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Probability Analysis Of Determining The Qibla Direction Using Global Star Qibla Rashdul At The Great Mosque Of Syekh Yusuf, Gowa Regency

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Abstract

This study discusses the determination of the Qibla direction using the global Rashdul Qibla method based on stars at the Syekh Yusuf Grand Mosque, Gowa Regency. The research problem is how to implement this method to ensure the mosque's qibla direction is accurate. This field research uses a descriptive qualitative approach, with primary data obtained from observations and secondary data in the form of books, journals, and supporting references. The results show that three stars, Gemini/36 Gemini, Wasat, and 63 Gemini can be used as references. The method involves determining the transit time of the star over the Kaaba, which is then converted to local time using *low accuracy* calculations. A comparison of the results with the qibla direction azimuth and the dioptra application shows consistency. Implementation at the Syekh Yusuf Grand Mosque reveals that the mosque's building is not precisely aligned with the qibla. This study recommends the method as an alternative for determining the qibla at night, although it faces challenges in identifying the positions of stars.

Keywords:
Probabilistic, Qibla Direction, Rashdul Qibla, Stars, Mosque of Syekh Yusuf

Abstrak

Studi ini membahas penentuan arah Qibla menggunakan metode global Rashdul Qibla berbasis bintang di Masjid Agung Syekh Yusuf, Kabupaten Gowa. Masalah penelitian adalah bagaimana menerapkan metode ini untuk memastikan arah kiblat masjid akurat. Penelitian lapangan ini menggunakan pendekatan kualitatif deskriptif, dengan data primer yang diperoleh dari observasi dan data sekunder berupa buku, jurnal, dan referensi pendukung. Hasil penelitian menunjukkan

bahwa tiga bintang, Gemini/36 Gemini, Wasat, dan 63 Gemini dapat digunakan sebagai referensi. Metode ini melibatkan penentuan waktu transit bintang di atas Ka'bah, yang kemudian dikonversi ke waktu setempat menggunakan perhitungan dengan akurasi rendah. Perbandingan hasil dengan azimuth arah kiblat dan aplikasi dioptra menunjukkan konsistensi. Implementasi di Masjid Agung Syekh Yusuf mengungkapkan bahwa bangunan masjid tersebut tidak sejajar dengan arah kiblat. Studi ini merekomendasikan metode ini sebagai alternatif untuk menentukan arah kiblat pada malam hari, meskipun menghadapi tantangan dalam mengidentifikasi posisi bintang.

Kata kunci:
Probabilitas, Arah Kiblat, Rashdul Kiblat, Bintang, Masjid Agung Syekh Yusuf

A. Introduction

The issue of the Qibla direction in Indonesia, particularly in relation to societal paradigms, is still marked by a significant lack of understanding regarding proper methods and measurements. On the other hand, the accuracy of facing the Qibla remains an important concern, considering that Saudi Arabia, the location of the Kaaba, is to the west of Indonesia.[1] These geographical facts lead some people to view the determination of the qibla merely as an estimate or to consider that simply facing west is sufficient.[2] In recent developments, the issue of qibla accuracy has resurfaced in public discourse, particularly in relation to the Rashdul qibla phenomenon on May 27-28. The Ministry of Religious Affairs has urged Muslims to re-verify the direction of the qibla in connection with this event.[3] Currently, Rashdul kiblat is considered the most accurate scientific and natural method for determining the direction of the qibla, as it does not require complex calculations or the use of sophisticated instruments.[4]

In this context, determining the direction of the qibla becomes very important, especially for historic mosques like the Great Mosque of Sheik Yusuf

[1]Muhammad Luthfi and Ahmad Izzuddin, "TIPOLOGI MENGHADAP AHMAD RIFA ' I" 2 (2021): 1–19.

[2]Nanti sore matahari di atas Kabah, waktu tepat tentukan kiblat - ANTARA News, (Accessed on September 12, 2025).

[3]Matahari Tepat di Atas Ka'bah, Kemenag Imbau Masyarakat Cek Ulang Arah Kiblat pada 27-28 Mei 2024, (Accessed on September 17, 2025)

[4]Syaifullah Nur Alwi Bashori, Angga Lianata Zulkarnain, "Matahari Meluruskan Arah Kiblat," *Al-Qawaid: Journal of Islamic Family Law* 2, no. 1 (2023): 45–59, https://ejournal.stainh.ac.id/index.php/qowaid/article/view/103/46.

in Gowa Regency, South Sulawesi. The existence of this mosque not only serves as a symbol of Islamization but also represents an integral part of the architectural cultural heritage that must be preserved,[5] including the accuracy of its qibla orientation. Considering the importance of the Qibla direction's accuracy as part of the validity of worship, re-evaluating the Qibla direction using various methods has become a necessity. These methods include the use of various measuring instruments such as the Qibla degree arc, compass, Qibla Tracker, theodolite, the *istiwa'aini*[6] method, as well as astronomical calculation methods using scientific[7] calculators, the azimuth of celestial bodies other than the sun such as the moon, planets, and constellations,[8] and the Rashdul Qibla[9] phenomenon, which occurs when the sun is directly above the Kaaba. These approaches are highly relevant to ensure that old mosques like Sheik Yusuf Mosque remain aligned with the correct Qibla direction based on astronomical precision.

In practice, the commonly used method to determine the direction of the qibla largely depends on the position of the sun during the day, especially when the sun is above the horizon.[10] As a result, there are significant limitations in determining the qibla direction at nite, considering that methods based on observing celestial bodies at nite are still relatively underdeveloped and not widely applied in society. These limitations highlight the need for the

[5]Jusmiati, Syamzan Syukur, Umar Sulaiman, "MENYELAMI IDENTITAS LOKAL DAN TANGGUNG JAWAB SPIRITUAL" 12, no. 1 (2024): 49–62.

[6]M. Arbisora Angkat, "Implementasi Theodolite Dalam Penentuan Arah Kiblat Kampus Stain Sultan Abdurrahman Kepulauan Riau," *Bilancia: Jurnal Studi Ilmu Syariah Dan Hukum* 16, no. 1 (2022): 117–33, https://doi.org/10.24239/blc.v16i1.929.

[7]Hikmatul Adhiyah Syam, "Harmonisasi Instrumen Arah Kiblat," *Hisabuna: Jurnal Ilmu Falak* 1 (2023): 130.

[8]Fikri Darul Falah, "Qibla Laser Sebagai Alat Penentu Arah Kiblat Malam Hari Dengan Menggunakan Posisi Harian Rasi Bintang" 6, no. 2 (2025): 662–75..

[9]Sakirman Sakirman, "Formulasi Baru Arah Kiblat: Memahami Konsep Rasydul Kiblat Harian Indonesia" 1, no. 1 (2018): 1–8, https://ejournal.iainkerinci.ac.id/index.php/alqisthu/article/view/781/382.

[10]Septia Novarisa, Susi Kusmawaningsih, Ariyanto "PENENTUAN ARAH KIBLAT DENGAN METODE BAYANG TONGKAT STUDI KASUS UIN AL-AZHAAR LUBULINGGAU" 1, no. 1 (2024): 48–55.

development of alternative methods for determining the qibla, such as the use of the star qibla compass, which can be a solution when daytime observations are not possible due to weather conditions, time constraints, or technical difficulties.[11]

This context, the utilization of stars with specific positions and azimuths that can be calculated astronomically offers a rational and scientific solution, as the positions of stars in the nite sky remain relatively constant over time.[12] This is due to the very slow proper motion of stars, resulting in a very small apparent angular displacement on the celestial sphere. Thus, the declination and right ascension coordinates of these stars remain relatively unchanged for hundreds of years.[13] Stars that have the same declination as the declination of the Ka'bah have special characteristics, as they will pass directly over the Ka'bah at the time of transit (culmination). The utilization of those stars allows the measurement of the Qibla direction to be conducted at nite without relying on the sun, while still maintaining a high level of accuracy, considering the stars' positions are almost constant within a certain observation period.[14]

B. Methods

This study specifically examines the method of determining the Qibla direction using the global star Qibla rashdul as an alternative. This method requires the observation of celestial objects, particularly stars, to determine the Qibla direction at nite. The primary data in this article were obtained thru observational measurements of the qibla direction, while the secondary data consist of Fathurrahman's thesis as well as several journals, articles, and books

[11]Samsul Hakim, "Studi Analisis Terhadap Bintang Rigel Sebagai Acuan Penentu Arah Kiblat Di Malam Hari," *AL - AFAQ : Jurnal Ilmu Falak Dan Astronomi* 2, no. 1 (2020): 31–52, https://doi.org/10.20414/afaq.v2i1.2298.

[12]Claus V. Fabricius, "Hipparcos And Tycho Catalogs", *Scholarpedia*, 5, 12 (2010): 10583 http://dx.doi.org/10.4249/scholarpedia.10583.

[13]Joseph A. Angelo JR, *Encyclopedia of Space and Astronomy* (New York: Fact on File, 2006).

[14]Nurfahizya Alimuddin, "MENGGUNAKAN RASI BINTANG DENGAN AZIMUTH MATAHARI" 2, no. November (2021): 148–62.

that have been published on the topic of the qibla direction. These secondary sources were selected based on their relevance to the main topic of this article.

Global star rashdul qibla method can be applied by calculating the transit time of stars directly above the Ka'bah, then converting it to the observer's local time using a low-accuracy calculation method.[15] The observational data obtained from determining the Qibla direction using this method will be categorized by grouping field observation data, Qibla azimuth calculation data, and documentation results. After categorization, the data will be presented in the form of descriptive narratives to facilitate understanding. Subsequently, the classified data will be analyzed by comparing field measurement results with Qibla azimuth calculation data, as well as the documentation produced using the Dioptra application. The purpose of this research is to evaluate the feasibility and accuracy of the Rashdul Global Star Qibla method as an alternative for determining the Qibla direction at nite.

C. Results and Discussions

1. *Rashdul Qibla*

The Rashdul method for determining the Qibla can be used in two ways to find the direction of the Qibla.[16] First, it refers to the position of the sun when it is at the zenith of the Ka'bah. At that moment, any upright object exposed to sunlight will cast a shadow that points directly toward the Qibla. This event is known as the global Qibla alignment, which occurs twice a year, around May 27-28 at 4:18 PM WIB and July 15-16 at 4:27 PM WIB. Secondly, the direction of the Qibla can also be determined when the Sun is at the same azimuth as the Ka'bah or directly opposite it, a phenomenon known as the local Qibla alignment.[17]

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[15] Fathurrahman, Fika Afhamul Fuscha, "Global Qibla Direction Using Stellar Transit at Kaaba Latitude," *Al-Hilal: Journal of Islamic Astronomy* 7, no. 2 (2025): 253–70, https://doi.org/10.21580/al-hilal.2025.7.2.29012.

[16]Reza Akbar, "PROBLEMATIKA KONSEP BENTUK BUMI DAN UPAYA MENCARI", *Shar-E: Jurnal Kajian Ekonomi Hukum Syariah* 6, no. 1 (2020): 43–52.

[17]Ila Nurmila, "Metode Azimuth Kiblat Dan *Rashdul kiblat* Dalam Penentuan Arah Kiblat," *Istinbath | Jurnal Penelitian Hukum Islam* 15, no. 2 (2017): 200, https://doi.org/10.36667/istinbath.v15i2.26.

According to this principle, the Rashdul Qibla approach can also be applied at nite by utilizing the transit of stars as a substitute for the Sun.[18] Certain stars with declinations close to the latitude of the Ka'bah can serve as global qibla indicators when crossing the upper meridian (upper culmination). At that moment, the observer's line is aligned with the direction of the Qibla toward the star. This method is supported by the fact that the position of stars in the sky is relatively stable because the proper motion of stars is very slow and does not show significant positional changes over a human lifetime.[19] Thus, utilizing the transit of stars as an alternative to the global qibla rashdul at nite is an advancement of traditional methods, allowing for more flexible measurements of the qibla direction in terms of time and location.

In the modern era, stars are still utilized by many people for various practical purposes such as navigation, agriculture, religion, mythology, and scientific research. The distribution of stars in the sky is not merely a natural decoration, but also serves as a guide for various human activities, including the performance of worship.[20] As for the stars that can be used to determine the global[21] Qibla direction, they must meet the following classification:

a. The star's declination (δ) is equivalent to the latitude coordinate of the Ka'bah (21° 25’ 21.17”), with a correction of ± 1°, written mathematically as 21°25’21.17”–1°<δ<21°25’21.17”.[22]
b. The apparent magnitude (Mv) of the star is at the minimum threshold that can be seen by the naked eye (Mv < +6). The smaller the magnitude of a

[18]Fathur Rahman Basir and Nur Aisyah, “Geneologi Tradisi Ilmiah Navigasi Bugis: Studi Historis Perkembangan Navigasi Bugis Dalam Astronomi Islam,” *HISABUNA: Jurnal Ilmu Falak* 1, no. 1 (2020): 90–101, https://doi.org/10.24252/hisabuna.v1i1.13115.

[19]N Zacharias et al., “THE FOURTH US NAVAL OBSERVATORY CCD ASTROGRAPH CATALOG (UCAC4)” 44 (2013), https://doi.org/10.1088/0004-6256/145/2/44.

[20]Ahmad Zulhaj, Andi Muhammad Akmal, dan Syukur Abu Bakar, “Rasi Bintang Dalam Penentuan Arah Mata Angin Perspektif Ilmu Falak”, *Hisabuna: Jurnal Ilmu Falak*, Vol. 4, No. 2 (2023), 3 https://doi.org/10.24252/hisabuna.v4i2.37112

[21]Fathurrahman, “Formulasi Algoritma *Rashdul kiblat* Global Menggunakan Bintang-Bintang Berdeklinasi Sama Dengan Lintang Ka’bah” (2023).

[22]Fathurrahman

star, the brighter the star is. Normally, with the naked eye, the limit of human capability can only identify up to magnitude 6.[23]

Table 1. List of stars thet meet the criteria of "Global Qibla Stars"[24]

No	Star	Catalog	Koordinate (J 1991,25)		Mv
			δ ° ′ ″	α h m s	
1	55 Pisces	HIP 3138	21 26 18,8	00 39 55,55	5,36
2	ψ1 Pisces A	HIP 5131	21 28 23,6	01 05 40,93	5,33
3	χ Pisces	HIP 5571	21 02 04,8	01 11 27,19	4,66
4	Sheratan	HIP 8903	20 48 29,9	01 54 36,35	2,64
5	η Aries	HIP 10306	21 12 39,5	02 12 47,98	5,23
6	υ Aries	HIP 12332	21 57 41,2	02 38 49,00	5,45
7	Al-Butain III	HIP 13914	21 20 25,6	02 59 12,73	4,63
8	Al-Butain IV	HIP 15110	21 02 40,7	03 14 54,11	4,87
9	T Aries	HIP 15627	21 08 49,7	03 21 13,61	5,27
10	51 Taurus	HIP 20087	21 34 45,8	04 18 23,14	5,64
11	53 Taurus	HIP 20171	21 08 32,7	04 19 26,08	5,5
12	ι Taurus	HIP 23497	21 35 24,2	05 03 05,70	4,62

[23]C. St. J. H. Daniel and Patrick Moore, *The Atlas of the Universe*, *The Geographical Journal*, vol. 137 (London: Philip's, 2005), https://doi.org/10.2307/1796793.

[24]Fathurrahman.

13	105 Taurus	HIP 23883	21 42 17,4	05 07 55,43	5,84
14	o Taurus	HIP 25539	21 56 13,1	05 27 38,08	4,88
15	ζ Taurus	HIP 26451	21 08 33,3	05 37 38,68	2,97
16	d Gemini	HIP 32921	21 45 40,4	06 51 33,05	5,28
17	Wasat	HIP 35550	21 58 56,4	07 20 07,39	3,50
18	63 Gemini	HIP 36238	21 26 44,0	07 27 44,39	5,2
19	μ Cancer	HIP 41909	20 26 28,6	08 32 42,52	5,33
20	Asellus Borealis	HIP 42806	21 28 06,9	08 43 17,21	4,66
21	92 Leo	HIP 56975	21 21 10,2	11 40 47,11	5,62
22	35 Coma Berenices	HIP 62886	21 14 42,1	12 53 17,77	4,89
23	e Bootes	HIP 67480	21 15 50,6	13 49 42,82	4,92
24	10 Bootes	HIP 68276	21 41 46,8	13 58 38,93	5,76
25	Kornephoros	HIP 80816	21 29 22,7	16 30 13,26	2,78
26	95 Hercules	HIP 88267	21 35 44,5	18 01 30,40	4,26
27	109 Hercules	HIP 90139	21 46 13,2	18 23 41,77	3,85
28	112 Hercules	HIP 92614	21 25 30,6	18 52 16,43	5,43
29	1 Vulpecula	HIP 94703	21 23 25,6	19 16 13,04	4,76
30	29 Vulpecula	HIP 101867	21 12 04,2	20 38 31,29	4,81
31	25 Pegasus	HIP 109240	21 42 11,1	22 07 50,33	5,79
32	Helvetios	HIP 113357	20 46 07,3	22 57 27,85	5,45

After the stars have been classified, the next step is to apply the data into the formulation of the Qibla direction calculation based on star observation. This research uses a calculation method with a low level of accuracy because it is practical and easy to apply, using annual ephemeris data published by the

Ministry of Religious Affairs of the Republic of Indonesia (Kemenag). The calculation method is as follows:

a. Finding the average value of the solar right ascension (αʘ) on the measurement day from the ephemeris data, then dividing by 15 to obtain the hour, minute, and second format. The right ascension data is at 9 o'clock in the ephemeris, because the time format in the ephemeris refers to Greenwich Mean Time (GMT 0), while the Kaaba uses the GMT +3 time zone, so 12 noon in Mecca is equivalent to 9 o'clock in GMT time format.
b. Calculating the solar transit time at the coordinates of the Ka'bah (mʘ), using the formula:

$$m\odot = 12^{j}0^{m}0^{d} - e + (45° - 39°49', 56") \div 15$$

c. Finding the right ascension value of the Ka'bah star in hours, minutes, and seconds format. Below is the data for the right ascension of the Ka'bah star for the year 2024.

Table 2. Asensio Rekta Year 2024

No.	Star	Catalog	α 2024.5
1	55 Pisces	HIP 3138	00 : 39 :56,05
2	ψ1 Pisces A	HIP 5131	01 : 05 :42,41
3	χ Pisces	HIP 5571	01 : 11 :28,58
4	Sheratan	HIP 8903	01 : 54 :41,56
5	η Aries	HIP 10306	02 : 12 :53,04
6	υ Aries	HIP 12332	02 : 38 :49,24
7	Al-Butain III	HIP 13914	02 : 59 :13,16
8	Al-Butain IV	HIP 15110	03 : 14 :55,01
9	τ Aries	HIP 15627	03 : 21 :14,33

10	51 Taurus	HIP 20087	04 : 18 :26,35
11	53 Taurus	HIP 20171	04 : 19 :27,06
12	ι Taurus	HIP 23497	05 : 03 :08,00
13	105 Taurus	HIP 23883	05 : 07 :55,49
14	o Taurus	HIP 25539	05 : 27 :38,14
15	ζ Taurus	HIP 26451	05 : 37 :38,36
16	d Gemini	HIP 32921	06 : 51 :33,05
17	Wasat	HIP 35550	07 : 20 :07,39
18	63 Gemini	HIP 36238	07 : 27 :44,39
19	μ Cancer	HIP 41909	08 : 32 :42,52
20	Asellus Borealis	HIP 42806	08 : 43 :17,21
21	92 Leo	HIP 56975	11 : 40 :47,11
22	35 Coma Berenices	HIP 62886	12 : 53 :17,77
23	e Bootes	HIP 67480	13 : 49 :42,82
24	10 Bootes	HIP 68276	13 : 58 :38,93
26	95 Hercules	HIP 88267	18 : 01 :30,40
27	109 Hercules	HIP 90139	18 : 23 :41,77
28	112 Hercules	HIP 92614	18 : 52 :16,43
29	1 Vulpecula	HIP 94703	19 : 16 :13,04
30	29 Vulpecula	HIP 101867	20 : 38 31,29
31	25 Pegasus	HIP 109240	22 : 07 : 50,33
32	Helvetios	HIP 113357	22: 57 : 27,85

d. Calculating the difference in right ascension of the sun (αʘ) on the measurement day with the right ascension of the star (α☆). The difference

in right ascension of the sun with the global qibla star indicates the time difference in transit between the two stars:

$$S = \alpha\square - \alpha\odot$$

e. If the right ascension of the sun is smaller than the right ascension of the global qibla star, then the value of S is positive, meaning the sun will transit first. Conversely, if the right ascension of the global qibla star is smaller than the right ascension of the sun, then the value of S is negative, meaning the global qibla star will transit first. The time interval between the two transits is the difference between the two right ascensions, so it can be expressed in the equation:

$$m\square = m\odot + S$$

The unit of the transit time of the global qibla star rashdul ($m\square$) is a time unit in the form of hours, minutes, and seconds.

f. Conversion of the global rashdul kiblat star transit time ($m\star$) to local time according to the time zone difference between the Ka'bah (GMT +3) and the local time zone (SZW).

2. Syekh Yusuf Grand Mosque, Gowa Regency

The Great Mosque of Sheik Yusuf is located in Sungguminasa Village, Somba Opu District, Gowa Regency. This mosque is named after the great scholar and national hero, Syekh Yusuf Tuanta Salamaka, a native of Gowa who played a significant role in the spread of Islam in the archipelago and beyond. His preaching activities spread from his birthplace to Banten, Malaysia, Ceylon (Sri Lanka), and eventually to Cape Town, South Africa.[25] This mosque has stood for centuries and is considered one of the oldest mosques in the region. Before undergoing renovation, the architecture of the building reflected the characteristics of traditional Indonesian mosques, namely a two-story building with a tiered roof shaped like a limasan, and symmetrical side roofs resembling

[25]Andi Rifqah, Andi Nur Zamzamniah, dan Zulkarnain AS, "Filosofi Penerapan Arsitektur Islam Pada Masjid Agung Syekh Yusuf Gowa," *TIMPALAJA : Architecture Student Journals* 1, no. 1 (2020): 70–81, https://doi.org/10.24252/timpalaja.v1i1a8.

small pyramids. The upper floor is used as the main prayer room, while the lower floor is used for ablution and other supporting facilities.

In 2017, the Great Mosque of Syekh Yusuf underwent a major architectural renovation that was essentially a complete rebuild, as most of the old structure was replaced.[26] The groundbreaking ceremony was conducted by the Regent of Gowa, Adnan Purichta Ichsan, after the Friday prayer. The architectural design was created by Mochammad Ramdhan Pomanto, better known as Danny Pomanto, the Mayor of Makassar. The architectural concept of this mosque is based on the anthropomorphic structure of the human body, where the roof represents the head, the main building symbolizes the body, and the stairs or base function as the legs, each depicting the harmony of function. Architecturally, the design of this mosque is distinctive because it does not use a dome as is customary in grand mosques in Indonesia. On the contrary, its roof resembles a monumental tower adorned with intricate Arabic calligraphy motifs, thus blending artistic and spiritual dimensions into a cohesive design.

The coordinates of the Great Mosque of Sheik Yusuf are 5°12'8.31" S and 119°27'2.53" E. Initial examination using the Google Earth application shows that the current qibla direction of the mosque forms an azimuth angle of about 285° (toward the west). However, the accurate qibla azimuth for the South Sulawesi region is about 292° toward the northwest, resulting in a measurable deviation. As the largest mosque in Gowa Regency, this difference presents a significant opportunity for recalibration and testing the accuracy of the mosque's qibla direction. This research uses the global Rashdul Kiblat method based on stars, utilizing stars with declinations close to the latitude of the Ka'bah as a reference to determine the alignment of the actual qibla direction of the mosque.

[26] https://www.celebes.co/masjid-agung-syekh-yusuf. (Accessed on September 17, 2025).

2. Implementation of The Global Stellar Rashdul Qibla Method

Here is a description of the method used to determine the direction of the qibla with the global qibla star rashdul:

a. Preparing calculation data according to the location to be calculated.
b. Calculating when the transit time of the global qibla star rashdul occurs above the Ka'bah using the low accuracy calculation method.
c. Calculating when the transit time of the global qibla star rashdul occurs above the Ka'bah using the low accuracy calculation method.
d. Conversion of the transit time of the Rashdul star to the local time zone of the measurement location.
e. Finding the location of the global qibla star in the nite sky using the Stellarium and Starwalk applications.
f. Waiting for the transit time of the Rashdul star toward the global qibla according to the converted time.
g. When the time has indicated the transit time, then face the body toward the direction of the star. Thus, indirectly, the observer is facing the Qibla (Kaaba).
h. The transit time is effectively used for 4 minutes so that the angle value does not shift.

In the case of the Sheik Yusuf Grand Mosque, nine stars have been determined to be visible on June 4, 2024 / 1445 AH, which is suitable for the implementation of Rashdul Qibla. The stars include d/36 Gemonirum, Wasat, 63 Gemini, μ Cancer, Asellus Borealis, 92 Leo, 35 Coma Berenices, ε Bootes, and 10 Bootes. However, due to observational limitations and the proximity to prayer time, specifically the Isha prayer, only three stars were selected for detailed analysis and practical determination: d Gemini, Wasat, and 63 Gemini.

Here is the calculation of the star transit over the Ka'bah using the low accuracy method:

a. Calculation of the qibla direction time for the star d Gemini/ 36 Gemini (HIP 32871) at the Masjid Agung Syekh Yusuf, Gowa Regency, on June 4, 2024.

αΘ = 72°53’45’ : 15
= 4^j 51^m 35^d

mΘ = 12 – e + (45° - 39°49’34,56”) : 15
= 12 – 1’35” + (45° - 39°49’34,56”) : 15
= 12:19:6,7

α = 6^j 51^m $33,25^d$

S = α - αΘ
= 6^j 51^m $33,25^d$ - 4^j 51^m 35^d
= 1^j 59^m $8,25^d$

m = mΘ + S
= 12:19:6,7 + 1^j 59^m $8,25^d$
= 14:19:4,95

TZD = *m* + (Selisih zona waktu Mekkah – Gowa)
= 14:19:4,95 + 5
= 19:19:4,95

Based on the calculations above, the star d Gemini will transit over the Ka’bah at 14:19:4.95 Mecca time. It is then converted to the observer's time zone to 19:19:4.95 WITA.

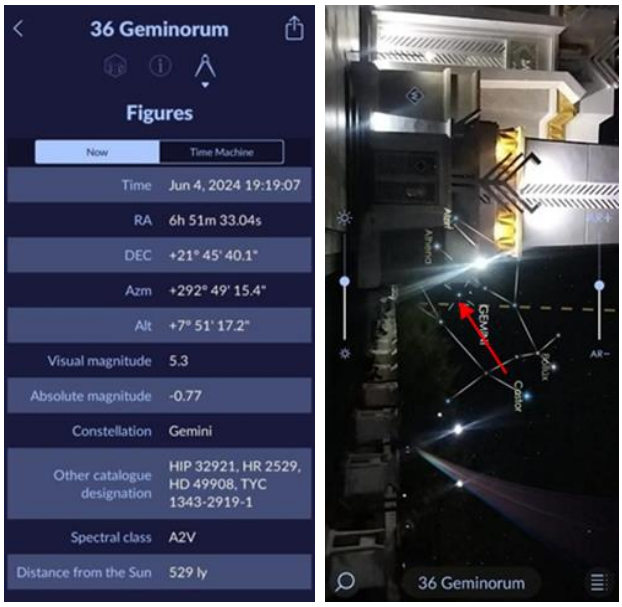


Figure 1. Data and position of the star d/36 Geminorum

b. Calculation of the qibla direction time for the star Wasat (HIP 35550) at the Masjid Agung Syekh Yusuf in Gowa Regency on June 4, 2024.

αΘ = 72°53’45’ : 15
= 4^j 51^m 35^d

mΘ = 12 – e + (45° - 39°49’34,56”) : 15
= 12 – 1’35” + (45° - 39°49’34,56”) : 15
= 12:19:6,7

α = 7^j 20^m 8,01^d

S = α – αΘ
= 7^j 20^m 8,01^d - 4^j 51^m 35^d
= 2^j 28^m 33,01^d

m = mΘ + *S*
= 12:19:6,7 + 2^j 28^m 33,01^d
= 14:48:39,71

TZD = *m* + (selisih zona waktu Mekkah– Gowa)
= 14:47:39,71 + 5
= 19:48:39,71

Based on the calculations above, the star d Gemini will transit over the Ka'bah at 14:48:39.71 Mecca time. It will then be converted to the observer's time zone, becoming 19:48:39.71 WITA.

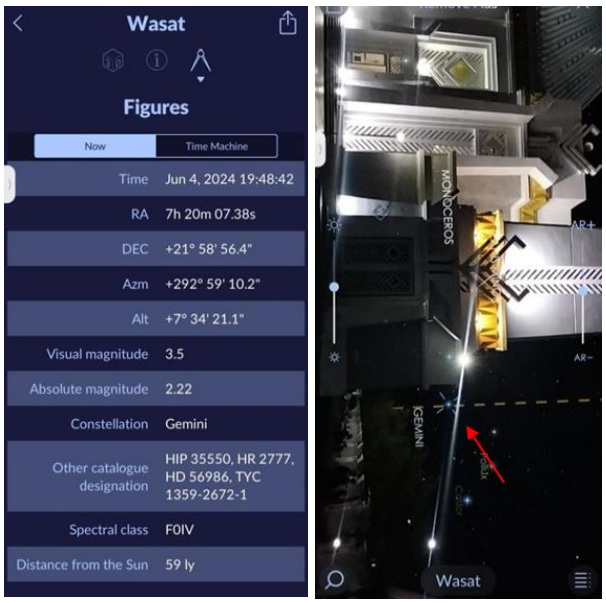


Figure 2. Data and Position of the star Wasat

c. Calculation of the qibla direction time for the star 63 Gemini (HIP 36238) at the Masjid Agung Syekh Yusuf in Gowa Regency on June 4, 2024.

αΘ = 72°53’45’ : 15
= 4^j 51^m 35^d

mΘ = 12 – e + (45° - 39°49’34,56”) : 15
= 12 – 1’35” + (45° - 39°49’34,56”) : 15
= 12:19:6,7

α = 7^j 27^m $46,04^d$

S = α - αΘ
= 7^j 27^m $46,04^d$ - 4^j 51^m 35^d
= 2^j 36^m $46,04^d$

m = mΘ + S
= 12:19:6,7 + 2^j 36^m $46,01^d$
= 14:55:17,74

TZD = *m* + (Time Zone Different Makkah – Gowa)
= 14:55:17,74 + 5
= 19:55:17,74

Based on the calculations above, the star 63 Gemini will transit over the Ka’bah at 14:55:17.74 Mecca time. It will then be converted to the observer's time zone, becoming 19:55:17.74 WITA.

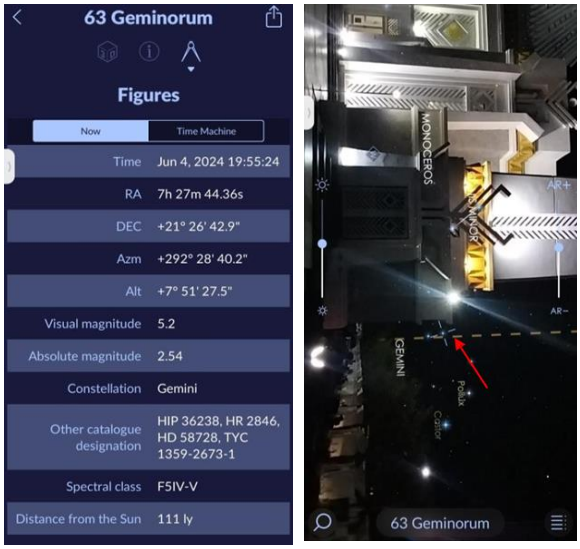


Figure 3. Data and Position of the star 63 Gemonirum

Calculation of the Qibla azimuth direction for South Sulawesi:

Location and Ka'ba Data

Local Latitude = -5°12'8,6" LS
Local Longtitude = 119°27'4,02" BT
Ka'bah Latitude = 21°25'21,09" LU
Ka'bah Longtitude = 39°49'34,25" BT

Formula for the Qiblat Direction:

$Cotan\ Q = Tan\ \theta^k \times Cos\ \theta^x : Sin\ C - Sin\ \theta^x : Tan\ C$

Where:

θk = Latitude of the Ka'bah
θx = Latitude of the location
C = Different in longtitude between the location and the Ka'bah

Determining the difference in longitude

Formula:

C = Local Longtitude – Ka'bah Longtitude

Substitution:

C = 119°27'4,02" – 39°49'34,25" = 79°32'29,77"

Finding the direction of the Qibla

$Cotan\ Q$ $= Tan\ \theta^k \times Cos\ \theta^x : Sin\ C - Sin\ \theta^x : Tan\ C$
$= Tan\ \theta^k$ (21°25'21,09") $x\ Cos\ \theta^x$(–5°12'8,6"): $SinC$(79°32'29,77")
$-Sin\ \theta^x$(–5°12'8,6"): $Tan\ C$(79°32'29,77")
=67°30'25,04" (U-B)
=90° – 67°30'25,04"
BU = 22°29'34,96"
AZK = 270° – 22°29'34,96"
= 292°29'34,96"

Based on the research conducted on Tuesday, June 4, 2024, using the Dioptra application, the results are as follows:



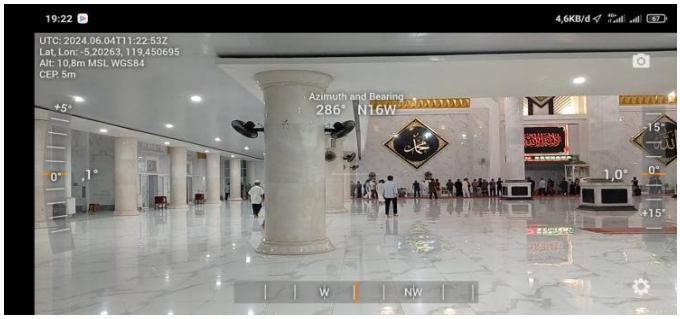


Figure 4. The direction of the Masjid Agung Syekh Yusuf building, Gowa Regency, uses the Dioptra application.

Based on the research, the global star rashdul kiblat method can serve as an accurate alternative method for determining the qibla direction at nite. Of the nine stars that meet the criteria of having a declination close to the latitude of the Kaʿbah and were observed on Tuesday, June 4, 2024, three stars were selected as the main objects of the study: δ Geminorum (36 Gemini), Wasat, and 63 Geminorum. The calculation of the transit time (upper culmination) of those stars over the Kaʿbah yielded a value consistent with the Qibla azimuth of Gowa Regency, which is 292°.

The orientation of the Great Mosque of Syekh Yusuf in Gowa Regency, which was initially reviewed using Google Earth with an azimuth result of 286°, was re-measured in this study using the Dioptra application and showed the same azimuth value, namely 286°. This result indicates a deviation of about 6° from the theoretical qibla azimuth of 292°. These findings confirm that theoretically, the star method provides accurate results, although in practice, there is still a slight directional deviation in the orientation of the mosque building.

Astronomically, this result can be explained by the fact that the global Rashdul Kiblat method using stars is very accurate because the positions of the stars remain stable due to their very slow proper motion. In addition, the estimation of the star's transit time, which is practical yet sufficiently precise for determining the Qibla direction, is provided by a technique that uses low-accuracy calculations based on annual ephemeris data published by the Ministry of Religious Affairs of the Republic of Indonesia.

D. Conclusion

The research results show that the global star qibla method can be used to determine the qibla direction, which examines three of the nine stars: δ Geminorum (36 Gemini), Wasat, and 63 Geminorum, as a viable approach for determining the qibla direction. This method works by calculating the transit time (culmination) of these stars above the Kaʿbah, then converting it to the observer's local time using a low accuracy calculation method. The observer can determine the Qibla direction by facing the selected star at its transit time. In this study, the Star Walk application is used to help identify the position of stars. However, light pollution at the observation site can hinder the visibility of stars with relatively low magnitudes, thus becoming a practical constraint in field implementation.

Results of this study, when linked to previous research, show that the measurements obtained thru the use of a Dioptra and standard mathematical calculations are consistent with the global star-based Rashdul Kiblat method. These findings reinforce previous studies that state that astronomical observation methods, when properly calibrated, can produce azimuth values equivalent to contemporary digital devices. Thus, this research provides empirical contributions to support the reliability of star-based qibla direction determination, particularly for use at nite or in certain environmental conditions when solar observation is not possible.

Although it shows a promising level of accuracy, this research also acknowledges a number of limitations that require further study. The main challenge lies in the process of identifying suitable stars within a limited observation time, especially in areas with high light pollution levels. Therefore, further research is recommended to refine star tracking techniques and conduct measurements in locations with minimal light interference to enhance observation precision. In addition, the development of specialized applications or integration with existing astronomy software has great potential to enhance the

practical implementation of the Rashdul Kiblat star method, making it more widely usable by the public.

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