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SHADIQ DAWN OBSERVATION USING ALL SKY CAMERA IN DELI SERDANG, NORTH SUMATERA

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Abstract

Technological advancements in optics and digital image recorders as means were breakthroughs in capturing and observing Shadiq Fajr's appearance which produce images according to visual as seen by the eye in the field. Digital camera usage such as the *All-Sky Camera which is* adjustable in taking dawn data according to a certain time, could show the sky conditions from dark to light, thus providing real evidence of the shadiq fajr appearance. Based on the research conducted, there are differences in Fajr prayer times based on the results of the observations by the *All-Sky Camera* with processed images using *ImageJ* and the Fajr prayer schedule issued by the Ministry of Religion of the Republic of Indonesia. Based on the image produced by ASC and processed using *imagej*, it shows that there is a change in the sky from dark to bright time which is characterized by significant graphic changes continuously. The study results obtained the average of the Sun depth at the Shadiq Fajr appearance is the altitude of 13.75 degrees below the horizon.

Keywords: Dawn Time, All Sky Camera, ImageJ

A. Introduction

In performing prayers, Muslims perform them following the time. The Prayers that performed before the time enters or after the time ends, make the prayers that have been done are invalid (Qomaruz Zaman, 2018). It is based on the word of God in Q.S. an-Nisa 103

اِنَّ الصَّلٰوةَ كَانَتْ عَلَى الْمُؤْمِنِيْنَ كِتٰبًا مَّوْقُوْتًا

Means:

"Prayer is actually a timed obligation upon believers" (QS. an-Nisa'/4:103).

Based on the verse above, Muslims are not allowed to pray at random times but must be at the following time as based on the Qur'an, hadith, and ijtihad of the scholars. So it can be concluded, that if the one who performs the prayer is not on the following time, then the prayer is invalid (Ramza et al., 2021). Therefore, Muslims must be careful in performing prayers whether it is in time or not.

The prayer times determination is inseparable from the position and movement of the Sun (Alimuddin, 2012). The sun's position on the earth's surface is not the same, So an accurate instrument and Islamic astronomy calculation are needed to be able to provide and know the early signs of prayer time (Marzhatillah, 2022). The Sun's position at dawn of Sadiq is below the true horizon with a certain height (Fuadi, 2021). Along with the development, the construction of many tall buildings, factories that are increasingly scattered everywhere, city lighting spread and pointing upwards of the sky, and some burning forests had a bad impact on the condition of the sky (Herdiwijaya, 2020). The sky filled with pollution condition, it makes it difficult for Muslims to be able to know the prayer times, especially the Fajr prayer time by observing the appearance of the Sadiq dawn as a sign of the beginning of the Fajr prayer (Basthoni, 2020). The beginning of Fajr prayer time begins at the dawn of Sadiq, as Allah says in Q.S. Al-Baqarah 187

وَكُلُواْ وَٱشۡرَبُواْ حَتَّىٰ يَتَبَيَّنَ لَكُمُ ٱلۡخَيۡطُ ٱلۡأَبۡيَضُ مِنَ ٱلۡخَيۡطِ ٱلۡأَسۡوَدِ مِنَ ٱلۡفَجۡرِ

It means:

"And eat, and drink until it is clear for you a white thread of black thread, which is the dawn" (QS. Al-Baqarah/2: 187).

The word "dawn" in the verse above referred to a sign to start fasting and the beginning of Fajr prayer time. In the hadith, dawn is also mentioned as a mark of fasting and the beginning of Fajr prayer time, and this is the basis of the morning for Islamic Astronomy experts in understanding the kadzib dawn and the Sadiq dawn.

وَعَنْ اِبْنِ عَبَّاسٍ رَضِيَ اَللَّهُ عَنْهُمَا قَالَ: قَالَ رَسُولُ اَللَّهِ صلى الله عليه وسلم اَلْفَجْرُ فَجْرَانِ: فَجْرٌ يُحَرِّمُ اَلطَّعَامَ وَتَحِلُّ فِيهِ اَلصَّلَاةُ وَفَجْرٌ تَحْرُمُ فِيهِ اَلصَّلَاةُ , أَيْ صَلَاةُ اَلصُّبْحِ, وَيَحِلَّ فِيهِ اَلطَّعَامُ (رَوَاهُ اِبْنُ خُزَيْمَةَ وَالْحَاكِمُ وَصَحَّحَاهُ)

It means:

"From Ibn Abbas radhiyallahu'anhu, He said the Prophet SAW said*: The dawn is two kinds: the dawn that forbids eating and allows prayer, and the dawn that forbids prayer (Fajr) and allows eat (suhoor)". (HR. Ibn Khuzaimah al-Hakim and both of them consecrated it).*

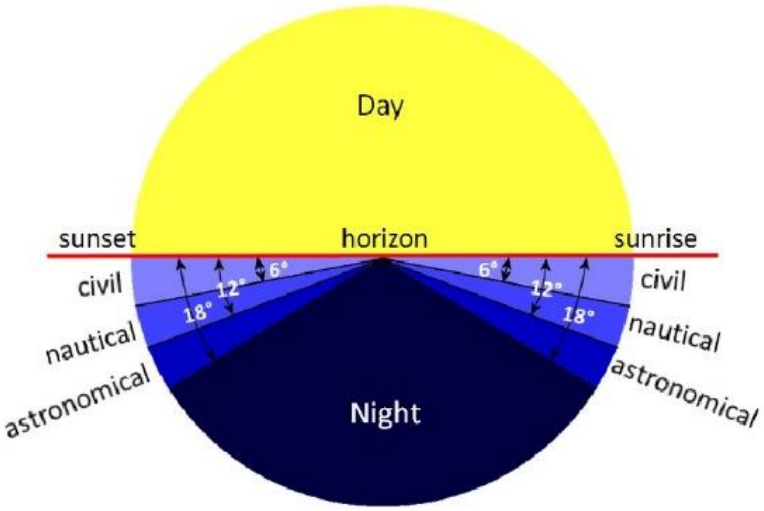
By the hadith redaction above, the scholars agreed to divide dawn into two, namely kadzib dawn and sadiq dawn (Rohmah, 2012). *First*, the dawn of kadzib is the light seen on the Eastern horizon that soars upwards like a wolf's tail and is commonly called the zodiac light (Saksono, 2017). In astronomical studies, the light that rises upwards is caused by the reflection of sunlight by celestial particles scattered between the planets in the solar system (Saksono, 2017). So it can be concluded, that the appearance of the dawn of kadzib is not at all related to sharia (Qusthalaani, 2018), But the presence of the kadzib dawn is a condition for the Sadiq dawn.

Second, the dawn of Sadiq is a white light that spreads and stretches across the Eastern horizon that rises after the disappearance of the kadzib dawn light (Musonnif, 2011). The appearance of the Sadiq dawn is closely related to Islamic Sharia such as fasting and the Fajr prayer time (Noor & Hamdani, 2018). The light of the sadiq dawn will gradually get brighter, it will continue to grow until the Sun rises. Based on this, scholars agree that the time of Fajr prayer begins at the Sadiq

dawn or the second dawn until the Sun rises. (Majelis Tarjih dan Tajdid Pimpinan Pusat Muhammadiyah, 2018).

Meanwhile, dawn in the astronomical view is divided into three types based on the position of its height below the horizon, namely astronomical dawn, nautical dawn, and civil dawn. The astronomical dawn occurs when the Sun is at a height of 18-12 degrees below the horizon, in these conditions the sky conditions are dark so it cannot distinguish celestial objects around anymore but the eyes are accustomed to it. Nautical dawn occurs when the Sun is at a height of 12-6 degrees below the horizon, the sky conditions are still dark or faint so the horizon boundary is not too clear. Civil dawn is when the Sun is at a height of 6 degrees below the horizon and up to the horizon, in these conditions, the surrounding conditions can be seen clearly without the help of lights or lighting because the scattering of sunlight is getting brighter radiating on the eastern horizon as shown in figure 1 (Herdiwijaya, 2017).

Figure 1. The astronomical division of dawn is based on the height of the Sun below the horizon



In Indonesia through the Ministry of Religious Affairs of the Republic of Indonesia (Kemenag RI) sets the height of the Sun at the time of the appearance of Sadiq dawn at a height of 20 degrees below the horizon and it has been considered appropriate based on the shari'a and astronomical reviews (Hariyadi Putraga, Arwin

Juli Rakhmadi, Muhammad Dimas Firdaus, 2022). Until now, many studies conducted by institutions/agencies and individuals who have expertise in science and astronomy get the results of Dawn quite varied at the time of the appearance of dawn Sadiq, which starts from 13-20 degrees below the horizon (Ritonga, 2021).

That is, the height of 20 degrees below the horizon is still disputed by people who also have expertise in Islamic astronomy as evidenced by the many dawn studies carried out using modern instruments such as *Sky Quality Meters* (SQM) and cameras (Setyanto et al., 2021). Thus, it is necessary to re-examine the appearance of Sadiq dawn to ensure that the beginning of Fajr prayer time corresponds to the appearance of the Sadiq dawn.

The determination of the Fajr prayer time is different from the determination of the other prayer times because the entry sign of the beginning of the Fajr prayer time is different and more difficult to observe when compared to the determination of the beginning of other prayer times (Akrim, 2020). So it takes a technology that can record and capture the dawn light when the Sun is still below the horizon. In addition to the Sun position below the horizon, sky conditions such as thick clouds, clouds, rain, moonlight and man-made light pollution also affect the visibility of the appearance of dawn even using special instruments such as Sky *Quality Meter* (SQM), *Digital Single-Lens Reflex* Camera (DSLR*), All Sky Camera* (ASC), *Dawn* Observation Automation System (SOOF), as well as other instruments that can capture and record the light of dawn (Ahyar et al., 2020).

With the instrument's limitations in capturing the appearance of dawn light, software assistance is needed *to* see changes in sky conditions from dark to light, namely with the help of *ImageJ software.* The use of *ImageJ* in image processing is intended to make it easier to provide signs or early indications of the appearance of Sadiq dawn based on average pixel value data (Raisal et al., 2019). To provide visual evidence of Dawn Shadiq's visibility, the author uses the *All Sky Camera* instrument to observe the appearance of Dawn Sadiq which produces several images (images) that are then processed using *ImageJ software* to determine the

beginning of the appearance of Dawn Sadiq as a sign of the early entry of dawn prayer time.

B. Methods

This research is a quantitative research with field research studies, *namely* direct observation in the field to collect and obtain the desired data using predetermined instruments, which is: *All Sky Camera* (ASC). In this study, the researchers emphasized the study of the change from dark to bright sky at the beginning of Fajr prayer time through observation of dawn shadiq using *All Sky Camera*. This research was conducted in Patumbak II, Deli Serdang, North Sumatra, with coordinate points $3^0$32'42,41" N & $98^0$42'34, 48" E. The location was chosen as an observation place because it is still classified as a dark area with minimal light pollution. After all, the location is right on the outskirts of the city, at the boundary between the cities of Medan and Deli Serdang (still classified as a rural location). Thus, the location is classified as ideal and representative for observing the dawn of Sadiq because it is in the suburbs far from the light pollution of city lights.

Dawn data collection was carried out for 4 days in October-November 2021 and February-March 2022, Data collection starts on October 18, November 6, 2021, February 5, and March 12, 2023. The observation of dawn shadiq was carried out for 1 hour (30 minutes before dawn and 30 minutes after dawn based on the prayer schedule issued by the Ministry of Religion of the Republic of Indonesia) with data collection every 30 seconds.

The procedures carried out in taking dawn data using the *All Sky Camera* are as shown in Figure 3:

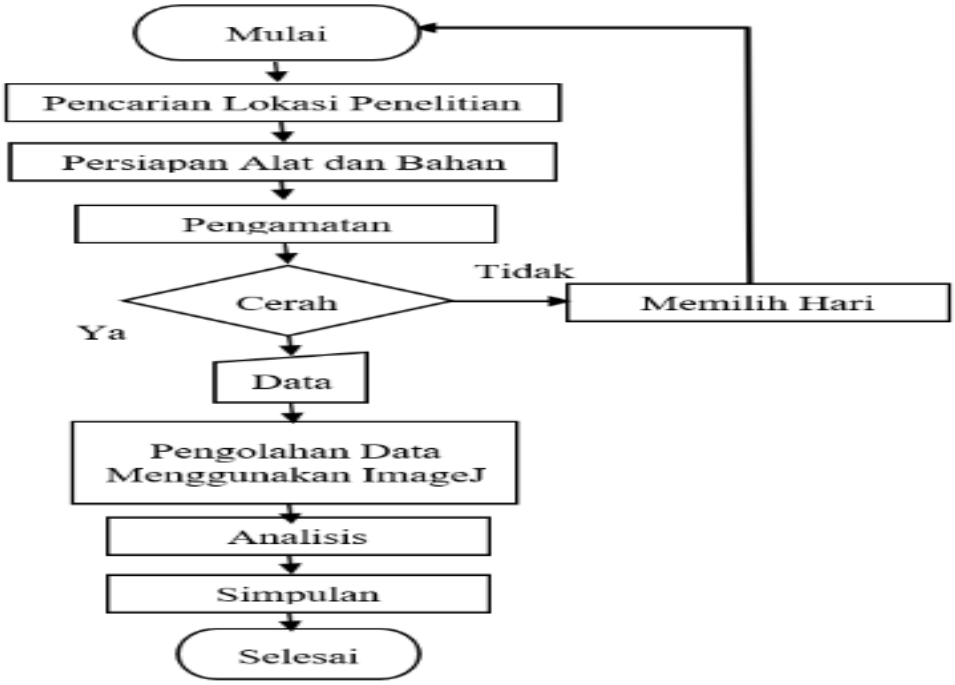


Figure 3. Dawn data retrieval diagram using *All Sky Camera*

Figure 2 shows where the observation of the dawn of Sadiq is carried out.

Figure 2. The observation location of Sadiq Dawn (Patumbak II, Deli Serdang) faces the eastern horizon at the time before dawn prayer.

C. Results and Discussion

1. *All Sky Camera* (ASC)

All Sky Camera is an optical device in the form of a camera with a 360-degree field of view that can be used to observe celestial objects and the changes in the sky from night to daytime (Saksono, 2017). With the concept of gathering light and objects shining in the sky, observing the sadiq dawn appearance using ASC has its advantages compared to other instruments commonly used in taking dawn data such as the *Sky Quality Meter* (SQM), where ASC captures can visually show the sky conditions from dark to light so that observers are easier to get the sadiq dawn appearance through the images produced by ASC (Ritonga, 2023). In addition, the detection of light increase can be done by looking at the increase in the *count* of each pixel in the image obtained (Rochman et al., 2019).

The Sky data recorded using the *All Sky Camera* were taken in 15-second intervals per image so that in 1 hour it produces as many as 240 images. After the night sky image is obtained, the selection and processing of data is carried out by taking the best data which has the least light (*noise) to* get the best image data which will be used as the main data in determining the appearance of the dawn prayer time sign.

After selecting and obtaining the best data, the pixel values on all observed images were obtained with the help of ImageJ software to get the average pixel values in the image. After knowing and getting the average pixel value in the image, the average pixel value is used as the main data to see changes in sky conditions from dark to light by looking at changes in the average pixel value continuously. Figure 4 shows the average pixel values in the observation image in Patumbak, Deli Serdang, North Sumatra.

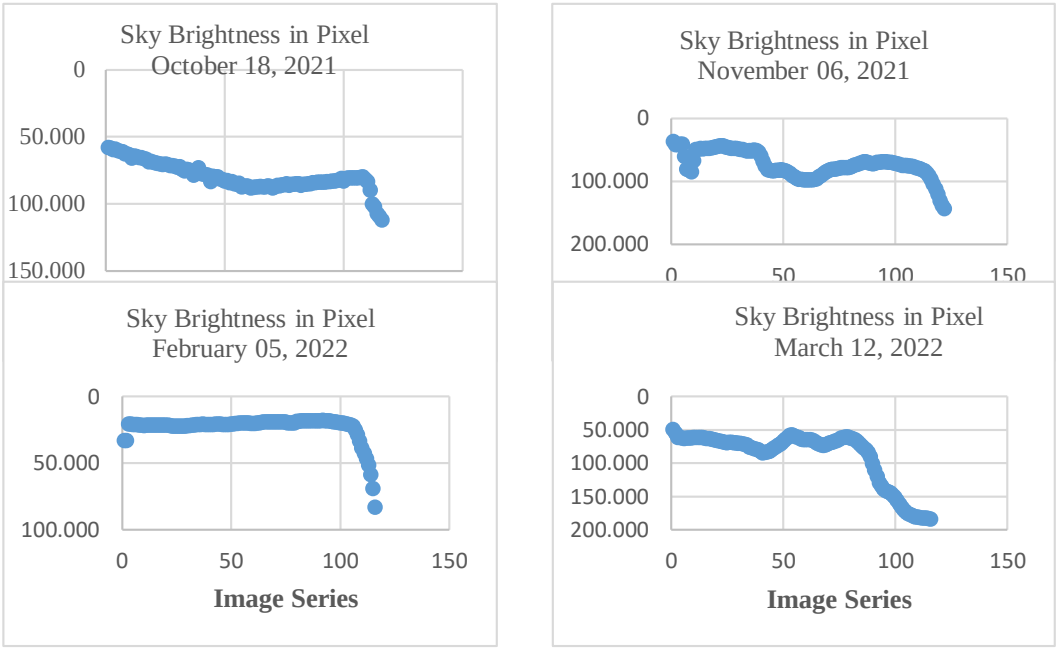


Figure 4. Graphs of sky brightness pixel value by All *Sky Camera* and processing using ImageJ in Patumbak, Deli Serdang.

Figure 4 shows a change in sky conditions from dark (indicated by a stable graph or vice versa) to bright sky (indicated by a graph that decreases continuously until the Sun rises). When the chart decreases continuously, it means a sign of the end of the night towards the beginning of the Sadiq dawn as the beginning of Fajr prayer time. The significant changes in the chart and the continuous change or decrease in the chart are the beginning of the Sadiq dawn appearance and a sign of the beginning of the time of Fajr prayer.

To see the change from night to light in the sky can be seen through observation images using the *All Sky Camera*, during, and after the Sadiq dawn. The following is a comparison of images before (figure 5), at the dawn of Sadiq (figure 6), and after the dawn of Sadiq on February 5, 2022 (figure 7). The Fajr prayer time used as a reference is taken from the website *https://bimasislam.kemenag.go.id/*. Based on the criteria of the Ministry of Religion on February 5, 2022, it shows the time of Fajr prayer at 05:22 WIB (Bimas Islam, 2023).

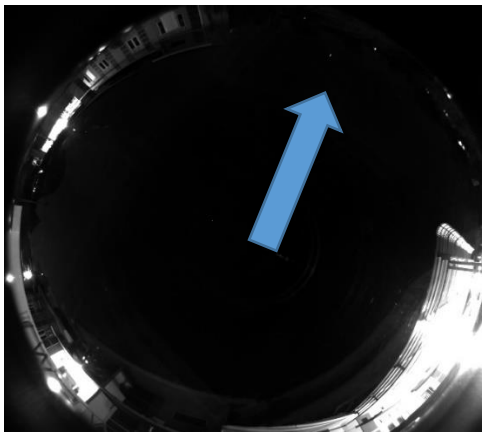


Figure 5 Based on the hisab of the Ministry of Religion of the Republic of Indonesia at 05:22 WIB it was still dark (arrows)

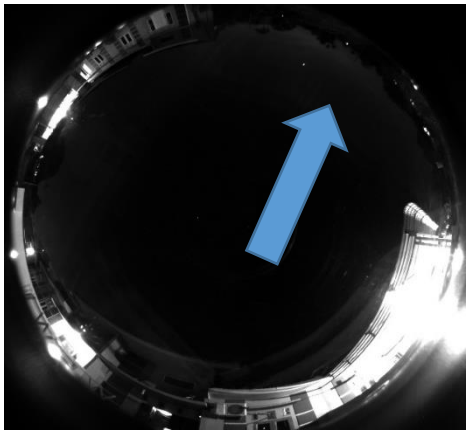


Figure 6 of the eastern horizon at 05:42 WIB. The condition of the eastern horizon sky has begun to light (arrows).

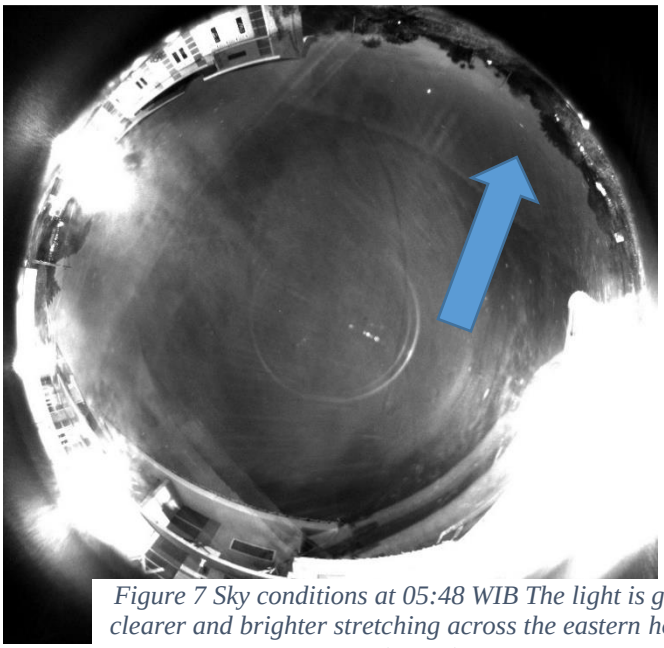


Figure 7 Sky conditions at 05:48 WIB The light is getting clearer and brighter stretching across the eastern horizon (arrow)

in Figure 5, if the condition of the eastern horizon has not seen any change (the sky is still dark) then in that condition it is categorized as night (not in Fajr time) this is following the word of Allah in surah al-Baqarah 187 which has been mentioned at the beginning of this article. From the picture above figure 6 and Figure 7, it can be concluded that when the sky conditions on the eastern horizon are bright, the light stretches and spreads or there has been a change from the dark

to the bright sky, then in these conditions it is said to be an early indication of the appearance of the Sadiq dawn.

Table 1. Observations using All Sky Camera for four days in Patumbak, Deli Serdang

No	Date	Fajr Time	DIP
1	October 18, 2021	05:18 WIB	-13
2	November 06, 2021	05:14 WIB	-14
3	February 05, 2022	05:42 WIB	-14
4	Maret 12, 2023	05:38 WIB	-14

Based on the graph and image above the collected data and converted to Sun's DIP (Height under the Horizon) were presented in Table 1. It can be seen that the average appearance of dawn shadiq using the *All Sky Camera* on four (4) days of observation made at 05:28 WIB corresponds to the average height of the sun at an altitude of -13.75 degrees below the horizon.

D. Conclusion

The shadiq dawn Observation using the *All Sky Camera* provides visual evidence directly based on the imagery produced, thus convincing the observers to determine the appearance of shadiq dawn as a mark of the beginning of dawn prayer time. Based on observations made in the period October-November 2021 and February-March 2022, it was found that the average appearance of Sadiq dawn is at 05:28 Local Time (WIB) with an average sun depth of 13.75 degrees below the horizon. This shows that the Fajr prayer time issued by the Ministry of Religion of the Republic of Indonesia is different than the actual appearance of shadiq dawn based on the *All Sky Camera* Observation. The Sadiq dawn observation using the *All Sky Camera* is very accurate because it can be proven by the visual evidence of Fajar Sadiq on the image that was produced.

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