Sun from north to south or from south to north causes the changes in the start times of prayers experienced by people every day. Today's prayer start times are different from yesterday's, and tomorrow's start times will not be the same as todays, and so on. Therefore, it is not the case that the start time for Dhuhr is always at 12:00, Asr at 15:00, Maghrib at 18:00, Isha at 19:15, and Fajr at 04:30.[5]

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[1] Dahlia Haliah Ma'u, "Jadwal Salat Sepanjang Masa Di Indonesia (Studi Akurasi Dan Batas Perbedaan Lintang Dalam Konversi Jadwal Salat)" (Disertasi, IAIN Walisongo, 2013), 2; Dahlia Haliah Ma'u, "Waktu Salat: Pemaknaan Syar'i Ke Dalam Kaidah Astronomi," *Istinbath: Jurnal Hukum Islam* 14, no. 2 (2015): 269–285.

[2] Susiknan Azhari, "Tracing the Concept of Fajr in the Islam Mosaic and Modern Science," *Ahkam: Jurnal Ilmu Syariah* 18, no. 1 (2018): 219–232.

[3] Ismail, "Dinamika Jadwal Waktu Salat Di Indonesia" (Disertasi, UIN Walisongo Semarang, 2021).

[4] A. Jamil, *Ilmu Falak Teori Dan Aplikasi: Hisab Arah Kiblat, Awal Waktu, Dan Awal Bulan (Hisab Kontemporer)* (Jakarta: Amzah, 2020), 6-7; Muhyiddin Khazin, *Ilmu Falak Dalam Teori Dan Praktik* (Yogyakarta: Buana Pustaka, 2004), 127-128; Vivit Fitriyanti, "Penerapan Ilmu Astronomi Dalam Upaya Unifikasi Kalender Hijriyah Di Indonesia," in *Annual International Conference On Islamic Studies (AICIS XII)*, 2012, 2125–2148; Yunus Muhammad Encep Abdul Rojak, Amrullah Hayatudin, "Koreksi Ketinggian Tempat Terhadap Fikih Waktu Salat: Analisis Jadwal Waktu Sholat Kota Bandung," *Al-Ahkam* 27, no. 2 (2017): 241–266.

[5] Departemen Agama RI, *Pedoman Penentuan Jadwal Waktu Shalat Sepanjang Masa* (Jakarta: Departemen Agama RI, 1994), 7.

The problem in the community is that many people still use a perpetual prayer schedule. However, there is a four-year cycle in the solar calendar, with 3 common years and 1 leap year, causing March 1 to shift back by one day in a leap year. Despite the term "perpetual," the prayer schedule is not truly perpetual, as it cannot be used effectively over a long period.

The study of the transformation of prayer schedules from a static-passive perspective to a dynamic-variable perspective is based on the argument that the community does not fully understand the impact of changes in the Sun's position, which cause daily variations in prayer times. The astronomical data of the Sun used in the calculation of prayer times must be accurate. When calculating the prayer time for June 18, 2022, the astronomical data of the Sun used must also be from June 18, 2022, to avoid discrepancies of seconds or even minutes in the prayer times. This accuracy is especially important during the month of Ramadan, where a one-minute difference in the Maghrib prayer time is significant for Muslims who wish to gain the virtue of breaking their fast on time.

The general public considers the prayer schedule important because it allows them to perform prayers easily regardless of conditions or location. Cloudy or even rainy weather does not prevent them from praying on time if the prayer schedule is available at the mosque and at home. However, the problem arises when the prayer schedule used does not correspond to the actual prayer times.[6] Therefore, studying the prayer schedule from a static-passive perspective to a dynamic-variable perspective is crucial to change the public's mindset regarding the perpetual prayer schedule, which cannot actually serve as a reliable guide for prayer times.

Method

This research is a library study with a phenomenological-astronomical approach. Phenomenology is used to uncover, study, and understand a phenomenon and its context as experienced by the community, in this case, the phenomenon of using a perpetual prayer schedule.[7] Meanwhile, the astronomical approach is used to interpret the events of the Sun as indicators of prayer times in the form of the Sun's position, which is constructed within the horizon coordinate system.

Prayer times from the perspective of Fiqh

The jurists (fuqaha) established the prayer schedule based on verses from the Quran and Hadiths of the Prophet Muhammad SAW. This resulted in a prayer schedule that aligns with the textual references in the Quran and Hadiths, using a method that is both practical and easy to apply. As indicated in the Hadith texts, the fuqaha determined the prayer times by directly observing the movement of the Sun, using an *istiwak* stick for assistance. Although the Quran does not explicitly outline the exact prayer times, it provides implicit guidance. The detailed prayer schedule is explained through Hadiths, aligning with one of the Hadiths' functions for the Quran: to clarify its meanings.[8]

Here are the Quranic verses that contain implicit meanings regarding the prayer schedule in the Qur'ann Surah Taha: 20 (verse 130), Surah al Isra: 17 (verse 78) and Surah Hud: 11 (verse 114). The scholars of tafsir (Quranic exegesis) differ in their interpretation of the

[6] Ismail & Husnaini, "Aktualisasi Jadwal Salat Sepanjang Masa Abu Muhammad Isa Mulieng Aceh," *Islamic Review: Jurnal Riset Dan Kajian Keislaman* 10, no. 1 (2021): 93–110.

[7] Engkus Kuswarno, *Metodologi Penelitian Komunikasi : Fenomenologi, Konsepsi, Pedoman, Dan Contoh Penelitiannya* (Bandung: Widya Padjadjaran, 2009), 22.

[8] Ahmad Izzuddin, *Ilmu Falak Praktis* (Semarang: Pustaka Rizki Putra, 2012), 80–81.

phrase "*wa aqimi al-shalah tharafayi al-nahar*" in the mentioned verse. Some say that this verse refers to the prayers established in the evening, namely the Maghrib prayer, and the prayers established in the morning, namely the Fajr prayer. Others say that the two ends of the day are the Zuhr and Asr prayers because they relate to the phrase "*wa zulafan min al-laili*," which refers to Maghrib, Isha, and Fajr. However, the correct opinion according to al-Thabari is that it refers to the Maghrib prayer. As for the phrase "*wa zulafan min al-laili*," al-Thabari interprets it as the Isha prayer because Isha is the last prayer performed after passing through part of the early night.[9]

Meanwhile, the hadiths that explain in detail about the beginning of prayer times are as follows:

1. Hadith narrated by Jabir bin Abdullah.
   rom Jabir bin Abdullah: Jibril (peace be upon him) came to the Prophet when the Sun had passed its zenith, and he called the Messenger of Allah (peace be upon him) to pray Zuhr when the Sun had just slightly declined. When a person's shadow was the same length as their height, he came to call the Prophet (peace be upon him) to perform Asr prayer. When the Sun had set, he came to call the Prophet (peace be upon him) to perform Maghrib prayer. He hastened the Maghrib prayer when the Sun was setting. When the redness had disappeared from the sky, he came once more to call the Prophet (peace be upon him) to perform Isha prayer. When dawn had broken, he came to call the Messenger of Allah (peace be upon him) to perform Fajr prayer. On the next day, when a person's shadow was the same length as their height, he came to call the Messenger of Allah (peace be upon him) to perform Zuhr prayer. Then, when a person's shadow had become twice their height, Jibril came to call the Messenger of Allah (peace be upon him) to perform Asr prayer. When the Sun had set, he came to call the Messenger of Allah (peace be upon him) to perform Maghrib prayer. Then, when the night had reached a third of it, he came to call the Messenger of Allah (peace be upon him) to perform Isha prayer. Then, on the next day, when the Sun had become bright, he came again to call the Messenger of Allah (peace be upon him) to perform Fajr prayer. After that, he said to him: The prescribed prayer times are between the times I performed the prayers with you yesterday and the times I performed the prayers with you today." (Narrated by Nasa'i). [10]
2. Hadith narrated by Abdullah bin Amar.
   "From Abdullah bin Amr (may Allah be pleased with him), the Messenger of Allah (peace be upon him) said: The time for Zuhr prayer is when the Sun passes its zenith and a person's shadow is the same length as their height, as long as Asr time has not arrived. The time for Asr prayer is as long as the Sun has not turned yellow. The time for Maghrib prayer is as long as the twilight (red light) has not disappeared. The time for Isha prayer is until midnight. And the time for Fajr prayer is from the breaking of dawn until the Sun rises. When the Sun has risen, refrain from performing prayers, for it rises between the two horns of the devil." (Narrated by Muslim).[11]

Based on these hadiths, the jurists (fuqaha) established the continuous prayer times from the arrival of Dhuhr until the end of Fajr time, marked by the sunrise. The obligation to

[9] Abu Ja'far Muhammad bin Jarir Al-Thabari, *Tafsir Al-Thabari*, Jilid 4 (Beirut: Muassasah al-Risalah, 1994), 317–318.

[10] Al-Hafiz Jalal al-Din Al-Suyuthi, *Sunan Al-Nasa'i Bi Syarhi Al-Hafidz Jalalu Al-Din Al-Suyuthi Wa Hasyiyatu Al-Imam Al-Sindi*, Juz 1 (Halab: Maktab al-Mathbu'at al-Islamiyyah, n.d.), 263.

[11] Imam Abi al-Husain Muslim bin al-Hajjaj al-Qusyairy Al-Naisabury, *Shahih Muslim* (Beirut-Libanon: Dar al-Kutub al-Ilmiyah, n.d.), 427.

perform prayers within the designated time frame is considered an obligation that is facilitated (*muwassa'an*), meaning it is a duty that is deemed fulfilled as long as it is performed within the specified time frame. As for the meaning of the Prophet's statement "*fainnaha tathlu'u baina qornai syaithanin*" some say that "the horns of Satan" refers to the people and their followers, while others say it refers to the horns of Satan on his head. The essence is that during that time, Satan approaches the sun, so that those who prostrate to the sun at that time, from among the disbelievers, seem to be prostrating to him. At that moment, he and his followers have the power and ability to disrupt someone's prayer. Therefore, prayer is disliked at that time for this reason, just as it is disliked to pray in places inhabited by Satan.[12]

Abdurrahman al-Jaziri in his book *al-Fiqh 'ala al-Mazhahib al-Arba'ah* explains that prayer times can be determined by five methods. Firstly, by relying on astronomically calculated and standardized times according to correct calculations. Nowadays, these calculations are widely available in urban and rural areas, which also determine the Shariah times. Secondly, by the sinking of the Sun, meaning the appearance of shadows shortly after culmination, the sinking of the Sun indicates the beginning of Dhuhr and Asr prayer times. Thirdly, by the setting of the Sun, indicating the beginning of Maghrib prayer time. Fourthly, by the disappearance of the red twilight, indicating the beginning of Isha prayer time. Fifthly, by the appearance of white light at the bottom of the eastern sky, indicating the beginning of Fajr prayer time.[13]

The determination of the entry of prayer times from the juristic perspective still follows the tradition of *rukyat* (visual sighting of the moon). This means that the sign of the entry of prayer time is when natural signs are visible, as indicated in the hadith above. The time for Dhuhr prayer begins when the Sun sinks until the shadow of an object is equal to its length or until the time of Asr prayer. This occurs when the latitude of a place differs from the declination of the Sun, so at the time of Dhuhr, the shadow of a perpendicular object is already present. The way to determine that the Sun has sunk is by observing the shadow of a perpendicular object. If the shadow of an object has reached its shortest point (on days when an object does not lose its shadow) or when the shadow of an object reappears after disappearing, then the beginning of Dhuhr time has arrived.[14]

The determination of the Asr prayer time is also done by observing the shadow of an object. The majority of scholars (Shafi'i, Maliki, Hanbali) are of the opinion that when the shadow of a perpendicular object has reached its length once, it is considered to have entered the Asr time, provided that on that day there was no shadow at the time of culmination. Meanwhile, the Hanafi scholars believe that the Asr prayer time has arrived when the shadow of an object is twice its length. However, the majority of scholars agree that when the Sun sets, the Asr prayer time ends.[15]

The determination of the Maghrib prayer time is also done by directly observing the Sun, which is when the entire disk of the Sun has set on the western horizon and ends when the red twilight disappears. Meanwhile, the Isha prayer time is determined when the red twilight disappears. The red twilight is the sunlight bias on the particles in the Earth's atmosphere

[12] Muhyiddin Yahya bin Syaraf An-Nawawi, *Shahih Muslim Bi Syarhi An-Nawawi*, Jilid 5 (Muassasah Qarthabah, 1994), 157–158.

[13] Abdurrahman Al-Jazairī, *Al-Fiqh 'Alā Al-Mazahib Al-Arba'Ah*, 1st ed. (Beirut-Libanon: Dar al-Kutub al-Ilmiyah, 2003), 166.

[14] Teungku Mustafa Muhammad Isa Pulo, *Fiqih Falakiyah* (Yogyakarta: Deepublish, 2016), 33–36.

[15] Arwin Juli Rakhmadi Butar-Butar, *Pengantar Ilmu Falak Teori Dan Praktik* (Medan: LPPM UISU, 2016), 38.

visible in the western sky. As for the Fajr prayer time, it is determined when the dawn light appears, which is the white light scattered along the eastern horizon.[16]

Here, it can be concluded that the boundaries of prayer times in the perspective of Islamic jurisprudence (fiqh) are based on daily events of the Sun that can be observed from the Earth by directly viewing (*rukyah*) the Sun's shadow, its disc, and its sunlight bias. The jurists also have various interpretations regarding the evidence for the boundaries of prayer times, especially for the Asr and Isha prayers. Differences of opinion in fiqh are evidence of ongoing ijtihad throughout history and demonstrate the intellectual richness that Muslims should be grateful for.

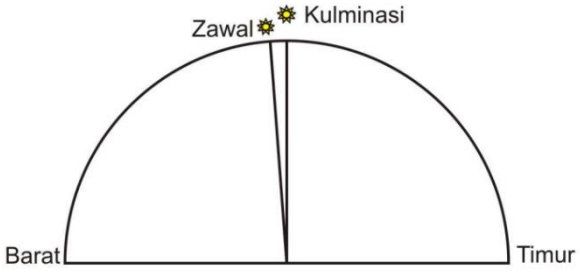
Prayer times from a scientific perspective

The astronomical basis used in determining the start of prayer times relies on the apparent motion of the Sun caused by the Earth's rotation. This apparent motion of the Sun includes sunrise, culmination (when the Sun is at its zenith), sunset, evening twilight, and morning twilight.[17] Here is an explanation of prayer times from an astronomical perspective:

1. The Beginning of Dhuhr Prayer Time

   The beginning of Dhuhr prayer time occurs at noon, when the entire disk of the Sun has passed the meridian line of the sky, which is relatively high compared to the latitude of the location and the declination of the Sun.[18] It takes approximately 3 minutes for the Sun to pass the meridian line. In calculating the start of Dhuhr prayer time, the value of the Sun's time angle is not needed because it is a certainty when the Sun's position is on the meridian line, the Sun's time angle is 0°, indicating the true noon time.

Figure 1. Visualization of the Sun's Position at the Beginning of Dhuhr Prayer Time



2. The Beginning of Asr Prayer Time

   As explained by the jurists, there are two opinions regarding the beginning of Asr prayer time. From an astronomical perspective, both opinions are valid. Firstly, Asr prayer time begins when the shadow of an object is equal in length to the object itself. This occurs

[16] Butar-Butar, 38–41.

[17] Thomas Djamaluddin, *Menggagas Fiqih Astronomi: Telaah Hisab-Rukyat Dan Pencarian Solusi Perbedaan Hari Raya* (Bandung: Kaki Langit, 2005), 137.

[18] Ketika Matahari melewati meridian, terdapat 3 bentuk bayangan yang terjadi, yakni: 1) Bayangan berada di selatan, 2) Bayangan berada di utara dan 3) Tidak ada bayangan. Perbedaan bentuk bayangan ini disebabkan oleh nilai deklinasi Matahari yang tidak selalu sama dengan nilai deklinasi Matahari. Baca Slamet Hambali, "Aplikasi Astronomi Modern Dalam Kitab As-Shalat Karya Abdul Hakim" (Semarang, 2012), 38; Direktorat Urusan Agama Islam dan Pembinaan Syariah, *Almanak Hisab Rukyat* (Jakarta: Direktorat Jenderal Bimbingan Masyarakat Islam Kemenag RI, 2010), 142.

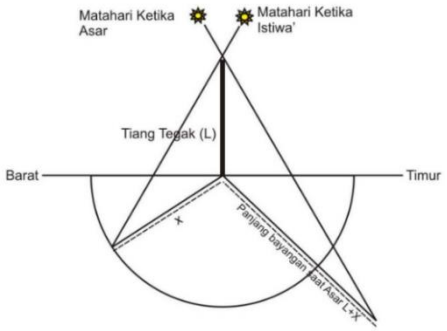
when the latitude of the location is the same or nearly the same as the Sun's declination, so when the Sun is at its zenith, an upright object has no shadow.

Secondly, Asr prayer time begins when the shadow of an object is twice the length of the object. This occurs because there is a difference between the latitude of the location and the Sun's declination, so when the Sun is at its zenith, an upright object already has a shadow that is equal to its length.

The length of the shadow when the Sun is at its zenith can be calculated using the formula Tan ZM, where ZM is the angular distance between the zenith and the Sun during its culmination along the meridian sky, equal to the absolute value of the latitude minus the Sun's declination. Thus, the position of the Sun at the beginning of Asr prayer time is calculated from the horizon along the vertical circle to the position of the Sun.[19]

$$\boldsymbol{Cotan\ h\ Asar = tan\ ZM + 1}$$

Figure 2. Visualization of the Sun's Position at the Beginning of Asr Prayer Time



3. The Beginning of Maghreb Prayer Time

The setting of the Sun is a sign of the arrival of the time for Maghreb prayers. It is said to set when the upper disk of the Sun has squeezed or touched the horizon of the mar'i. At sunset, the distance of the center point of the Sun as long as the semi-diameter (SD) of the Sun is 0o 16' 0". This value is obtained from half the average value of the diameter of the Sun (0,5 x 0^o 32′ 0″).[20]

Then, the phenomenon of light refraction or refraction is also the most important part in determining the beginning of the time for Maghrib prayers. The position of the Sun when it sets, actually the upper disk of the Sun is already below the western horizon. This is because there is a refraction of light that has a maximum value when the Sun is on the horizon with a value of equal to 0^o 34′ 30″.[21]

Another thing that affects the calculation of the time of Maghrib prayers is the height of the place. According to Slamet Hambali, someone who is in the same place with different heights will also be different when the Sun is visible when it rises and sets. Someone who is higher will see the sunrise first and see the sunset longer than someone who is below. This is then said to be the low horizon (KU) which can be known by the formula 0o 1.76' x √ the height of the place. So the sunset height formula is –(SD + Refraksi + KU).[22]

[19] Khazin, *Ilmu Falak Dalam Teori Dan Praktik*, 88-89.

[20] Ahmad Musonnif, *Ilmu Falak* (Yogyakarta: Teras, 2011), 73.

[21] Musonnif, 73.

[22] Slamet Hambali, *Ilmu Falak I: Penentuan Awal Waktu Salat Dan Arah Kiblat Seluruh Dunia* (Semarang: Program Pasca Sarjana IAIN Walisongo, 2011), 143.

4. The Beginning of Isha Prayer Time

An astronomical phenomenon at the beginning of Isya prayer time is the loss of red light. This phenomenon occurs due to the scattering of sunlight by atmospheric particles, so that even though the Sun has set, the light bias is still left in the western sky. This state is called "twilight."[23]

Looking at the observations of the observers, Twilight is divided into 3 levels, namely [24]:

a. Civil twilight

Civil twilight is a term for a situation when the position of the Sun is between 0 degrees to -6 degrees below the horizon. At that time, objects that were out of shape were still clearly visible and bright stars began to be visible.

b. Nautical twilight

Nautical twilight is a term for a situation when the position of the Sun is between -6 degrees to -12 degrees below the horizon. At that time, objects that were out of shape were already faintly visible and the stars could all be seen.

c. Astronomical twilight

Astronomical twilight is a term for a situation when the position of the Sun is between -12 degrees to -18 degrees below the horizon. At that time, the surface of the Earth was so dark that objects outside of its shape were no longer visible and all stars, both strong and weak, could be seen. When the position of the Sun is at -18 degrees below the horizon, the red light refraction has disappeared and this is when the time of Isha prayer begins.

5. The Beginning of Fajr Prayer Time

Astronomical events as a sign of the beginning of Fajr prayer time are the emergence of dawn *s}a>diq* or often known as the beginning of astronomical twilight. This time is marked by the appearance of light on the eastern horizon before sunrise. There is a difference of opinion as to when the dawn of *s}a>diq* appeared. According to the calendar of *Rabit}ah* Alam Isla>mi> (Islamic World League) the dawn of *s}a>diq* appears when the Sun is at -18 degrees below the horizon. While the Ummur Quro calendar pegs the position of the Sun at -19 degrees below the horizon. While Sa'adoeddin Djambek mentions that the appearance of dawn *s}a>diq* when the position of the Sun is at -20 degrees below the horizon. This last opinion is used by the Hisab Rukyat Institute of the Ministry of Religious Affairs of the Republic of Indonesia in starting the beginning of dawn prayer time.[25]

Various forms of prayer time schedules

The variety of forms of prayer time schedules circulating in the community is inseparable from the diversity of prayer time determination methods. The terminology of the prayer time schedule has now shifted from rukyat (observation) to hisab (calculation), this shift is due to the interpretation of verses and hadiths about the Science of Islamic

[23] Khazin, *Ilmu Falak Dalam Teori Dan Praktik*, 2004, 91.

[24] Jamil, *Ilmu Falak Teori Dan Aplikasi: Hisab Arah Kiblat, Awal Waktu, Dan Awal Bulan (Hisab Kontemporer)*, 32–33.

[25] Nihayatur Rohmah, *Syafaq & Fajar: Verifikasi Dengan Aplikasi Fotometri (Tinjauan Syar'i Dan Astronomi)* (Yogyakarta: Lintang Rasi Aksara Books, 2012), 2.

Astronomy.[26] Today, the needs and dependence of the community on the prayer time schedule are still very pronounced, it can even be ascertained that before carrying out the prayer worship no one sees the astronomical phenomenon of the sun anymore. A small example is that the majority of Muslim communities are always guided by prayer times or Imsakiyah schedules during Ramadan.[27]

In general, there are two forms of prayer time schedules, namely manual prayer time schedules and digital prayer time schedules.

1. Manual Prayer Time Schedule

   Manual prayer time schedule is a prayer time schedule that is prepared for a full year from January to December and is enforced forever. By the general public often call it the eternal prayer time schedule. This prayer time schedule is usually presented in the form of neatly framed paper with interpolations between 3 to 5 days and pasted on the walls of mosques.[28]

   The results of Dahlia Haliah Ma'u's research in her dissertation stated that the schedule of manual prayer times circulating in the community varied in form, some were single and some were in the form of conversion. A single prayer time schedule is drawn up and enforced for only one area. While the conversion prayer time schedule is arranged in one region but can also be applied to other regions by increasing or subtracting a few minutes (conversion).[29]

2. Digital Prayer Time Schedule

   The digital prayer time schedule is actually the same as the manual prayer time schedule. It's just that it looks in digital form, both in the form of applications and websites. Seeing the existing phenomenon, the current digital prayer time schedule has been posted on the walls in mosques or surau-surau as a guideline in starting prayers. Even as technology develops rapidly, this digital prayer time schedule is summarized into an application that can be installed on a smartphone.

   Like manual prayer time schedules, digital prayer time schedules also have many varieties. This diversity is dominated by the ability of compilers to enter astronomical data into digital-based algorithms. In addition, the programming languages are also different from one another. So that the prayer time displayed on the display is often not the same. Another difference also arises because when entering coordinate data, some are manually by selecting district or city areas that have been programmed in it and some have been automatically connected to the Global Positioning System (GPS) according to the coordinate point of the place where the device is located. In addition, the non-uniform use of *ikhtiyath* is also the cause of this difference.

   There are many forms of digital prayer time schedules that we can find, for example prayer time schedules listed on the website, such as the Bimas Islam digital prayer time

[26] Ismail & Husnaini, "Aktualisasi Jadwal Salat Sepanjang Masa Abu Muhammad Isa Mulieng Aceh"; Riza Afrian Mustaqim, "Relevansi Jadwal Waktu Salat Sepanjang Masa," *Jurnal Alwatzikhoebillah : Kajian Islam, Pendidikan, Ekonomi, Humaniora* 6, no. 2 (2020): 22–34.

[27] Moh Yusuf Faizin, Muhammad Himmatur Riza, and Muhammad Habibur Rahman, "Dinamika Waktu Imsak Pada Jadwal Imsakiyah Ramadan," *Al-Marshad: Jurnal Astronomi Islam Dan Ilmu-Ilmu Berkaitan* 7, no. 2 (2021): 151–161.

[28] Nailur Rahmi dan Firdaus, "An Analysist Of Sa'adudin Djambek's Hisab Method About All The Time Of Praying Schedule," *Al-Hilal: Journal of Islamic Astronomy* 2, no. 1 (2020): 15–38.

[29] Ma'u, "Jadwal Salat Sepanjang Masa Di Indonesia (Studi Akurasi Dan Batas Perbedaan Lintang Dalam Konversi Jadwal Salat)."

schedule of the Ministry of Religious Affairs of the Republic of Indonesia[30], al-Habib eternal prayer time schedule[31], prayer time schedule of the Rukyatul Hilal Indonesia institution[32], Muslim Pro prayer time schedule[33] whose calculation base uses geographical coordinate points by manually inputting through the options in it.

In addition, there is also a digital prayer time schedule that is programmed through an application that can be downloaded and installed on a smartphone, such as the prayer time schedule in the Digital Falak application[34], , in the application the prayer time schedule is arranged based on the coordinate point of the place where the smartphone is located and the clock is integrated with an atomic clock connected to the internet. It is even equipped with the sound of the call to prayer, so when it is time to pray, the sound of the call to prayer will automatically sound.

There are other digital prayer time schedules as posted on the walls of mosques, for example Di9ital Prayer Time by Hendro Setyanto. In the prayer time schedule, Hendro uses local coordinates and has used place height correction in the calculation process. The clock used is also integrated with an internet connection. There is something different from other digital prayer times, the difference lies in the search for data on the Sun's Declination and the Equation of Time. In looking for Declination and Equation of time data, this digital clock uses Julian Day or Julian Date, so this digital clock has a high level of accuracy.35

Other forms of digital prayer time schedules are prayer time schedules that are controlled using Arduino and displayed on Running Text. Prayer time automatically works with the display of date and time (hours, minutes, seconds) starting from Fajr prayer to Isha prayer.[36] There are also those who design a digital time schedule through Arduino Mega 2560 which when entering prayer time can be immediately accepted for Telegram users.[37]

Please note that in preparing a digital prayer time schedule, it will have higher accuracy if the clock is integrated with an internet connection or integrated with the Global Positioning System (GPS). If the clock is only controlled manually, then the accuracy level is very low, it must even be calibrated frequently so that the clock displayed matches the day.[38] So that the compilers of the digital prayer time schedule pay more attention to this so that the published prayer time schedule has an ideal accuracy standard to be guided.

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[30] Bimas Islam Kemenag RI, "Jadwal Shalat," accessed June 19, 2022, https://bimasislam.kemenag.go.id/jadwalshalat.

[31] Habib bin Hilal, "Jadwal Shalat," ALHABIB, accessed June 19, 2022, https://www.al-habib.info/jadwal-shalat/di/Indonesia/.

[32] Rukyatul Hilal Indonesia, "Jadwal Shalat," rukyatulhilal.org, accessed June 19, 2022, http://rukyatulhilal.org/jadwalshalat.

[33] "Prayer Times," muslimpro.com, accessed June 19, 2022, https://www.muslimpro.com/id/prayer-times.

[34] Ahmad Tholhah Ma'ruf, "Digital Falak," accessed June 19, 2022, https://play.google.com/store/apps/details?id=com.digital.falak&hl=en&gl=US.

[35] Fitriyani & Syaifur Rizal Fahmy, "Program Di9ital Prayer Time Dalam Penentuan Waktu Salat," *Ulul Albab: Jurnal Studi Dan Penelitian Hukum Islam* 2, no. 2 (2019): 59–79.

[36] Emil Naf'an, "Akurasi Sistem Penjadwalan Sholat Digital Menggunakan Arduino Sebagai Pengendali," *Jurnal Sistim Informasi Dan Teknologi* 1, no. 4 (2019): 81–88.

[37] Juhariansyah, Ritzkal, and Ade Hendri Hendrawan, "Design of an Automatic Bell Warning System for Prayer Times in a Net-Centric Computing Lab," *Journal of Robotics and Control (JRC)* 1, no. 3 (2020): 92–95.

[38] Ismail, "Akurasi Waktu Jam Masjid Di Kota Lhokseumawe," *Jurnal Al-Ijtimaiyyah* 6, no. 1 (2020): 75–90.

Transformation of prayer time schedule from Static-Passive perspective to Dynamic-Varied perspective

The prayer time schedule is prepared as a guide to make it easier for Muslims to perform prayers. In addition to the geographical position of the place, the five daily prayers require knowledge of the position of the Sun, because the schedule of the five daily prayers spans one day and is related to astronomical phenomena, especially the apparent movement of the Sun. So the astronomical data needed in the initial calculation of prayer time is very dependent on the schedule of movement of the Sun.

Along with the development of science, the initial determination of prayer times is also increasingly accurate with various careful calculations, ranging from calculations with the *hisab at taqribi* method to contemporary *hisab.* Because performing prayers not on time can be a violation of Islamic law and affect the validity of a Muslim's prayer. This shows the spiritual meaning in this paper which expresses the solemnity of a Muslim in performing prayers.

The sun does not stay in place but moves like any other celestial body in space. In his book, Slamet Hambali grouped the motion of the Sun into two movements, namely the true motion of the Sun and the apparent motion of the Sun. First, the true motion of the Sun is the actual motion of the Sun and this motion can be viewed if the observer is in a place that is not affected by any movement. The essential motion of the Sun is of two kinds, namely: a) Rotational Motion or Solar Cycle, is the rotation of the sun on its axis for about 27 days. b) Motion between clusters of Stars, the Sun moves with the entire Solar System as a unit around the center of the Milky Way Galaxy. The Sun and solar system are moving towards Star Vega in the constellation Harp away from Star Sirius in the constellation Canis Major. The abandoned area is called anti-apex.[39] Research shows that the sun along with the solar system moves at a speed of 20 km / second or thus every year the sun moves about 365 x 24 x 60 x 60 x 20 km = + 600 million km. One full rotation of the solar system around the galaxy lasts for 230 million years or one cosmic year.[40]

Second, the apparent motion of the Sun is a motion as if when viewed from Earth, the Sun looks like it is moving from east to west and north to south. The apparent motion of the Sun is divided into two: a) Daily motion (Diurnal motion), is the apparent appearance of celestial motion in this case the Sun, around the Earth caused by the rotational motion of the Earth[41]. b) Annual motion: The Sun moves in a 360° circle eastward across the ecliptic circle in one year. If we observe the rising of the sun, we will see the sun shifting to the east against the background of stars. The sun shifts by one degree per day. Then we can calculate 360° / 365.2425 days = 0° 59' per day (almost 1°).[42] The apparent motion of the Sun, the position of the Sun is also not right at the celestial equator, which has a tilt difference of 23o 27', so that every day the position of the Sun always changes and causes the beginning of prayer time is not the same as the previous days.[43]

[39] Slamet Hambali, *Pengantar Ilmu Falak: Menyimak Proses Pembentukan Alam* (Sleman: Bismillah Publisher, 2012), 213.

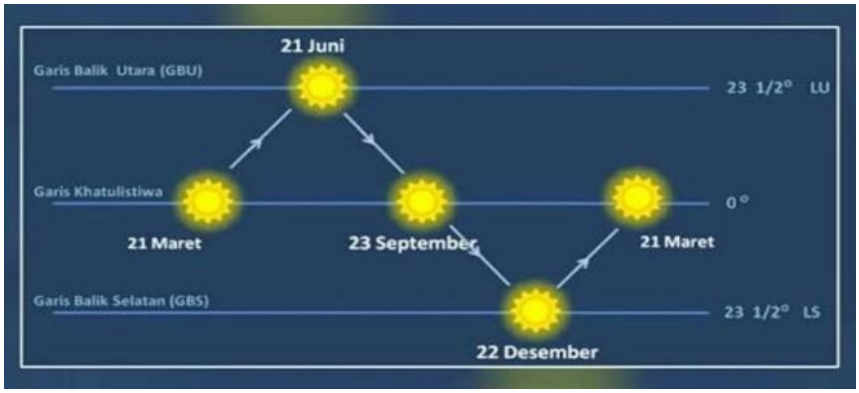
[40] Robbert Ball, *A Primer of Astronomi* (Cambridge: Cambridge University Press, 1911).

[41] Hambali, *Pengantar Ilmu Falak: Menyimak Proses Pembentukan Alam*.

[42] Ball, *A Primer of Astronomi*.

[43] A. Frangky Soleiman, "Penentuan Awal Waktu Salat," *Jurnal Ilmiah Al-Syir'ah* 9, no. 2 (2011): 1–14.

Figure 3. Apparent Motion of the Sun



The apparent motion of the Sun produces a solar data that is used in the calculation of the initial prayer time. The data are the Sun's Declination and the equation of time. Solar declination is the distance from a celestial body to the celestial equator measured through a time loop (declination circle) and calculated by degrees, minutes and seconds. [44] While the equation of time or time averager is the time difference between the essential time and the average solar time (mid). The essential time is based on the rotation of the earth which is not always 24 hours, but the time we use uses average (mid) time, so it is necessary to adjust the time. The difference is caused by the Earth's circular line around the Sun which is elliptical. One moment the Earth is closest to the Sun (perihelium) and at another time the Earth is far from the Sun (aphelium), so the value of the equation of time each day is dynamic.[45]

Data on the Sun's declination and equation of time can be taken from astronomical tables containing periodic values of the Sun's movement, including using Rubu' al-mujayab, Ulugh Beigh's astronomical table, Ephemeris Hisab Rukyat of the Indonesian Ministry of Religious Affairs, classical books, The Astronomical Almanac, The Nautical Almanac, Jean Meeus' Astronomical Tables Of The Sun, Moon and Planets by New Comb, Tables Of Motion Of The Earth by New Comb and Winhisab softwere from the Indonesian Ministry of Religious Affairs. [46] It can also be calculated using contemporary calculation formulas contained in the book Astronomical Algorithms by Jean Meeus.[47] However, in this case, the author uses the book Ephemeris Hisab Rukyat of the Ministry of Religious Affairs of the Republic of Indonesia in 2022[48] and the Winhisab software of the Ministry of Religious Affairs of the Republic of Indonesia to find data on the declination of the Sun and the equation of time in the past and future years. Meanwhile, to make it easier to make graphs, the author uses the Jean Mesuss algorithm and the prayer time calculation algorithm which is then processed in excel form..

The following is an example of changes in the value of the Sun's declination and equation of time from January 1 – December 31, 2022:

[44] Sayuthi Ali, *Ilmu Falak I* (Jakarta: PT. Raja Grafindo Persada, 1997), 11.

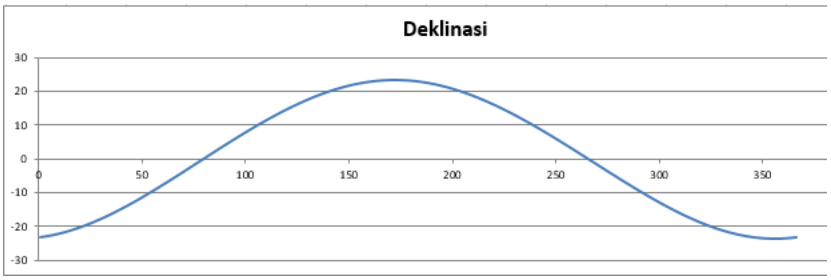
[45] Khazin, *Ilmu Falak Dalam Teori Dan Praktik*, 69.

[46] Moch. Riza Fahmi, "Studi Komparasi Jadwal Salat Sepanjang Masa H . Abdurrani Mahmud Dengan Hisab Kontemporer," *Jurnal Bimas Islam* 10, no. 3 (2017): 565–590.

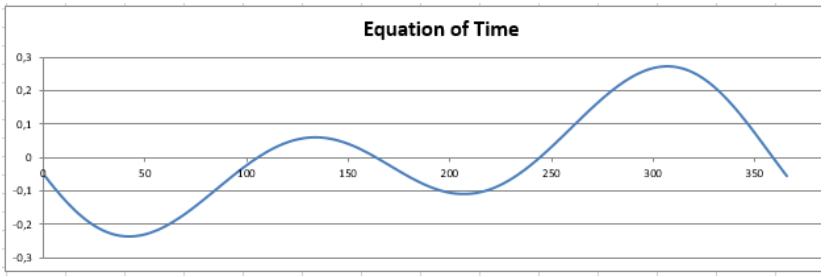
[47] Jean Meeus, *Astronomical Algorithms*, Second Edt (Virginia: Willmann-Bell, Inc., 1998).

[48] Direktorat Jenderal Bimbingan Masyarakat Islam Kementerian Agama RI, *Ephemeris 2022* (Jakarta: Direktorat Jenderal Bimbingan Masyarakat Islam Kementerian Agama RI, 2021).

Graph 1. Sun Declination Chart in 2022

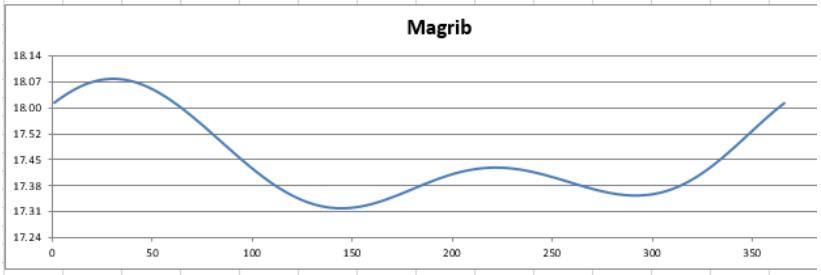


Graph 2. Equation of Time Graph in 2022

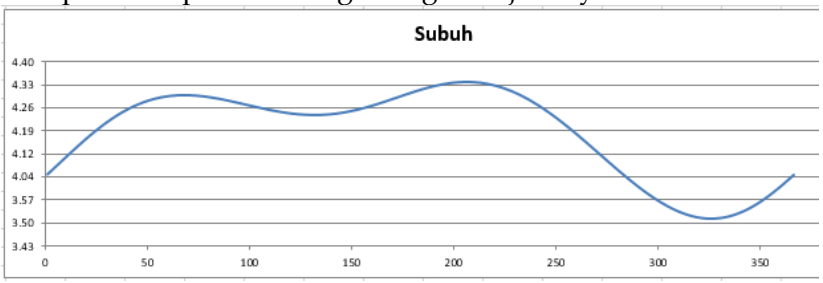


Both graphs above, it can be seen that the value of the Sun's declination and the equation of time change every day. As a result of these changes, the beginning of daily prayer times also changed. For example, changes in the beginning of Maghreb and Fajr prayer times are presented in the form of graphs for the city of Semarang during 2022. The author takes the example of the beginning of the time of Maghrib and Fajr prayers because these two times are used as markers of the time to break and start fasting.

Graph 3. Graph of the Beginning of Maghreb Prayer Times in 2022



Graph 4. Graph of the Beginning of Fajr Prayer Times in 2022



Looking at the graph of changes in the beginning of the time of Maghrib and Fajr prayers every day is dynamic-varied. This means that every day the prayer time always changes and the changes vary, on January 1, 2022, for example, the time of Maghreb prayer occurs at 18.00 WIB, then the graph rises to the top point on February 3, 2022 which occurs at 18.08 WIB. After

that, the graph began to decline until the lowest point on June 5, 2022, where the Maghreb prayer time occurred at 17.32 WIB. Furthermore, the chart began to rise again but not too significantly until August 21, 2022, which occurred at 17.43 WIB. Then the chart declined again with an insignificant decrease until October 25, 2022. After that, it can be seen that the graph began to rise again until December 31, 2022 with the time of Maghreb prayers occurring at 18.01 WIB.

Likewise, the beginning of dawn time, January 1, 2022 occurred at 4.05 WIB, then the graph rose until March 15, 2022 where the dawn prayer time occurred at 04.30 WIB. Then it can be seen that the graph began to decline but the decline was not too significant until May 27, 2022 with the beginning of dawn at 04.24 WIB. After that, the chart rose again to the top point which coincided on August 1, 2022 at 04:34 WIB for the beginning of dawn time. Furthermore, the chart fell sharply to the lowest point which occurred on November 26, 2022 with the beginning of Fajr prayer time at 04.51 WIB. Finally, the chart rose again until December 31, 2022 with the beginning of Fajr prayer time occurring at 04.05 WIB.

Both graphs refute that sekagilus is material to understand people who still consider prayer time to be static-passive. That is, every day prayer time always occurs at the same time and does not change. If one considers that the beginning of the Maghreb prayer time always occurs at 18.00 WIB, then on January 1 to March 3 the Maghrib prayer and fasting are invalid. Because on that date, the beginning of the Maghreb prayer time only occurs between 18.01 – 18.08 WIB. Similarly, someone who considers that the beginning of Fajr prayer time always occurs at 04.30 WIB, then from June 29 to August 17, 2022 his Fajr prayer is invalid. Because on that date the beginning of the Fajr prayer time only occurred between 04.31 – 04.34 WIB.

Another problem that occurs is that there are still many circulating schedules for eternal or all-time prayers in the midst of society. This schedule is usually posted in mosques, both mosques in villages and mosques in urban areas. Even this eternal prayer schedule has also been found on the Merak-Bakauheni inter-island crossing ship. Some examples of eternal prayer time schedules circulating in the community include the eternal prayer time schedule calculated by Airus Syaikhi for the Teluk Betung, Tanjung Karang, Metro, Panjang, Manggala areas and for areas on the islands of Kalimantan and West Sumatra.[49]

Figure 4. Airus Shaikhi Prayer Time Schedule for Eternity

[49] Jayusman, "Jadwal Waktu Salat Abadi," *Jurnal Khatulistiwa* 3, no. 1 (2013): 51–70.

In addition, in research conducted by Moch. Riza Fahmi mentioned that there is a timetable for eternal prayers that is still used today by mosque and surau administrators in the city of Pontianak and the people of West Kalimantan, this schedule was made by H. Abdurrani Mahmud around 1970.[50] There is another timetable of eternal prayers compiled by Abu Muhammad Isa Mulieng around 1984. This schedule is also still applied today as a guideline for prayer times for the people of North Aceh and its surroundings.[51]

Figure 5. Prayer Time Schedule for Eternity Abu Muhammad Isa Mulieng

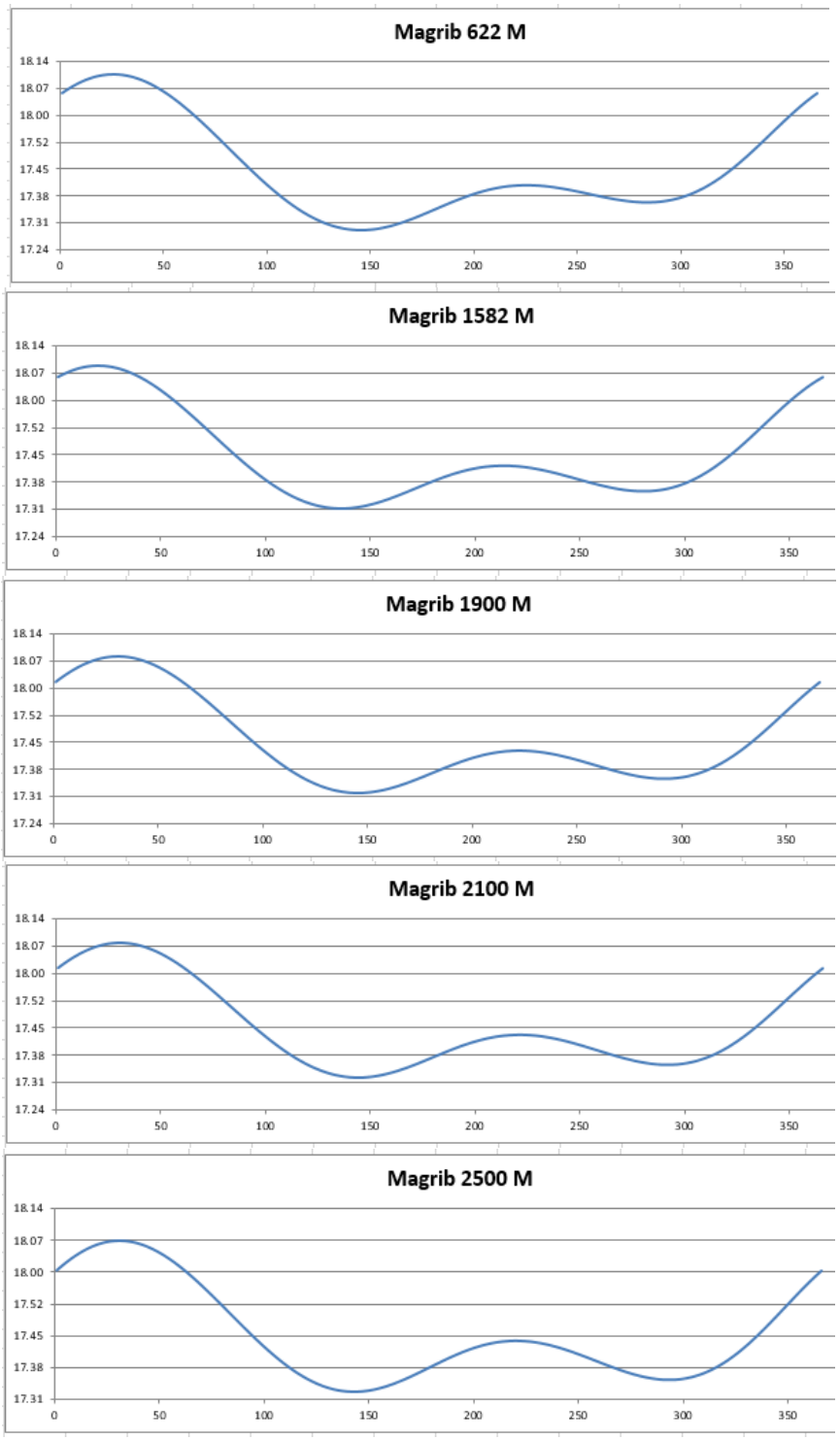
The timetable of eternal prayers was compiled, all using data on the Sun's declination and the equation of mean time. Even though we know that the position of the Sun is dynamic and produces varied data. This means that the solar data on March 16, 2022 is not the same as the solar data on March 16, 2023. Moreover, if you enter a leap year, automatically the solar data after February will be pushed back 1 day, which should be March 16, 2024 to March 17, 2024. Even this prayer time schedule by them is used for the next tens, hundreds or even thousands of years. Although the difference is not too significant, it is still said to be different and can affect the prayer.

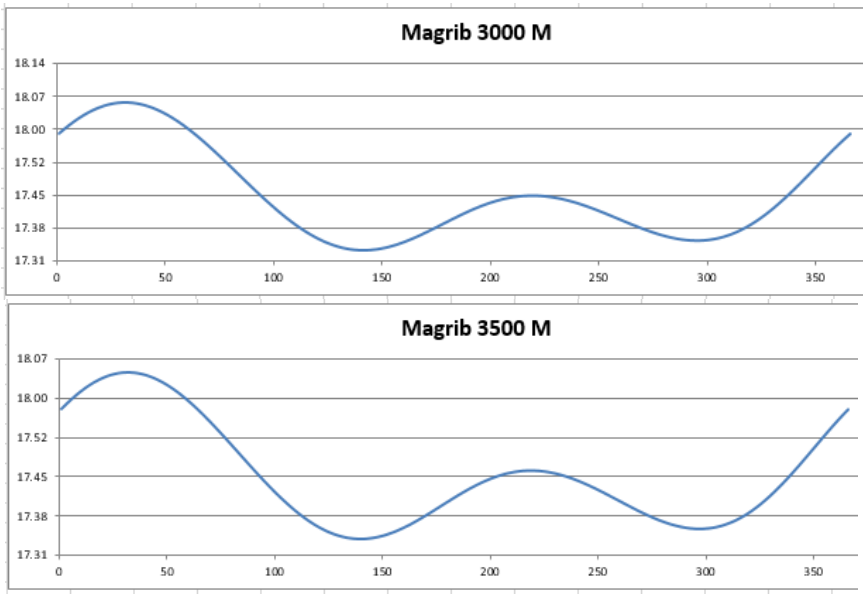
As an illustration, below is included a graph of changes in the beginning of the Maghreb prayer time in Semarang city with a height of 95 meters in several years randomly, namely 622 AD, 1582 AD, 1900 AD, 2100 AD, 2500 AD, 3000 AD and 3500 AD. The author provides an initial sample of Maghreb prayer time because it is closely related to the time of breaking the fast, so that with the known change in the beginning of the time of Maghrib prayer, People are more careful in using prayer time schedules. The graph of the change in the beginning of the time of Maghrib prayer is as follows.

[50] Fahmi, "Studi Komparasi Jadwal Salat Sepanjang Masa H . Abdurrani Mahmud Dengan Hisab Kontemporer."

[51] Ismail & Husnaini, "Aktualisasi Jadwal Salat Sepanjang Masa Abu Muhammad Isa Mulieng Aceh."

Graph 5. Graph of Changes in the Early Maghreb Time of Semarang City in 622 AD, 1582 AD, 1900 AD, 2100 AD, 2500 AD, 3000 AD and 3500 AD





Based on the chart above, the beginning of the Maghreb prayer time is not always the same every year. The changes were seen drastically in 1582 AD to 1900 AD and from 2100 AD to 3000 AD. The value of these changes is seen in more detail in the table below.

Table 1. Changes in the Beginning of Maghreb Prayer Times in 622 AD, 1582 AD, 1900 AD, 2100 AD, 2500 AD, 3000 AD and 3500 AD

Date/Year	622	1582	1900	2100	2500	3000	3500
January 1	18.06	18.06	18.01	18.01	18.00	17.59	17.57
January 15	18.10	18.08	18.06	18.06	18.05	18.03	18.02
February 1	18.10	18.08	18.08	18.07	18.07	18.05	18.04
February 15	18.07	18.04	18.06	18.06	18.05	18.04	18.03
March 1	18.02	17.58	18.02	18.01	18.01	18.00	17.59
March 15	17.55	17.51	17.56	17.55	17.55	17.54	17.53
April 1	17.46	17.42	17.47	17.47	17.47	17.46	17.46
April 15	17.39	17.37	17.41	17.41	17.41	17.41	17.40
May 1	17.32	17.32	17.35	17.35	17.35	17.36	17.36
May 15	17.29	17.31	17.32	17.32	17.33	17.33	17.34
June 1	17.29	17.32	17.32	17.32	17.33	17.34	17.34
June 15	17.31	17.35	17.34	17.34	17.35	17.36	17.37
July 1	17.34	17.39	17.37	17.38	17.39	17.40	17.41
July 15	17.38	17.41	17.40	17.41	17.42	17.43	17.44
August 1	17.40	17.42	17.42	17.43	17.44	17.45	17.46
August 15	17.41	17.42	17.43	17.43	17.44	17.45	17.46
September 1	17.40	17.39	17.41	17.41	17.42	17.43	17.44
September 15	17.38	17.37	17.39	17.39	17.40	17.40	17.41
October 1	17.37	17.36	17.37	17.37	17.37	17.37	17.38
October 15	17.36	17.36	17.35	17.35	17.35	17.36	17.36
November 1	17.38	17.39	17.36	17.36	17.36	17.36	17.36
November 15	17.43	17.44	17.39	17.39	17.39	17.38	17.38
December 1	17.50	17.51	17.46	17.46	17.45	17.44	17.44
December 1	17.57	17.59	17.53	17.53	17.52	17.51	17.50

Looking at the table above, it can be concluded that the beginning of Maghrib prayer time changes every year. This change is caused by the apparent motion of the Sun due to the Earth's rotation and revolution. Since the primary reference for prayer times is the position of the Sun, when the Sun's position changes, the solar data, which includes the Sun's declination and the equation of time, also changes. This affects the beginning of prayer times. Although the author uses Maghrib prayer time as a sample, it does not mean that the other prayer times (Dhuhr, Asr, Isha, and Fajr) do not change. In fact, these prayer times also experience changes similar to the changes in the beginning of Maghrib prayer time.

The changes observed in several graphs and tables can serve as an understanding for communities that still use perpetual prayer schedules. Although the term "perpetual" is used, these schedules are not truly perpetual, as the accuracy of the prayer times is not static and passive but dynamic and variable. This means that the beginning of prayer times in one year is not always the same as in subsequent years, and these changes vary. Thus, this research provides a scientific guideline for the community to better understand and be cautious in using prayer schedules, considering that the entry time of prayers determines the validity of a Muslim's prayer.

Prayer schedules will be more effective and accurate if they are created annually using the latest astronomical data and the geographical coordinates of each region. If calculated only by applying regional correction factors by adding or subtracting minutes, the prayer schedules will be inaccurate. Additionally, prayer schedules should ideally be issued by authorized entities, such as official institutions or individuals who are experts in Islamic of Astronomy. [52] Another important consideration is that dates should be written in full, not just at intervals of 3-5 days. Accuracy should be prioritized over merely optimizing paper size. These considerations reflect the spiritual significance of a Muslim’s devotion in performing prayers with concentration and reverence.

Conclusion

Prayer times change every day. If someone believes that the beginning of Maghrib prayer is always at 18:00 WIB, then from January 1st to March 3rd, their Maghrib prayer and fasting would not be valid. During those dates, the beginning of Maghrib prayer actually occurs between 18:01 and 18:08 WIB. Similarly, if someone believes that the beginning of Fajr prayer is always at 04:30 WIB, then from June 29th to August 17th, 2022, their Fajr prayer would not be valid. During those dates, the beginning of Fajr prayer actually occurs between 04:31 and 04:34 WIB. This applies to individuals who always perform their prayers at the beginning of the prayer time.

The changes in the beginning of prayer times over several random years, as seen in various graphs and tables, can serve as a guide for communities still using perpetual prayer schedules. Although labeled as perpetual, these schedules are not truly perpetual because their accuracy is not static and passive but dynamic and variable. This means that the beginning of prayer times in one year is not always the same as in subsequent years, and the changes can vary. Therefore, this research serves as a scientific guideline for the community to better understand and be cautious in using prayer schedules, considering that the correct entry time of prayers determines the validity of a Muslim's prayer.

[52] Arwin Juli Rakhmadi Butar-Butar, “KAJIAN ILMU FALAK DI INDONESIA: Kontribusi Syaikh Hasan Maksum Dalam Bidang Ilmu Falak,” *Journal of Contemporary Islam and Muslim Societies* 1, no. 1 (2017): 113–134.

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