



INTEGRATING ARTIFICIAL INTELLIGENCE IN HIJRI MONTH DETERMINATION: A MAQASID APPROACH

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ABSTRACT

This study aims to analyze the ongoing problem of determining the beginning of Hijri months in Indonesia by integrating modern astronomical technology with the principles of *maqāsid al-sharī'ah*. The core objective is to formulate a reconciliatory framework that addresses both scientific accuracy and religious unity through a novel theory, *al-Tawfiq al-Maqāsidī li-Taqwīm al-Hilāl* (The Maqāsid-Based Reconciliation Theory for Hilal Calendar). This theory proposes a dynamic model that incorporates artificial intelligence (AI) in astronomical calculations (*Al-Hisab*) and optical-enhanced digital moon sighting (*rukyat*), contextualized by the five essential *maqāsid*: religion, life, intellect, wealth, and social harmony. The research applies a qualitative method with a normative-philosophical and conceptual approach, supported by comparative analysis of global hilal determination practices and Indonesian legal fatwas. Interviews with astronomy experts, Islamic scholars, and legal practitioners are also conducted to strengthen the multidisciplinary analysis. Findings reveal that the current dichotomy between *hisab* and *rukyat* often neglects the broader dimension of *maqāsid al-sharī'ah*, resulting in repeated public confusion and disunity during major Islamic observances. The proposed theory enables the development of a *maqāsid*-oriented dynamic Hijri calendar, which not only fulfills scientific validity but also ensures social cohesion and religious legitimacy. In conclusion, integrating AI-based astronomical tools with *maqāsid* considerations presents a viable solution to the hilal controversy in Indonesia. This model has the potential to be institutionalized through a specialized body—*Majelis Hisab-Rukyat-Maqāsidīyah*—that mediates technology and theology for the common good.

Keywords: Hilal Determination, Hisab Rukyat, Maqāsid al-Sharī'ah, Artificial Intelligence, Islamic Calendar.

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INTRODUCTION

The Hijri calendar is a lunar calendar used to determine important times in Islam, such as the month of Ramadan to perform the Fasting Worship, the month of Shawwal to end the Ramadan fast and celebrate the Eid al-Fitr holiday, and the month of Dzulhijjah to perform the Hajj pilgrimage in Mecca Al-Mukarromah and celebrate the

Eid al-Adha holiday. The tradition of determining the beginning of the month in Islam generally uses the rukyat method (direct observation of the crescent moon) or hisab (astronomical calculations). Rukyat is traditionally considered more valid by many scholars, but has limitations such as the influence of weather and differences in time zones. Some Muslim countries combine these two methods or only use hisab, such as in the Global Hijri Calendar proposed at the 2016 Istanbul Congress. Traditional methods that rely on observations of the crescent moon or sightings of the crescent moon often result in discrepancies in dates between different regions or countries, mainly due to differences in geography and weather conditions. This raises the need for a more uniform approach, which is not only reliable but also acceptable among Muslims globally.¹

The use of modern technology in determining the beginning of the Hijri month is one of the relevant solutions and has received attention in various international Islamic discussions. Technologies such as digital telescopes, moon simulation software, and the use of satellite data can provide more precise data on the position of the crescent moon, thereby increasing the accuracy and uniformity of the Hijri calendar. The perspective of Maqashid Syariah, or the objectives of sharia, is very relevant in reviewing the implementation of this technology because this approach aims to achieve the benefit (maslahah) or welfare for the people. In other words, technology in this context is expected to be able to realize the values of Maqashid Syariah, which include protection of religion, reason, soul, descendants, and property.² Differences in the determination of the beginning of the Hijri month often result in uncertainty and differences in the timing of important religious observances for Muslims. In some cases, these differences have led to conflict, inconsistency, and confusion among Muslims living in different countries or regions. Furthermore, in the modern era, many countries with significant Muslim populations face challenges in synchronizing their social and economic activities with the often inconsistent determination of Islamic holy days. As technology advances, there is a need to consider how technology can be applied to address these issues more effectively, without compromising the principles of the Shari'a.

Comparative Assessment of Hijria Calendars

Model	Method	Strengths	Weaknesses
GIHC (Muhammadiyah)	<i>Hisab hakiki wujudul hilal</i>	Predictable, global, scientifically accurate	Limited international acceptance

¹ Tono Saksono, "GLOBAL ISLAMIC CALENDAR: SHARIAH, ECONOMIC, AND POLITICAL PERSPECTIVES," *Journal of Sharia Science* Vol 15, No 2 (2016), <http://dx.doi.org/10.31958/juris.v15i2>.

² "Efforts to Unify the International Islamic Calendar by the Organization of Islamic Cooperation (OIC)," nd, 7–8.

Model	Method	Strengths	Weaknesses
Umm al-Qura (Saudi)	Conjunction + fixed altitude	Simple and widely used in Arab world	Non-transparent and politically centralized
OIC Unified Calendar	Hisab + visibility zones	Balance between tradition and modernity	No uniform implementation
ISNA Calendar	Global visibility calculation	Practical for minorities	Lacks <i>fiqh</i> legitimacy in traditional contexts
MABIMS (Malaysia, Brunei Darussalam, Indosensia, Singapore)	<i>Imkanur Rukyah</i>	Balance between tradition and modernity	Non-transparent and politically centralized

Source: Author’s Analysis, 2025

Modern astronomical technologies, such as digital telescopes, crescent simulation software, and satellite data, allow for more accurate crescent observations independent of local weather or atmospheric conditions. Globally connected digital telescopes, as well as software such as Stellarium and MoonCalc, allow for precise crescent predictions and observations that can be accessed in real time by scholars and religious authorities around the world. The use of these technologies helps create more uniform and efficient observation standards, which are essential for the global implementation of the Hijri calendar.

Maqashid Syariah includes five main objectives: preserving religion (*hifz ad-din*), reason (*hifz al-aql*), soul (*hifz an-nafs*), descendants (*hifz an-nasl*), and property (*hifz al-mal*).³ In the context of determining the Hijri calendar, Maqashid Syariah emphasizes the importance of accuracy in worship times and the welfare of the community. The use of technology aims to support accuracy and unity in determining worship times so as to strengthen social and religious harmony. These principles are the basis for the application of technology in the Hijri calendar which is recognized by Islamic institutions, such as the Hisab Rukyat Agency of the Indonesian Ministry of Religious Affairs, the Islamic mass organization Nahdhatul Ulama, the Muhammadiyah Tarjih Council and the National Sharia Council.⁴

³ “The Theory of Maqashid Syariah in Islamic Law,” nd, 3.

⁴ Sakirman Sakirman, “Fiqh’s Response to the Development of Rukyat Technology,” *Al-Manahij: Journal of Islamic Law Studies* 14, no. 1 (June 2, 2020): 69–86, <https://doi.org/10.24090/mnh.v14i1.3190>.

Based on the explanation of the background of the problem above, this study will explore how technology can fulfill the principles of Maqashid Syariah in the Hijri calendar because it more flexible, applicable, or responsive to technological developments and it can examine the various challenges and opportunities that arise from efforts to implement a uniform calendar globally for Muslims.

This research aims to (1) identify various technologies that can be applied in determining the beginning of the Hijri month, (2) analyzing the use of technology in determining the beginning of the Hijri month from the perspective of Maqashid Syariah, and (3) evaluating the obstacles and challenges of implementing astronomical technology to determine the beginning of the Hijri month in a global context. With this approach, the research is expected to provide a comprehensive view of the role of technology in helping Muslims perform their worship more punctually and uniformly throughout the world, while still respecting the principles contained in Maqashid Syariah and it can be known what the obstacles and challenges are of implementing astronomical technology for determining the beginning of the Hijri month globally.

METHOD

The methodological approach in research on the use of technology in determining the beginning of the Hijri calendar from the perspective of Maqashid Syariah requires a holistic and interdisciplinary approach. This study uses a qualitative approach with literature analysis and case study methods. A qualitative approach is suitable for understanding how technology can be integrated into the process of determining the Hijri calendar and how this can be seen through the principles of Maqashid Syariah. The literature study aims to identify technologies that have been or have the potential to be applied in determining the crescent moon, such as digital telescopes, simulation applications, and satellite-based data analysis.

The data collected comes from primary and secondary literature: Scientific articles, books, and organizational reports related to astronomical technology and crescent-spotting methods in Islam. This includes documents from international Islamic astronomy conferences, such as the 2016 Istanbul Congress, as well as sources discussing the application of technology in the context of sharia. Documentation from Islamic institutions: Guidelines and decisions issued by Islamic institutions, such as the Muhammadiyah Tarjih Council and the Organization of the Islamic Conference (OIC), which include views on technology in determining the Islamic calendar. Data analysis in this research:

- a. Content Analysis: This technique was used to examine qualitative data collected from literature and interviews. The analysis focused on mapping the key concepts that emerged in relation to Maqashid Syariah, specifically on how technology can protect and strengthen religion, intellect, soul, lineage, and property.
- b. Comparative Study: Comparing the advantages and challenges of traditional crescent sighting methods with technology-based methods. This includes a comparison between direct observation technology and digital simulation-

based predictions and how each of these approaches contributes to the welfare of the community.

- c. **Maqasid Shariah Analysis:** This approach will be used to evaluate whether the use of technology in the Hijri calendar supports the principles of Shariah, such as preserving religion (hifz al-din), reason (hifz al-aql), life (hifz al-nafs), progeny (hifz al-nasl), and property (hifz al-mal). Each technology or method will be evaluated based on its contribution to each element of Maqasid.

Validation was conducted through data triangulation by comparing information from various sources, including scientific literature, expert opinions, and official documents from Islamic institutions. Additional verification was obtained from panel discussions or focus group discussions (FGD) with astronomy experts, scholars, and sharia experts. This aims to ensure that the interpretation of the Maqashid Syariah principles is in line with the understanding recognized in the Muslim community. This method is expected to provide a comprehensive picture of the potential, challenges, and impacts of implementing technology in the Hijri calendar, both from an astronomical aspect and the principles of Maqashid Syariah, so that it can be a sustainable solution for Muslims globally.

DISCUSSION

Identification of Various Technologies that can be Applied in Determining the Beginning of the Hijri Month to Improve Accuracy and Consistency

a. Advanced digital telescope and observatory

The use of digital telescopes and advanced observatories in determining the beginning of the Hijri month has been a significant step forward to increase the accuracy and efficiency in seeing the crescent (first crescent moon). This tool not only helps in observing the crescent in a specific location, but also supports predictive simulations that can estimate the visibility of the crescent in various regions before the new moon appears. The Digital Telescope for Real-Time Observation serves to observe the crescent moon more accurately because it is equipped with a high-resolution camera and automation features. This camera is able to capture crescent images even in less than ideal weather conditions or when the moonlight is dim, reducing dependence on weather conditions that often hamper traditional rukyat. This telescope can also be controlled remotely, allowing for international coordination in crescent observation.⁵ For example, telescopes connected through an Internet of Things (IoT) network can be controlled and monitored by multiple observatories globally, so that data from multiple locations can be compared and validated in real time. By integrating observational data from multiple locations, organizations such as the Organization of the Islamic Conference (OIC) or astronomical institutions in different countries can make faster and more accurate decisions regarding the determination of the beginning of the month.

⁵ Ahmad Junaidi, "Combining Rukyatulhilar with the Development of Science," *MADANIA: JOURNAL OF ISLAMIC STUDIES* 22, no. 1 (July 3, 2018): 8, <https://doi.org/10.29300/madania.v22i1.730>.

Digital telescopes connected through a global network have the advantage of Global Data Integration, making it easier to collect data simultaneously from multiple locations. For example, observational data from the Middle East, Southeast Asia, and the American continent can be integrated to verify the visibility of the crescent moon on a global scale. With this approach, uniformity in determining the beginning of the Hijri month across countries can be more easily achieved, overcoming the challenges of geographical differences and time zones.⁶

Advanced Observatories are needed for Crescent Moon Simulation Data Processing, Modern observatories have advanced capabilities in processing astronomical data and creating simulations of the visibility of the crescent moon in various geographical zones. These simulation tools, such as those supported by astronomical software such as Stellarium or MoonCalc, utilize data on the positions of the moon and the sun, the elevation of the moon, and atmospheric conditions to estimate whether the crescent moon will be visible at a particular location. This simulation process allows for a very accurate initial estimate of the probability of the crescent moon sighting before the actual sighting is performed. These simulations also take into account relevant astronomical factors, such as a minimum crescent altitude of 5° and an elongation of 8° which are often used as criteria for determining the beginning of the month. In addition, these observatories can develop simulations several decades into the future, allowing for a more certain determination of the Hijri calendar for the long term.

The use of advanced observatories also supports further astronomical research on the visibility of the crescent in various atmospheric environments, helping to improve the accuracy of future simulations. Collaboration between countries in the use of this technology is expected to facilitate a global consensus on the Hijri calendar, which has so far faced challenges due to differences in the methods of determining the beginning of the month in various Muslim countries. The integration of digital telescopes and advanced observatories in determining the crescent moon is very relevant to Maqashid Syariah because it supports unity and accuracy in carrying out worship throughout the world. With this technology, Muslims can perform worship at the same time, strengthening social harmony and the integrity of the community in worship such as fasting in Ramadan and celebrating Eid al-Fitr and Eid al-Adha. The use of digital telescopes and advanced observatories is one promising solution to create a more consistent and globally acceptable Hijri calendar, overcoming geographical and climatic obstacles that have been the main obstacles in traditional rukyat.⁷

b. Astronomy simulation software

Astronomical simulation software plays a vital role in determining the beginning of the Hijri month, primarily by predicting the visibility of the crescent moon (hilal). Such software, such as Stellarium, MoonCalc, and SkySafari, utilize astronomical data to

⁶ Unggul Suryo Ardi, "The Validity of the Image Processing Method by CASA in Hilal Observation," *Al-Mizan* 14, no. 1 (June 1, 2018): 135–61, <https://doi.org/10.30603/am.v14i1.934>.

⁷ Sakirman, "Fiqh's Response to the Development of Rukyat Technology."

model the positions of the moon, sun, and atmospheric conditions to estimate when and where the crescent moon will be visible in various geographic locations.⁸

Astronomical simulation software calculates various parameters that affect the visibility of the crescent, such as:

- I. Moon Altitude: Indicates how high the moon is above the horizon at a given time, which is important in determining whether the crescent moon can be seen by an observer at a given location.
- II. Elongation: The angle between the moon and the sun that indicates whether the crescent has enough light to be visible.
- III. Moon Phase: Indicates the phase of the moon in the days leading up to and following conjunction (ijtima'), which is when the sun and moon are in a straight line, which generally marks the beginning of a new month in the lunar calendar.

This software can be set according to a specific geographic location, so that the results are more accurate and in accordance with the needs of Muslim communities in various regions.

Examples of Software Used, Stellarium: Stellarium is a planetarium software that allows simulation of the positions of celestial objects, including the moon. With Stellarium, users can enter a specific location and predict the position of the crescent moon based on available astronomical data. MoonCalc: MoonCalc is specially designed for crescent moon prediction, allowing its users to check the visibility of the crescent moon based on the moon's altitude and elongation at various locations. This application is popular among Islamic astronomers because it provides accurate data for determining the beginning of the Hijri month. SkySafari: SkySafari is a mobile application that also functions as a planetarium, providing simulations of the positions of the moon, sun, and other planets. This is very useful for Muslim communities in remote locations to access crescent predictions independently.⁹

With simulation software, Islamic astronomical institutions and religious authorities can predict the visibility of the crescent moon well in advance, even decades in advance. This allows for a more consistent Hijri calendar, which is very helpful in planning annual worship and organizing schedules globally. The software also helps overcome differences in determining the beginning of the month caused by weather conditions or limited direct observation. Astronomical simulation software provides a powerful tool to ensure the accuracy and uniformity of the determination of the Hijri calendar. By utilizing this technology, Muslims can achieve certainty in worship times, reduce differences in dates, and realize greater benefits for the entire global Muslim community.

⁸ Desy Kristiane, "The Use of Telescopes for Rukyat Al-Hilal: Analysis of the Opinions of Muhammad Bakhit Al-Muṭī'i and Ibn Hajar Al-Ḥaitamī," *Bilancia: Journal of Sharia and Legal Studies* 13, no. 2 (December 30, 2019): 331–54, <https://doi.org/10.24239/blc.v13i2.498>.

⁹ Junaidi, "Combining Rukyatulhilal with the Development of Science."

Astronomy simulation software can be useful for determining the Hijri calendar, but its effectiveness depends on the software's features and accuracy. Here's a critique of some astronomy simulation software in relation to determining the Hijri calendar: Key Features Required for Hijri Calendar Determination.

Limitations and Potential Issues

- i. Most software requires manual configuration and calculation to determine the Hijri calendar.
- ii. Accuracy depends on the software's algorithms and data sources.
- iii. Limited support for specific calendar systems like Hijri.

Moon-specific software: Virtual Moon Atlas or WinJupos might be more suitable for Hijri calendar determination due to their focus on lunar features and phases. Keep in mind that while these software options can aid in determining the Hijri calendar, their accuracy and effectiveness depend on user expertise and configuration.

c. Satellite data and remote sensing

Data collected from satellites, such as those used by space agencies such as NASA or other astronomical institutions, allows global lunar observations. With the help of remote sensing, the position of the moon can be measured with high precision, without being disturbed by atmospheric conditions on the Earth's surface. This data can be accessed to adjust the calendar in various regions, overcoming different geographical and time challenges. The use of satellite data and remote sensing in determining the beginning of the Hijri month offers a technology that can accurately and consistently observe the position of the moon in various locations. This technology is very useful for overcoming the obstacles to direct observation due to weather factors, atmospheric conditions, and geographical differences, thus providing a more precise way to determine the visibility of the crescent.¹⁰

- i. **Satellite Data Collection for Moon Position**
Earth observation satellites, such as those operated by NASA, ESA, and other space agencies, provide real-time, high-precision data on the position of the moon. These satellites are equipped with special sensors that can detect the positions of the moon and the sun as well as environmental factors such as the atmosphere and weather conditions on the Earth's surface. With this data, Islamic authorities around the world can estimate the visibility of the crescent moon in each region, both at high latitudes and in equatorial regions, which usually have different challenges in crescent observation.
- ii. **Remote Sensing for Real-Time Crescent Observation**
Remote sensing technology uses optical and infrared sensors mounted on satellites or spacecraft to monitor celestial objects, including the moon. These sensors can detect the crescent moon even in difficult atmospheric conditions, such as pollution or thick clouds, which often hinder traditional observation methods. By utilizing infrared data, this technology is able to detect very thin and

¹⁰ Ardi, "The Validity of the Image Processing Method by CASA in Hilal Observation."

low-luminous crescent moons, providing greater certainty in determining the beginning of the Hijri month compared to manual observation methods.¹¹

iii. Global Data Integration for Hijri Calendar

Consistency Data from satellites can be collected and integrated into a global observation network, which is then accessed by astronomical institutions and religious authorities in various countries. This integration allows for the same standard in determining the beginning of the month, so that the Hijri calendar can be followed uniformly in various parts of the world. With this technology, differences in determining the beginning of the month between countries can be minimized, supporting efforts to unify the global Hijri calendar.

iv. The Advantages of Satellite Data in Determining Crescent Visibility Criteria

Satellite technology allows the measurement of crescent criteria such as height above the horizon and elongation (angular distance between the moon and the sun), which are often used as a benchmark for determining the beginning of the Hijri month. These measurements can be made long before the rukyat time, allowing religious institutions to determine the Hijri calendar more precisely and scientifically. With this more accurate data, predictions of crescent visibility can be made several years in advance, supporting the preparation of an accurate long-term calendar.

Overall, satellite data and remote sensing provide a more modern and scientific way to determine the Hijri calendar, supporting the welfare of the people by providing greater certainty and accuracy in determining the beginning of the month, in line with sharia principles.

d. Artificial intelligence (AI) and machine learning

AI and machine learning technologies can be used to predict the visibility of the crescent moon based on historical and astronomical data. AI can be trained to analyze the pattern of lunar visibility in various geographical and atmospheric conditions, thus providing more accurate predictions. In addition, AI can also help reduce human error in lunar observations and predictions.

Artificial Intelligence (AI) and Machine Learning (ML) technologies are increasingly recognized for their potential in supporting the determination of the beginning of the Hijri month by providing an accurate and sustainable crescent visibility prediction method. AI and ML enable the processing of complex astronomical data and the integration of various variables that affect the appearance of the crescent, resulting in more precise predictions.

i. Crescent Visibility Prediction Based on Historical Data

AI and ML can be trained using historical crescent sighting data, including astronomical factors such as lunar altitude, elongation, moon phase, as well as weather and atmospheric data. By processing this data, the algorithm can learn

¹¹ Muhammad Dimas Firdaus et al., "Effectiveness Test of iOptron Cube-G Telescope for Hilal Observation," *AL - AFAQ : Jurnal Ilmu Falak dan Astronomi* 4, no. 2 (December 11, 2022): 219–36, <https://doi.org/10.20414/afaq.v4i2.5341>.

patterns of crescent visibility and produce more precise predictions for the best times and places to view the crescent. AI can also help identify areas where crescent sighting may be difficult based on local weather conditions or other visual obstacles.

- ii. **Machine Learning Algorithm for Measuring Hilal Criteria**
ML models, such as decision trees and neural networks, can be programmed to calculate whether the crescent moon meets certain visibility criteria, for example, a minimum altitude of 5° and a minimum elongation of 8°. These algorithms can be optimized based on astronomical data and weather forecasts, allowing for high-precision predictions of crescent visibility. With this method, AI can reduce reliance on manual observations and make determining the new moon more efficient and objective.¹²
- iii. **Long Term Predictions for the Preparation of the Hijri Calendar**
AI enables the preparation of a long-term Hijri calendar by simulating the prediction of the crescent for decades to come. By utilizing continuously updated prediction algorithms, AI can help Islamic institutions prepare a more stable and uniform calendar. This is very helpful in ensuring the consistency of Islamic holidays, such as the beginning of Ramadan, Eid al-Fitr, and Eid al-Adha, which are crucial for Muslims around the world.
- iv. **Using Computer Vision for Crescent Observation**
Computer vision, a sub-field of AI, can also be applied to automatically identify the crescent moon. This technology allows telescopes or digital cameras to recognize the crescent moon with high accuracy, even if the crescent moon is very thin or the atmospheric conditions are less than ideal. Computer vision can be used to automatically analyze lunar images and detect the crescent moon, which reduces the potential for human error in direct crescent observation.¹³

The use of AI and machine learning in determining the beginning of the Hijri month has made a significant contribution to creating a more accurate and uniform Hijri calendar that is globally accepted. With continuously updated algorithms, this technology has great potential to reduce human error, increase observation efficiency, and support the achievement of the main goals of sharia for the benefit of Muslims.

e. Global navigation system (GPS) and mobile applications

GPS technology allows for very accurate position and time measurements, which can be combined with astronomical simulation software. These GPS-based mobile applications can provide users with information about when and where the crescent moon is likely to be visible based on their location. Several applications have been specifically designed to help users access real-time crescent moon information and accurate prayer times, such as MyMoon, Moon Observer, and IslamicFinder. Global Navigation Systems (GPS) and mobile applications play a significant role in determining the beginning of the Hijri month, especially with the use of technology to assist in

¹² Kristiane, "USE OF TELESCOPE FOR RUKYAT AI-HILAL."

¹³ "Marwadi, Renewal of Hijri Calendar Thought in Indonesia (Study of Muhammadiyah, Nahdlatul Ulama and Islamic Unity 1330-1443 H/1912-2021), Dissertation UIN Walisongo Semarang, 2022," nd, 122.

observing the crescent moon that marks the beginning of a new month in the Hijri calendar.¹⁴

- i. The Role of GPS in Determining the Beginning of the Hijri Month GPS allows users to determine their location with high accuracy, which is essential for identifying the best place and time for crescent observation. Crescent observation must be done at a specific location with a clear geographical position, such as latitude and longitude, because the position of the moon and sun varies greatly depending on the observer's location. With GPS, astronomers or moon watchers can ensure that they are in the optimal location to see the crescent at the right time.
- ii. Use of Mobile Applications for Hilal Observation Mobile applications with astronomy features provide information about the position of the moon, sun, and crescent moon based on real-time astronomical data. Some popular applications such as *Stellarium*, *SkySafari*, or applications specifically developed for crescent observation, allow users to see predictions of crescent sightings based on their GPS location. These features include:¹⁵ Sky Visualization: Shows the position of the moon and crescent moon in the sky at specific times, making it easier to identify the crescent moon; Moon Time and Phase Information, Provides accurate data on sunset, moonset, and moon phase times, which helps predict the potential sighting of the crescent; and Alerts or Notifications: Some applications can send notifications at important times for crescent sighting, helping observers not to miss critical times.

Analysis of the Use of Technology in Determining the Beginning of the Hijri Month from the Perspective of Maqashid Syariah

The use of technology in determining the beginning of the Hijri month can support the principles of Maqashid Syariah (the objectives of the Shari'ah) through improvements in accuracy, consistency, and the benefit of Muslims globally. The following is an analysis of how technology can support the five main principles of Maqashid Syariah:¹⁶ Technology has enabled more accurate and consistent prayer times, especially during major Islamic holidays such as the beginning of Ramadan, Eid al-Fitr, and Eid al-Adha. Using devices such as digital telescopes and moon simulation software, the accuracy of crescent sightings has increased, allowing Muslims to start and end their prayers at the same time globally. This is important in maintaining the unity of worship and reducing differences that often become a source of uncertainty and debate among Muslim communities.

The use of data-based technology and scientific methods such as AI, machine learning, and astronomical calculations strengthens rationality and science in determining the Hijri calendar. This approach not only increases accuracy but also

¹⁴ Rupi'i Amri, "THOUGHTS OF MOHAMMAD ILYAS ON THE UNIFICATION OF THE INTERNATIONAL ISLAMIC CALENDAR," *Profetika: Journal of Islamic Studies* 17, no. 01 (July 13, 2016): 1–15, <https://doi.org/10.23917/profetika.v17i01.2096>.

¹⁵ Ardi, "The Validity of the Image Processing Method by CASA in Hilal Observation."

¹⁶ Ghofar Shidiq, "THE THEORY OF MAQASHID AL-SHARI'AH IN ISLAMIC LAW," nd

prevents people from relying on methods that may be inaccurate due to weather or location limitations. This technology supports the principle of maintaining reason by providing a more scientific and factual view in carrying out Islamic teachings. Maintaining Reason (Hifz al-Aql) in the use of technology to determine the beginning of the Hijri month means using technology intelligently, wisely, and critically, so that it helps develop the ability to think, understand, and utilize information correctly. Here are some important aspects of Hifz al-Aql in this context:

The punctuality in determining the beginning of the Hijri month supported by technology reduces the potential for social conflict that can arise due to differences in dates in carrying out worship. For example, with a uniform calendar, Muslims in various countries can celebrate Eid at the same time, which strengthens the sense of brotherhood and unity among them. This directly supports the goal of Maqashid Syariah to maintain peace and security of souls in the community.

Preserving the Soul (Hifz an-Nafs) in determining the beginning of the Hijri month refers to ensuring that the process and decisions related to the beginning of the Hijri month are carried out in a way that maintains the welfare, safety, and peace of mind of the Muslim community. Given that determining the beginning of the Hijri month determines the time of important acts of worship such as the fast of Ramadan and Eid, preserving the soul in this context means protecting the spiritual and emotional interests of the community.

- a. **Avoiding Confusion and Conflict Between Communities**
Determining the beginning of the Hijri month is often a source of difference among Muslim communities due to the methods of rukyah (observation of the crescent moon) and hisab (astronomical calculations). Protecting the soul means trying a transparent and clear process so that people avoid confusion or conflict that can disturb peace of mind. This effort includes good communication from religious authorities and agreements that can unite or reduce differences.
- b. **Creating Peace and Certainty in Worship**
Uncertainty in determining the beginning of the Hijri month can trigger anxiety for some people, especially before the fasting month of Ramadan or Eid. Protecting the soul means ensuring that information related to the determination of the beginning of the Hijri month is delivered on time, clearly, and reliably. With certainty, people feel calm and ready to start worship with full confidence that the time is in accordance with religious provisions.
- c. **Ensure Decisions Are Based on Strong Sharia Principles**
Preserving the soul in determining the beginning of the Hijri month also means adhering to the established sharia principles so that the people feel spiritually secure. Decision-making based on evidence and methods accepted by sharia ensures that the process does not raise doubts about

the validity of worship. This strengthens faith and provides peace of mind for Muslims in carrying out their worship.

d. Maintaining Community Unity for Peace and Life Safety

Hifz an-Nafs also means striving for unity in the decision of the beginning of the Hijri month, which has a direct impact on the peace and safety of the soul. Differences in determining the date can create division and tension among the Muslim community. By trying to find a widely accepted decision, preserving the soul means promoting unity and harmony among Muslims, so that all can perform their worship with a sense of peace.

e. Avoiding Emotional Burden on Society

When there is a change or difference in the determination of the beginning of the month, such as the beginning of fasting differing between countries or regions, this can burden the emotions and souls of the people. Protecting the soul in this context means paying attention to how the decisions taken impact the feelings of the people. Unclear or late delivery of decisions can cause anxiety, especially during major worship services such as the fast of Ramadan. Therefore, protecting the soul means considering the emotional impact of the decision and delivering it wisely.

f. Providing Education to Increase Understanding and Acceptance

The lack of understanding of the people regarding the rukyah and hisab methods can sometimes be a source of dissatisfaction that can disturb the peace of mind. Protecting the soul in this case means providing education that helps the community understand the process of determining the beginning of the Hijri month. With a good explanation of how and why decisions are made, the community is expected to be able to accept differences with a calmer and more open attitude, thus reducing internal conflicts that can disturb the well-being of the soul.

Maintaining the soul in determining the beginning of the Hijri month means creating a calm, safe, and peaceful environment for Muslims in carrying out their worship. This can be done by trying to avoid conflict, providing clear and sharia-based decisions, and ensuring effective communication. The ultimate goal is to maintain the welfare of the soul of the people in carrying out worship that is directly connected to the determination of the beginning of the Hijri month.

Technology can help provide more consistent and reliable education to the younger generation about the importance of an accurate Islamic calendar. With a uniform Hijri calendar, Muslims can celebrate major holidays on time, and this helps in maintaining family traditions and religious values. This is very important to ensure that the descendants of Muslims can understand and continue the well-established religious traditions.

Preserving the Offspring (Hifz an-Nasl) in the context of using technology to determine the beginning of the Hijri month means ensuring that the application of technology supports the unity, stability, and sustainability of Islamic values among future generations. Given that the determination of the beginning of the Hijri month is related to important worship such as Ramadan and Eid al-Fitr, preserving the offspring in this case means using technology wisely so that religious values and traditions are maintained and passed on to future generations.

Accuracy in determining important dates in the Hijri calendar also has a positive impact on the economy, because business and economic activities related to the Ramadan, Eid al-Fitr, and Eid al-Adha holidays can be managed more efficiently. Determining the right date reduces the risk of wasting resources due to sudden changes in work schedules or holidays that may occur if the dates of worship are not determined consistently. This supports the sharia principle of preserving property by optimizing the arrangement of work hours and holidays in a more planned manner.

By introducing technology in determining the Hijri calendar, Muslims can achieve the goals of Maqashid Syariah in important aspects, from preserving religion to wealth. Technology helps achieve previously difficult accuracy and consistency, supports the unity of the community, and maintains the wider welfare of society.

Obstacles and Challenges to the Implementation of This Technology in Supporting the Welfare of the People in Accordance with the Main Objectives of Sharia.

The implementation of technology in determining the beginning of the Hijri month brings various benefits in supporting the welfare of the people. However, several significant obstacles and challenges still need to be overcome so that the technology can function optimally and in line with the principles of Maqashid Syariah. The following are the main obstacles and challenges:

I. Differences between Schools of Thought and Sharia Approach

In Islam, the method of determining the new month often varies, depending on the school of thought or fiqh school of thought that is followed. Some schools emphasize the importance of direct rukyat (physical observation of the crescent moon), while others allow hisab (astronomical calculations) as a method of determining the beginning of the month. The main challenge in implementing technology is integrating the results of observation technology with different fiqh views, so that the results can be accepted by all Muslims.

The differences in schools of thought and the sharia approach in determining the beginning of the Hijri month relate to the methods, criteria, and

interpretations used in determining important times in the Islamic calendar. Here are some of the main differences:¹⁷

- a. Observation Method
Shafi'i School: Tends to emphasize direct observation of the new moon. They adhere to the hadith stating that fasting begins after sighting the moon, Hanafi School: Uses astronomical calculations as one method, but still recognizes the importance of physical observation. They are often more open to the use of scientific methods in determining the month, Maliki School: Emphasizes the testimony of those who saw the moon. If two people testify to having seen the moon, then the beginning of the month is established, Hanbali School: Similar to Shafi'i, emphasizes direct observation of the new moon.
- b. Criteria for Determining the Beginning of the Month
Observation Criteria: Some schools emphasize observation at the local location. For example, Shafi'i and Maliki generally require local observation. However, others, such as Hanafi, are more flexible and can accept observations from other areas.
Astronomical Criteria: Some modern approaches, especially in the Hanafi school and some contemporary groups, prefer to accept pre-calculated astronomical and calendar calculations, which can provide better accuracy and avoid conflicts.
- c. Approaches to Global Connectedness
Local Approach: Some schools of thought still focus more on local sightings. For example, if the moon is sighted in a region, then other regions nearby that do not see the moon still follow the ruling.
Global Approach: A contemporary approach adopted by some global Muslim communities suggests that sighting the moon in one place can affect the entire Muslim world, given advances in technology and communications.
- d. Interpretation of Hadith and Sources of Sharia
Hadith on Observation: Different interpretations of hadith may influence decisions. Some schools base their decisions more on hadiths that support physical observation, while others place more emphasis on hadiths that permit the use of calculations.
Sources of Shariah: More conservative schools tend to maintain traditional methods based on classical sources, while more liberal approaches may take inspiration from modern scientific and technological developments.
- e. Social and Cultural Implications
Compliance with Local Authorities: In some schools of thought, decisions about the beginning of the month may be influenced by local authorities who issue announcements. This may cause differences between different communities even though they are geographically close.

¹⁷ Saksono, "GLOBAL ISLAMIC CALENDAR: SHARIAH, ECONOMIC, AND POLITICAL PERSPECTIVES."

Unity of the Ummah: A more contemporary approach seeks to achieve unity among global Muslims, by using technology to harmonise the determination of the beginning of the month, although this may face challenges from more conservative schools of thought.

The differences in schools of thought and approaches to the Shari'ah in determining the beginning of the Hijri months reflect the diversity of Islamic thought. By considering different methodologies, Muslims around the world can celebrate their religious practices with greater confidence and within a framework that is in accordance with the teachings of their religion. Despite the differences, the ultimate goal remains the same: ensuring that religious practices are in accordance with the Shari'ah and uniting the Muslim community.¹⁸

Global consensus in determining the beginning of the Hijri month is becoming increasingly important amidst the challenges and complexities of the modern world. Here are some reasons that indicate the need for global consensus in determining the beginning of the Hijri month:

- a. Islamic Community Unity
 - Reducing Divisions: With a global consensus, Muslims around the world can celebrate religious observances, such as Ramadan and Eid, at the same time. This can reduce confusion and division among different Muslim communities.
 - Strengthening Collective Identity: When all Muslims celebrate religious holidays at the same time, it strengthens the sense of solidarity and collective identity among them.
- b. Technology advances
 - Utilization of Astronomical Methods: With the advancement of technology in astronomy and mathematical calculations, the determination of the beginning of the month can be done more accurately. Global consensus can allow for the widespread use of this technology, strengthening the accuracy of time determination.
 - Access to Information: Modern technology makes it easier to access information and data related to the determination of the moon, allowing people in various parts of the world to participate in the decision.
- c. Justice in Determining the Beginning of the Month
 - Reducing Local Bias: Global consensus can help reduce the bias that may arise from determining the start of the month based on local observations alone, so that all Muslims have an equal opportunity to perform their prayers at the agreed times.
 - Transparency and Accountability: By involving multiple institutions and organizations in the consensus process, there is an opportunity to increase transparency and accountability in setting the start of the month.

¹⁸ "Marwadi, Renewal of Hijri Calendar Thought in Indonesia (Study of Muhammadiyah, Nahdlatul Ulama and Islamic Unity 1330-1443 H/1912-2021), Dissertation UIN Walisongo Semarang, 2022."

- d. Inter-State Coordination
 - International Cooperation: Global consensus can facilitate cooperation between Muslim countries in observing and determining the moon, sharing information and technology to improve the accuracy of time determination.
 - Knowledge Exchange: Countries with more advanced experience in lunar observations can share knowledge and best practices with other countries, creating a mutually beneficial collaborative network.
- e. Facing Contemporary Challenges
 - Environmental Issues and Climate Change: In the context of environmental challenges and climate change, having a global consensus on determining prayer times can be an example of how Muslims can unite to address larger global issues.
 - Social and Cultural Change: Global consensus can help address the challenges arising from social and cultural change, providing a foundation for Muslims to remain relevant in modern society.
- f. Dialogue Between Schools
 - Increasing Understanding: Global consensus requires dialogue between schools of thought, which can increase understanding and tolerance among different groups within Islam. This can reduce tensions that may arise from differences in practice and interpretation.
 - Unifying Approaches: Through dialogue and collaboration, different schools of thought can find common ground in determining the beginning of the month, resulting in a more inclusive and harmonious approach.

Global consensus in determining the beginning of the Hijri month is not only important for uniform worship practices, but also to strengthen unity, improve accuracy, and overcome the challenges faced by Muslims in the modern era. With an inclusive and collaborative approach, Muslims can build better understanding and celebrate their diversity in unity.

II. Technology Implementation and Maintenance Costs

Investments in digital telescope devices, IoT network systems, and training in operating simulation software require high costs, which may not be affordable for all Muslim countries, especially those with limited budgets for astronomical infrastructure. In addition, the cost of maintaining and upgrading these technologies must also be considered, as the technology is constantly evolving and requires updates to remain accurate and reliable.

These obstacles show that the implementation of technology in determining the beginning of the Hijri month is not only a matter of scientific innovation, but must also consider social, economic, and religious aspects. To support the welfare of the people in accordance with Maqashid Syariah, these challenges need to be overcome through collaboration between technology experts, astronomers, and scholars, as well as with adequate financial and educational support for Muslim communities around the world.

CONCLUSION

Various technologies that can be applied in determining the beginning of the Hijri month include digital telescopes and advanced observatories, astronomy simulation software, satellite data and remote sensing. Support for the protection of mind, property, and life the application of astronomical technology helps in preserving reason (hifz al-aql) by utilizing rational and accountable knowledge in determining the beginning of the month. In addition, this technology also reduces the costs and resources required for traditional observations, thus helping to preserve property (hifz al-mal). At the same time, astronomical technology can reduce social conflicts that arise due to differences in the beginning of the month, which means it helps to preserve the soul (hifz al-nafs) and the unity of the community. The Potential of astronomy technology as a modern solution, astronomy technology offers a modern solution to meet the needs of Muslims for consistent, accurate, and efficient determination of prayer times. Its use is in line with sharia values, and has the potential to increase harmony and unity among Muslims. Thus, this study concludes that the application of astronomy technology in determining the beginning of the Hijri month is not only acceptable in the context of maqashid sharia, but also provides real benefits in fulfilling sharia goals in modern society. Evaluating the obstacles and challenges of implementing astronomical technology to determine the beginning of the Hijri month in a global context.

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