The Role of Istiwa' A'dzam as A Practical Verification of the Qibla Direction

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ABSTRACT

The Istiwa' A'dzam phenomenon is an astronomical event when the sun is directly above the Kaaba in Mecca, causing the shadows of perpendicular objects at various locations to point directly towards the qibla. This study aims to model this phenomenon and assess its accuracy in determining the direction of the qibla. Using a mathematical approach and computer modeling, the position of the sun and the direction of the shadow were analyzed during Istiwa' A'dzam. The results show that this phenomenon occurs twice a year in Malaysia: on 28 May at approximately 5:16 pm. and on 16 July at approximately 5:27 pm. In leap years, this phenomenon occurs slightly earlier, around 27 May and 15 July, with approximately the same duration. At this time, the shadows of upright objects can be used as indicators of the direction of the qibla with a very high level of accuracy. Apart from being a practical method for confirming the direction of the qibla, this phenomenon also has educational value in demonstrating the relationship between astronomy, the movement of the sun, and Islamic religious practices.

Keywords: *Qibla; Kaaba; Sun, Istiwa A'dzam*

INTRODUCTION

The direction of the Qibla is a fundamental aspect of Islamic practices, particularly during the act of prayer (salat). Every Muslim is required to face the Kaaba in Mecca while praying, and determining this precise direction, especially when one is far from the holy city, can often be challenging. Historically, the Qibla has been identified using tools like compasses, maps, and modern digital apps. However, these tools are not always accurate due to factors such as magnetic interference or technical issues. An ancient and reliable method to verify the Qibla direction is through the astronomical event known as Istiwa' A'dzam, which occurs when the sun is directly above the Kaaba, typically twice a year. This celestial phenomenon offers a unique opportunity to determine the Qibla direction using a straightforward yet highly effective method by observing the position of the sun. Istiwa' A'dzam serves as a practical verification tool that allows Muslims to establish the correct Qibla direction in real-time without the need for electronic devices. By simply observing the shadow of an object during this event, individuals can ensure that they are facing the Kaaba for their prayers. The role of Istiwa' A'dzam in Qibla determination is not only rooted in astronomy but also offers a deeper connection to Islamic practices, reaffirming the relationship between faith, nature, and the universe. This method leverages the sun's position at the zenith,

creating an alignment between the Kaaba's azimuth and the sun's azimuth. By calculating this alignment, Muslims can accurately determine the Qibla direction anywhere on Earth. This paper explores the scientific and practical aspects of using Istiwa' A'dzam as a verification tool for the Qibla, highlighting its significance in both spiritual and practical contexts.

Problem Statement

Determining the exact direction of the Qibla is very important in prayer. However, most Muslims rely on compasses or phone apps which are often prone to errors such as magnetic interference, sensor errors, or signal instability. The astronomical phenomenon of Istiwa' A'dzam (the sun is directly above the Temple) actually provides a more accurate and independent method of shadow-based geometry than modern tools. However, awareness and mathematical understanding of how to use this phenomenon is still low.

METHODOLOGY

The problem of determining the direction of the Qibla which is sometimes prone to errors can be overcome by utilizing the phenomenon of Istiwa' A'dzam. This phenomenon occurs when the sun is directly above the Temple, and the shadows that are produced around the world at that time can be used as a direct guide to confirm the direction of the Qibla.

From a mathematical and trigonometric point of view, this method involves the basic concept of a perpendicular triangle. Object height, shadow length, and slant lines can be connected through trigonometric functions such as tangents, sine, or cosine. This function helps to clarify the angular position of the sun's altitude as well as the geometric relationship between objects, shadows, and the direction of the sun. Although detailed calculations are not necessarily carried out by all users, the understanding that this phenomenon is based on the principles of trigonometry gives confidence about the accuracy of the method.

Therefore, by combining the astronomical phenomenon of Istiwa' A'dzam with the basic concepts of mathematics, Muslims have a practical, simple, and highly accurate method of Qibla verification, without relying entirely on modern equipment that is prone to errors.

Research Design:

This research used a quantitative study approach and observational field experiments. The main focus is on the use of the phenomenon of Istiwa' A'dzam in determining the direction of the qibla practically with the help of the concept of trigonometry.

Location and Time:

The research was conducted in an open area that is not obstructed by sunlight such as a school field, surau, or mosque, on the official date of the occurrence of Istiwa' A'dzam (usually 27 May and 15 July each year). The reference time is exactly according to the time announced by the falak.

Tools and Materials:

- Gnomons (upright objects, such as sticks or tripods)
- Tape ruler (measures shadow length)
- Compass or digital map app
- High-precision watches
- Scientific calculator or smartphone
- Trigonometric calculator application (if necessary)

Procedures:

1. Erect a vartical object (such as a stick or pole) on a flat surface.
2. At the time of Istiwa A'dzam (twice a year, the time announced by the falak institution), mark the end of the shadow.
3. Draw a line from the base of the object to the end of the shadow.

- The direction line of the sun is the direction of the actual qibla.
- The shadow line is the opposite direction (Qibla + 180°)

4. Use simple Mathematics:
    - If the height of the object = h and the length of the shadow = s, then the height of the sun is $\tan(\theta)=h/s$
    - The direction of the Qibla can be determined by subtracting 180° from the angle of the shadow.

Steps to find the direction of the Qibla using mathematics

First step: Find altitude of the Sun in θ

- The wood upright at a height of h=1.00 m.
- The length of the shadow was s=0.50 m.

Solution:

$$\tan^{-1}\left(\frac{1.00}{0.50}\right)$$

$$63°26'5.82"$$

Second step: Determining the Direction of the Qibla from the Direction of the Shadow (Azimuth)

- The shadow line (from the base to the end of the shadow) Bshadow=305∘.

Solutions:

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305° - 180°
                                                    125°0'0.00"
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The azimuth of the Qibla is AQ=125◦ (from the true North).

Third step: Compare with the App (Error Effect)

- The Qibla app is 120◦
- The Istiwa A'dzam is 125◦

Solution:

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125° - 120°
⋮                                                   5°0'0.00"
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Absolute difference: = 5◦

RESULTS AND DISCUSSION

Table 1. Comparison of results and benefits between Istiwa adzam method and Monile Application Method (Apps)

Aspect	Istiwa A'dzam Method	Mobile Application Method (Apps)
Accuracy of Qibla direction	Very accurate (based on the actual position of the sun above the Kaaba)	Can be accurate, but exposed to sensor errors, magnetic fields, and environmental interference
Dependence on tools	Does not require modern devices; only needs sunlight and a vertical object	Requires a smartphone, GPS, magnetometer, and in some cases an internet connection
Usage time	Limited to two dates in a year (28 May & 16 July) at specific times	Can be used anytime as long as the device functions
Weather factor	Depends on weather conditions (clear sky and visible sun)	Not affected by weather; can be used indoors

Learning aspect	Directly applies science and mathematics (trigonometry, angles, shadows)	Fewer learning elements, more technology-automatic in nature
Long-term reliability	Very reliable because it is based on natural phenomena that do not change	Accuracy may vary depending on device type and sensor calibration
Awareness & exposure	Less known by the general public; requires more exposure	More popular and easy to use since most people own a phone
Suitability for education	Very suitable as a STEM activity in schools/madrasahs	Suitable for tech demonstrations, but less interactive in teaching basic science

The determination of the Qibla direction is essential in Islamic practice, and both traditional and modern methods have their own strengths and limitations. The Istiwa' A'dzam method is highly accurate because it relies on the astronomical phenomenon when the sun is directly overhead at the Kaaba. By using only a vertical object and observing the shadow, one can determine the exact Qibla direction. This method requires no modern tools, making it simple and cost-free. Furthermore, it integrates scientific and mathematical concepts such as geometry, trigonometry, and angular measurement, which makes it highly suitable for educational purposes. However, its limitation lies in the fact that it can only be applied on two specific dates each year, and only under clear weather conditions when the sun is visible.

On the other hand, mobile applications offer convenience and accessibility since they can be used anytime and anywhere. With the integration of GPS and magnetometer technology, apps can provide immediate results for Qibla direction, even indoors or under cloudy skies. This makes them more practical for daily use. However, they are subject to sensor errors, magnetic interference, and calibration issues, which may compromise their accuracy. Additionally, while apps are popular and widely used, they offer less opportunity for learners to engage with the scientific and mathematical foundations of Qibla determination, as the process is automated.

In terms of reliability, the Istiwa' A'dzam method stands out because it is based on an unchanging natural phenomenon. Apps, however, depend on the quality of devices and software updates. From an educational perspective, Istiwa' A'dzam provides a more hands-on, interactive experience that can be applied in STEM learning, while apps are better suited for general public use due to their popularity and ease of access.

CONCLUSION

The phenomenon of Istiwa' A'dzam serves as an invaluable natural method for confirming the Qibla direction. Unlike technological tools that may be influenced by external factors such as sensor calibration, magnetic fields, or environmental interference, Istiwa' A'dzam is rooted in the consistent and unchanging movement of celestial bodies. This makes it not only highly accurate but also universally reliable for all Muslims across the globe. By simply observing the sun and the shadow of a vertical object during this phenomenon, believers are able to determine the exact direction of the Kaaba without any reliance on modern devices or external resources.

From an educational perspective, the method also carries significant value as it introduces practical applications of mathematics and trigonometry in real life. Concepts such as angles, ratios, tangent, sine, and cosine are not merely abstract theories but can be directly observed and applied in the process of determining the Qibla. This hands-on integration of science and religion makes Istiwa' A'dzam especially suitable as a teaching tool in schools, madrasahs, and other educational settings, promoting a deeper appreciation for the harmony between scientific knowledge and Islamic practice.

However, it is also important to acknowledge the limitations of this method. Its usability is restricted to only two specific dates each year, and clear weather is a necessary condition for accurate observation. For this reason, modern tools such as mobile applications remain relevant, as they provide flexibility and accessibility in daily situations. Yet, these technological methods should not be relied upon blindly; instead, they can be strengthened and verified through natural checks such as Istiwa' A'dzam.

Ultimately, the most balanced approach lies in combining both methods. Istiwa' A'dzam provides certainty, accuracy, and educational benefits, while mobile applications offer convenience and accessibility. Together, they ensure that Muslims are able to face the Qibla with both confidence and scientific understanding. This dual approach also reflects the broader message that Islam encourages making use of natural phenomena created by Allah alongside beneficial human innovations, while always striving for accuracy and truth in acts of worship.

ACKNOWLEDGMENT

The authors would like to express their appreciation for the support of sponsor; Kolej PERMATA Insan and Research & Innovation Management Centre (RIMC), Universiti Sains Islam Malaysia (USIM) for the financial funding through the Geran Penyelidikan Pusat Tanggungjawab (PTJ) Vote No. PPPI/PTJ/KPI/USIM/19324.

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