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Identification of Mosque Qibla Azimuth Accuracy Based on Four-Direction Laser System in Seram Utara Timur Kobi

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Abstract

Ideally, the Qibla direction is a fundamental element in mosque architecture that must be determined accurately to ensure that Islamic worship practices align with Sharia principles. However, in reality, many mosques in various regions, including the Seram Utara Timur Kobi Subdistrict, Central Maluku Regency, are suspected to have Qibla direction deviations due to inaccurate methods of determining the Qibla azimuth. This study aims to identify the accuracy level of mosque Qibla azimuths in the region using a mapping system based on the Four Direction Laser System (Foudils). The method applied in this research involves two-dimensional mapping through satellite image projection and true north orientation measurement using intersecting laser beam

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projections, combined with a geological compass and a digital protractor with 0.01° precision. Astronomical data are then analyzed using a simulator based on spherical trigonometric equations to obtain the Qibla Azimuth to Spherical Building (QUTSB) value. The findings indicate a significant angular deviation (SM) between the mosque building azimuth (M) and the QUTSB, with M ranging from 269°36'0" to 310°54'0", while the QUTSB ranges from 291°23'36.80" to 291°26'32.13". These results show that most mosques in the region are oriented too far westward, leading to an inaccurate Qibla direction that requires realignment to precisely face the Kaaba in Mecca.

Keywords*: Accuracy, Azimuth, Qibla, Mosque*

Abstrak

Idealnya, arah kiblat merupakan elemen fundamental dalam arsitektur masjid yang harus ditentukan secara akurat agar pelaksanaan ibadah umat Islam dapat sesuai dengan syariat. Namun realitasnya, masih banyak masjid di berbagai daerah, termasuk di Kecamatan Seram Utara Timur Kobi, Kabupaten Maluku Tengah, yang diduga mengalami deviasi arah kiblat akibat kurang tepatnya metode penentuan azimuth kiblat. Penelitian ini bertujuan untuk mengidentifikasi tingkat akurasi azimuth kiblat masjid di wilayah tersebut dengan menggunakan sistem pemetaan berbasis *Four Direction Laser System* (Foudils). Metode yang digunakan dalam penelitian ini adalah pemetaan dua dimensi melalui proyeksi citra satelit dan pengukuran arah utara sejati menggunakan proyeksi sinar laser berpotongan yang dikombinasikan dengan kompas geologi dan busur derajat digital presisi 0,01°. Data astronomikal kemudian dianalisis dengan simulator berbasis persamaan trigonometri bola untuk mendapatkan nilai *Qibla Azimuth to Spherical Building* (QUTSB). Hasil penelitian menyimpulkan bahwa terdapat deviasi sudut (SM) yang signifikan antara azimuth bangunan masjid (M) dan QUTSB, dengan rentang arah M berkisar antara 269°36'0" hingga 310°54'0", sedangkan QUTSB berkisar antara 291°23'36,80" hingga 291°26'32,13". Temuan ini menunjukkan bahwa mayoritas masjid di wilayah tersebut mengarah terlalu condong ke barat, sehingga arah kiblatnya tidak akurat dan perlu dilakukan penyesuaian ulang agar benar-benar tepat mengarah ke Ka'bah di Kota Mekkah.

Kata kunci: Akurasi, Azimut, Kiblat, Masjid

Introduction

The determination of the *Qibla* direction is a fundamental aspect in the performance of Islamic worship, particularly in the observance of *ṣalāh*, which is the second pillar of Islam. The precision of the *Qibla* direction holds not only symbolic significance but also reflects obedience to the *Shariah* prescribed by Allah SWT. When Muslims face the *Kaʿbah* during prayer, they are affirming their spiritual commitment and uniting the direction of worship toward a single axis of faith. Therefore, determining the *Qibla* direction must be carried out with great caution, using scientific and methodological approaches that are accountable. In this context, astronomy, known in Islamic tradition as *'ilm al-falak*, has played a critical role in bridging science and *Shariah* to ensure the correct direction toward the *Kaʿbah*.

With the passage of time, technological developments have introduced various instruments and methods that facilitate Muslims in determining the *Qibla* direction more accurately. Digital devices, optical instruments, and information technology-based applications have now become integral to efforts in calibrating the *Qibla* direction. However, such technological tools cannot stand alone; they must be accompanied by a deep understanding of *falak* to ensure the validity of the results. According to Sari Abdul Rauf and Supardin (2020), the integration of modern technology and astronomical science forms an essential foundation for Muslims to perform *ṣalāh* facing the correct *Qibla* and avoid errors that could compromise the integrity of worship.

Various methods have been employed to determine the *Qibla* direction, ranging from traditional techniques such as *rashdul qiblah* to modern tools like theodolites, Polaris-based orientation, and digital compass sensors. Each method has its strengths and limitations. For instance, *rashdul qiblah* relies on observing the shadow cast by the sun when it is directly above the *Kaʿbah*, but this method is difficult to apply in eastern Indonesia due to limited visibility of the sun during the critical moments. In fact, some regions never experience *rashdul qiblah* at all due to geographical and time zone constraints (Sakirman, 2018). Other methods, such as using theodolites commonly employed in mapping, also have limitations because they cannot be used indoors and depend heavily on the sun's position. Additionally, the Polaris method, which uses the North Star to determine true north, presents further challenges in Indonesia. In southern latitudes such as Indonesia, the north point indicated by Polaris is difficult to observe because of limited visibility and unfavorable geographic positioning. According to Sayehu and Aspandi (2023), this method is more suitable in northern latitudes above 10°, which excludes most parts of Indonesia. Therefore, the shortcomings of these methods highlight the need for a new, more effective approach that can be broadly applied.

Ideally, every mosque should have its *Qibla* direction determined through an accurate measurement process using methods that are valid both scientifically and religiously. This is crucial so that congregants can pray with confidence in the legitimacy of their worship. Precise determination of the *Qibla* direction also prevents disputes among worshippers and religious leaders and strengthens unity in congregational prayer. Therefore, the effort to improve the accuracy of the *Qibla* direction should be a serious concern not only for mosque administrators but also for religious institutions and Muslim scholars. However, field observations reveal that many mosques, particularly in remote and rural areas, still lack accurate *Qibla* alignment. This is also evident in the Seram Utara Timur Kobi District, Central Maluku Regency, where several mosques are suspected of having misaligned *Qibla* directions, sparking debate among community members. One specific case is at the Al-Falah Grand Mosque in Kobi Mukti Village, where differing opinions on the *Qibla* direction have led to tension between religious leaders and the local community. Consequently, the prayer rows were adjusted several degrees off from the *mihrab* without a proper scientific measurement process. Based on discussions with the local Office of Religious Affairs (KUA), it was recommended that a re-verification be conducted using more scientific and technological methods to ensure that the results are both explainable and acceptable to the entire community (Hamdani et al., 2020).

This study aims to describe the results of two-dimensional mapping using the Four Direction Laser System to analyze the azimuth of mosque building orientation and assess the accuracy level of the *Qibla* direction in mosques located in the Seram Utara Timur Kobi District. This method offers superior precision, as it consistently displays vertical and horizontal lines with an accuracy of up to 0.01°, and it can be used indoors without reliance on the sun's position. Such a method shows great promise for widespread application in calibrating the *Qibla* direction across various regions. It is hoped that this research will provide both scientific and practical contributions to communities and religious institutions in improving mosque *Qibla* alignment. The results are also expected to offer a solution for communities facing confusion or disagreement regarding the *Qibla* direction. Moreover, technology-based approaches such as the Four Direction Laser System could serve as an alternative model for *falak* experts, local governments, and religious leaders to ensure that mosque *Qibla* directions truly align with the direction of the *Kaʿbah* in Mecca.

Literature Review

Studies related to the determination of the *Qibla* direction are not new; several researchers have addressed and published findings using various traditional and modern methods and approaches. Ikhsan Mahaendra and Ahmad Adib Rofiuddin, in their work titled; *"Robot Pengukur Arah Kiblat Berbasis Offline untuk Penyandang Tuna Netra,"* discuss the design of a robotic *Qibla* direction aid specifically intended for the visually impaired. The robot is ergonomic and can be used practically in various locations, including areas with poor signal reception, as well as indoors and outdoors. This study shows that the *Qibla* robot has a high level of accuracy, as it showed no difference compared to the theodolite method, and only a deviation of 0° 35' 36.09" when compared to the Stellarium application (Mahendra, 2024). The similarity between this study and the author's research lies in the use of technology to achieve *Qibla* direction accuracy. However, the difference is that the *Qibla* robot has limitations on uneven terrain, is sensitive to magnetic interference, and has limited battery life. Additionally, the robot requires reprogramming when changing locations based on latitude and longitude coordinates, whereas the author's study seeks to develop a more stable, precise method with minimal environmental interference.

Akbar and Mustaqim, in their publication titled; "Theoretical Study of the Use of the Polaris Star as a Reference for the North Point in Determining the Qibla Direction," conduct a theoretical study on the use of the Polaris star as a north reference point in determining the *Qibla* direction. This research indicates that Polaris is difficult to observe in areas near the equator or below 10° north latitude due to its very low position on the horizon. These findings conclude that the Polaris method is unsuitable for application in Indonesia, particularly in Maluku Province, which lies in the southern hemisphere (Akbar, 2023). The similarity with the author's study lies in the effort to find alternative methods for determining the *Qibla* direction. However, the difference is that their research is more theoretical and astronomical, while the author's study emphasizes a laser-based visual-instrumental approach for two-dimensional mapping with high accuracy.

Sriani and Ukhti, in their study titled "Uji Akurasi Arah Kiblat Menggunakan Fitur Kompas Kiblat Pada Aplikasi Quran Kemenag Versi 2.1.4.," discuss the effectiveness of the Ministry of Religious Affairs' *Qibla* compass application in determining the *Qibla* direction. Their research found that there is a deviation of about 1° to 2° when compared with measurements using a theodolite. The similarity between their work and the author's lies in analyzing the accuracy of the *Qibla* direction using digital technology (Sriani & Ukhti, 2022). However, Sriani and Ukhti's study still relies on a digital compass application that is highly sensitive to magnetic fields and the instability of smartphone sensors, whereas the author's study uses a laser beam-based mapping system that is more independent of magnetic interference and provides direct visualization of the mosque building's azimuth.

Nada Putri Rohana, in her article titled "Accuracy of Qibla Direction of the Mosque with the Qibla Shadows and Rashdul Qibla Methods," discusses a method for determining the *Qibla* direction using object shadows when the sun is directly above the Kaʿbah (*istiwa aʿẓam*). This method is very popular and quite accurate in some areas, as the object's shadow will directly indicate the *Qibla* direction. However, it is difficult to apply in eastern regions of Indonesia, including Maluku, because when the sun is exactly above the Kaʿbah, it is already *Maghrib* time in those regions, so shadows are no longer visible (Rohana, 2024). The similarity with the author's study lies in addressing the geographic challenges in determining the *Qibla* direction. The difference is that Rohana's study relies on a temporary natural phenomenon, while the author's research develops a method that can be used at any time, regardless of time or weather conditions.

Syukur and Basri, in their work titled "Formulasi Trigonometri Dalam Pembuatan Software Penentuan Arah Kiblat berbasis Visual Basic," developed software to calculate the *Qibla* direction based on trigonometric formulas. This program is designed to assist the general public in theoretically and mathematically determining the *Qibla* direction (Syukur & Basri, 2019). The similarity with the author's study is that both are technology-based and aim to provide alternative methods for determining the *Qibla*. However, the difference lies in the implementation aspect: Syukur and Basri's work only produces numerical data without direct visualization on buildings, whereas the author's study presents a visual approach that can be directly applied to the physical surface of mosque buildings using highly accurate laser lines.

Based on the conducted literature review, although many methods and tools have been developed to determine the *Qibla* direction, there remains a research gap in applying a measurement system that can be visualized directly in two dimensions, offers high precision, and can be used within mosque buildings without interference from terrain or lighting conditions—particularly in Seram

Utara Timur Kobi District. Therefore, this study aims to fill that gap by developing a method for identifying the accuracy of *Qibla* azimuth using the Four Direction Laser System, which can map mosque *Qibla* directions visually, accurately, and efficiently, especially for eastern regions of Indonesia like Seram Utara Timur Kobi District, which face unique geographical challenges.

Research Methodology

This research is a type of qualitative descriptive study conducted to collect and analyze qualitative data in order to describe phenomena or realities (Zellatifanny & Mudjiyanto, 2018). The research location is in the Seram Utara Timur Kobi District, which is one of the administrative districts of Central Maluku Regency. It is located in the northern part of Seram Island, positioned between 2°55'–3°25' South Latitude and 129°55'–130°09' East Longitude, with a total area of 280.65 km^2 (Solehuwey et al., 2024). This district consists of 12 villages, namely Kobi, Kobi Mukti, Maneo Rendah, Leawai, Samal, Waitonipa, Morokay, Waimusi, Waiasih, Marasahua, Sariputih, and Kabauhari (Lailiyah et al., 2017).

In this study, the variables observed include astronomical data, such as the latitude and longitude positions of the mosque, the latitude and longitude of the *Ka'bah*, true north direction, mosque building azimuth, measured *qibla* azimuth, and *qibla* azimuth deviation. The latitude and longitude coordinates of the mosques in Seram Utara Timur Kobi District were obtained using satellite imagery projection on Google Maps. The azimuth of the mosque building (M) was obtained by first determining the true north direction using the intersecting beam projection from a Foudils detector, assisted by a geological compass and a digital protractor with an accuracy of up to 0.01°.

Figure 01. Research Instrument

All the data were successfully collected, processed, and analyzed using a simulation program that operates based on the spherical trigonometric equations of the Earth to calculate the actual *qibla* azimuth of the mosque building (Q_{UTSB}). Therefore, if there is a difference between the value of M and the (Q_{UTSB}) value, the *qibla* azimuth deviation of the mosque building can be determined.

Azimuth Accuracy: Its Urgency and Historical Background

The accuracy of a mosque's azimuth refers to the precision of the horizontal direction from a specific geographic reference point toward the Kaʿbah in Mecca, which serves as the *qibla* for Muslims in performing *ṣalāh*. In Islamic architecture, the orientation of a mosque is heavily determined by the *qibla* direction, making azimuth accuracy fundamentally important. Azimuth itself is a term in geodesy and astronomy that refers to the angle between true north and the direction of a particular object, measured in degrees (Nurmila, 2017). In the context of mosques, that object is the *qibla*. Accurate azimuth determination is essential as it forms the basis for constructing the *miḥrāb*—the niche indicating the direction of prayer—and aligning the rows (*ṣaff*) of worshippers behind the imam. An error in determining azimuth can result in a deviation from the correct *qibla*, thereby potentially affecting the validity of *ṣalāh*, especially in terms of its formal compliance as a ritual obligation (*ʿibādah maḥḍah*).

The concept of determining the *qibla* direction is not new in Islamic history. In the early days of Islam in Mecca, the Prophet Muhammad and his companions performed prayers facing *Bayt al-Maqdis* in Jerusalem. However, after the migration to Madinah, a revelation in the Qur'an (Surah al-Baqarah: 144) instructed the shift of the prayer direction from *Bayt al-Maqdis* to the Kaʿbah. This event is known as the *taḥwīl al-qiblah* (change of *qibla*). Since then, the *qibla* direction has been a critical aspect of mosque construction. During the Prophet's time, the *qibla* was determined simply through observations of the sun's position and intuitive direction-finding. While not scientifically precise, this method was sufficiently effective for the needs of that era (Thoyfur, 2021).

Throughout Islamic history, methods for determining the *qibla* evolved alongside advancements in *ʿilm al-falak* (Islamic astronomy) and classical astronomy. In the medieval period, Muslim scholars such as Al-Battani, Al-Biruni, and Al-Tusi developed mathematical methods and spherical trigonometric calculations to determine the *qibla* from various regions of the Islamic world. They also invented instruments such as the astrolabe and *qibla* indicators to facilitate more accurate determination of the Kaʿbah's direction. *ʿIlm al-falak* became an essential part of classical Islamic education due to its relevance to religious practices such as prayer times, lunar month beginnings, and *qibla* orientation. Manuscripts and *qibla* tables from that era demonstrate the seriousness with which Muslim scholars approached directional precision (Muhajir et al., 2022). Over time, *qibla* determination became a multidisciplinary field, integrating astronomy, geodesy, cartography, and modern digital technology. In the modern era, technologies like the Global Positioning System (GPS), satellite imagery, and geospatial software have enabled highly precise *qibla* direction calculations—even mobile applications now exist that can indicate the *qibla* in seconds.

The urgency for azimuth accuracy in mosque construction has grown in line with increasing public awareness of the importance of correct *qibla* orientation. Even minor orientation errors of a few degrees can have major implications for mosque buildings already in use by the public. This has led to a phenomenon of *ṣaff* corrections in some mosques, where prayer rows are realigned after more accurate azimuth measurements reveal misdirection. Such corrections require financial resources, time, and culturally sensitive approaches, given their direct impact on religious identity and sacred architecture (Zahara & Muhib, 2024). Azimuth accuracy has also become a formal concern in mosque construction standards issued by religious institutions such as Indonesia's Ministry of Religious Affairs and the Indonesian Ulema Council. These standards address not only architectural aesthetics and physical structures but also technical requirements for determining the *qibla*, often involving experts in *ʿilm al-falak* and supporting technologies.

Hisāb and *rukyat* services, which once focused solely on prayer time and lunar calendar determinations, now also extend to assisting with precise *qibla* measurements. Modern astronomers have begun employing tools such as theodolites, digital compasses, and laser systems to enhance azimuth accuracy. In practical terms, azimuth accuracy often serves as the starting point in mosque development projects, especially during the site selection and layout orientation stages. Architects and construction teams must collaborate with *falak* experts and geospatial technicians to ensure the *miḥrāb* and prayer rows are correctly positioned. In some Muslim-majority countries, azimuth determination is even part of the mosque construction permitting process. This indicates a collective awareness that the *qibla* is not merely symbolic but a substantive factor determining ritual validity.

Nonetheless, in some cases, mosques remain in active use even though their *qibla* orientation is inaccurate. In such situations, religious scholars often issue accommodative *fatwas*, permitting worship to continue as long as the deviation is not excessive and the original alignment was based on the best available *ijtihād* of the time. However, with modern technology and widespread access to information, the excuse of unawareness (*taʿadhdhur*) becomes less applicable for newly constructed mosques. Thus, the moral and technical responsibility to ensure azimuth accuracy has grown significantly. Educational and research institutions play a vital role in supporting this effort. Islamic universities and geospatial institutes have the capacity to develop accurate measurement methods and provide technical training for mosque committees and the general public. In Indonesia, for example, the development of the Four Direction Laser System is an innovative step aimed at improving practical and measurable *qibla* accuracy. Such innovations not only provide technical solutions but also educate communities about the importance of precision in worship.

From a theological perspective, azimuth accuracy is directly tied to the objectives of *maqāṣid al-sharīʿah*, specifically the preservation of religion (*ḥifẓ al-dīn*). Ensuring the correct direction in *ṣalāh* is a form of safeguarding the sanctity and order of worship. Therefore, aligning a mosque properly to the *qibla* is not merely a matter of architectural design but a reflection of the Muslim community's commitment to fulfilling divine instruction. It is no exaggeration to say that building a mosque without careful consideration of azimuth can amount to negligence in a fundamental aspect of worship (Iskandar et al., 2024). In the future, the challenge of maintaining and enhancing azimuth accuracy will become increasingly complex. Issues such as densely populated areas, limited land availability, and technical constraints in measurement may pose difficulties. Hence, the integration of scientific knowledge and religious consciousness must continue to evolve in synergy. Azimuth accuracy cannot be separated from the collective commitment of the Muslim ummah to ensure that every act of worship—especially *ṣalāh*—is carried out with clear directional awareness and deep spiritual intent.

Mapping of Mosque Building Azimuth

The azimuth of mosque buildings from eighteen mosques in the Seram Utara Timur Kobi District was obtained by first determining the latitude and longitude coordinates using the Global Positioning System (GPS). This was followed by identifying the four main cardinal directions using a four-direction laser system, supported by a geological compass and a digital protractor. The results of the mosque building azimuth mapping can be seen in the following table.

Mosque Name	Village Location	*Latitude* (φ_t)	*Longitude* (λ_t)	Building Azimuth (M)
Nurul Huda	Samal	- 02° 56’ 57.60”	129° 51’ 26.99”	270° 27’ 0”
An Nur	Mandiri Baru	- 02° 54’ 35.78”	129° 47’ 27.44”	291° 48’ 0”
Baburrahman	Samal	- 02° 57’ 13.71”	129° 51’ 18.23”	279° 42’ 0”
Al Muhajirin	Leawai	- 02° 57’ 19.78”	129° 50’ 20.42”	282° 00’ 0”
Sabilunnajaah	KTM Kobi	- 02° 55’ 40.40”	129° 48’ 27.58”	269° 36’ 0”
Baiturrahman	Mandiri Lama	- 02° 54’ 00.26”	129° 46’ 54.53”	276° 39’ 0”
Al Falah	Kobi Mukti	- 02° 55’ 19.68”	129° 47’ 58.41”	310° 54’ 0”
An-Nur Lama	Kobi Mukti	- 02° 55’ 32.82”	129° 47’ 42.51”	279° 33’ 0”
An Nur	Sariputih SP 4	- 02° 56’ 29.84”	129° 44’ 45.78”	275° 24’ 0”
Jabar Nur	Sariputih Unit O	- 02° 56’ 09.97”	129° 43’ 54.61”	280° 54’ 0”
Misbakhul Falah	Sariputih Unit N	- 02° 54’ 16.14”	129° 45’ 40.75”	294° 12’ 0”
Riadhusolihin	Sariputih Unit N	- 02° 54’ 39.45”	129° 45’ 27.78”	278° 51’ 0”
Hayatul Iman	Sariputih	- 02° 53’ 59.11”	129° 45’ 41.18”	296° 54’ 0”
Al Ansor	Marasahua	- 03° 00’ 20.34”	129° 52’ 25.51”	271° 45’ 0”
Ittikhadul Mubalighin	Morokay	- 02° 58’ 43.54”	129° 51’ 51.24”	277° 57’ 0”
Al Fatah	Waimusi	- 02° 59’ 44.61”	129° 50’ 02.26”	288° 42’ 0”
Baitul Makmur	Waiasih	- 02° 59’ 27.73”	129° 48’ 41.58”	281° 00’ 0”
At Taqwa	Waitonipa	- 02° 59’ 18.85”	129° 52’ 47.93”	278° 15’ 0”

Table 01. Mosque Building Azimuth

The negative sign (–) in the latitude value indicates that although the mosque is located in the northern part of Seram Island, it is still situated in the southern hemisphere, commonly referred to as the southern latitude (LS). The azimuth value of the mosque building is obtained by measuring the angle between the westward vector and the reference vector of the mosque's orientation, which in this case is represented by one of the vertical lines on the mosque floor tiles. The angle between the west vector and the reference vector is then added to 270°, which represents the rotational angle from the north to the west, passing through the east and south (Padil, 2013).

Identification of the Accuracy of Mosque Qibla Azimuth

1. Accuracy Value of Mosque Qibla Azimuth

The latitude, longitude, and azimuth data from the eighteen mosque buildings that have been collected were then integrated into a simulator device that operates logarithmically in accordance with the spherical triangle trigonometric equations to calculate the values of $Q_{U\text{-}B}$, $Q_{B\text{-}U}$, and the actual Qibla azimuth (Q_{UTSB}) of the mosque buildings, as shown in the following table;

Mosque Name	Village Location	$Q_{U\text{-}B}$	$Q_{B\text{-}U}$	Q_{UTSB}
Nurul Huda	Samal	68° 36’ 16.87”	21° 23’ 43.13”	291° 23’ 43.13”
An Nur	Mandiri Baru	68° 36’ 03.80”	21° 23’ 56.20”	291° 23’ 56.20”
Baburrahman	Samal	68° 36’ 16.77”	21° 23’ 43.23”	291° 23’ 43.23”
Al Muhajirin	Leawai	68° 36’ 14.31”	21° 23’ 45.69”	291° 23’ 45.69”
Sabilunnajaah	KTM Kobi	68° 36’ 07.55”	21° 23’ 52.45”	291° 23’ 52.45”
Baiturrahman	Mandiri Lama	68° 36’ 01.35”	21° 23’ 58.21”	291° 23’ 58.21”
Al Falah	Kobi Mukti	68° 36’ 05.91”	21° 23’ 54.09”	291° 23’ 54.09”
An-Nur Lama	Kobi Mukti	68° 36’ 05.42”	21° 23’ 54.58”	291° 23’ 54.58”
An Nur	Sariputih SP 4	68° 35’ 58.47”	21° 24’ 01.53”	291° 24’ 01.53”
Jabar Nur	Sariputih Unit O	68° 35’ 55.85”	21° 24’ 04.15”	291° 24’ 04.15”
Misbakhul Falah	Sariputih Unit N	68° 35’ 58.75”	21° 24’ 01.25”	291° 24’ 01.25”
Riadhusolihin	Sariputih Unit N	68° 35’ 58.55”	21° 24’ 01.45”	291° 24’ 01.45”
Hayatul Iman	Sariputih	68° 35’ 58.49”	21° 24’ 01.51”	291° 24’ 01.51”
Al Ansor	Marasahua	68° 36’ 23.20”	21° 23’ 36.80”	291° 23’ 36.80”
Ittikhadul Mubalighin	Morokay	68° 33’ 27.87”	21° 26’ 32.13”	291° 26’ 32.13”
Al Fatah	Waimusi	68° 36’ 16.07”	21° 23’ 43.93”	291° 23’ 43.93”
Baitul Makmur	Waiasih	68° 36’ 12.12”	21° 23’ 47.88”	291° 23’ 47.88”
At Taqwa	Waitonipa	68° 36’ 23.07”	21° 23’ 36.93”	291° 23’ 36.93”

Table 02, Qibla Azimuth of Mosque Buildings

The qibla azimuth value of the mosque buildings indicates the true qibla direction, which directly faces the Kaaba in the city of Mecca. As explained by Hosen & Ghafiruddin (2018), the qibla issue is an azimuth issue, which refers to the angle from the north point to the vertical circle passing through a celestial object or a particular location, measured along the horizon in a clockwise direction. Therefore, the matter of qibla direction is closely related to the geographical location of a place. This value is then subtracted from the mosque building's azimuth value to determine the difference between the two (SM). This difference directly reflects the accuracy level of the mosque building, as shown in the following table:

Mosque Name	Village Location	QUTSB	M	SM	Accuracy
Nurul Huda	Samal	291° 23’ 43.13”	270° 27’ 0”	20.95°	2.1%
An Nur	Mandiri Baru	291° 23’ 56.20”	291° 48’ 0”	-0.4°	98.13%
Baburrahman	Samal	291° 23’ 43.23”	279° 42’ 0”	11.7°	45.33%
Al Muhajirin	Leawai	291° 23’ 45.69”	282° 00’ 0”	9.4°	56.07%
Sabilunnajaah	KTM Kobi	291° 23’ 52.45”	269° 36’ 0”	21.8°	1.83%
Baiturrahman	Mandiri Lama	291° 23’ 58.21”	276° 39’ 0”	14.75°	31.07%
Al Falah	Kobi Mukti	291° 23’ 54.09”	310° 54’ 0”	-19.5°	8.88%
An-Nur Lama	Kobi Mukti	291° 23’ 54.58”	279° 33’ 0”	11.85°	44.63%
An Nur	Sariputih SP 4	291° 24’ 01.53”	275° 24’ 0”	16°	25.23%
Jabar Nur	Sariputih Unit O	291° 24’ 04.15”	280° 54’ 0”	10.5°	50.93%
Misbakhul Falah	Sariputih Unit N	291° 24’ 01.25”	294° 12’ 0”	-2.8°	86.92%
Riadhusolihin	Sariputih Unit N	291° 24’ 01.45”	278° 51’ 0”	12.55°	41.35%
Hayatul Iman	Sariputih	291° 24’ 01.51”	296° 54’ 0”	-5.5°	74.3%
Al Ansor	Marasahua	291° 23’ 36.80”	271° 45’ 0”	19.64°	8.22%
Ittikhadul Mubalighin	Morokay	291° 26’ 32.13”	277° 57’ 0”	13.49°	37.08%
Al Fatah	Waimusi	291° 23’ 43.93”	288° 42’ 0”	2.7°	87.38%
Baitul Makmur	Waiasih	291° 23’ 47.88”	281° 00’ 0”	10.4°	51.4%
At Taqwa	Waitonipa	291° 23’ 36.93”	278° 15’ 0”	13.14°	38.6%

Tabel 03, akurasi azimuth kiblat masjid

If the SM value is negative, it indicates that the mosque building must be adjusted toward the south, and vice versa. The accuracy value of the qibla azimuth is the ratio between the SM value and the decimal degree value of the QB-U, which shows the level of alignment between the mosque's azimuth and the actual qibla azimuth. The closer the SM value is to the QB-U value, the higher the percentage of qibla azimuth accuracy. Conversely, the greater the difference between the two values, the lower the percentage of qibla accuracy will be.

2. Visualization of Mosque Qibla Azimuth Accuracy

The mapping results are then visualized in a rotated compass coordinate system, adjusted in such a way that all identified parameters—namely QB-U, QU-B, QUTSB, M, and SM—can be clearly observed, as shown in the following figure:

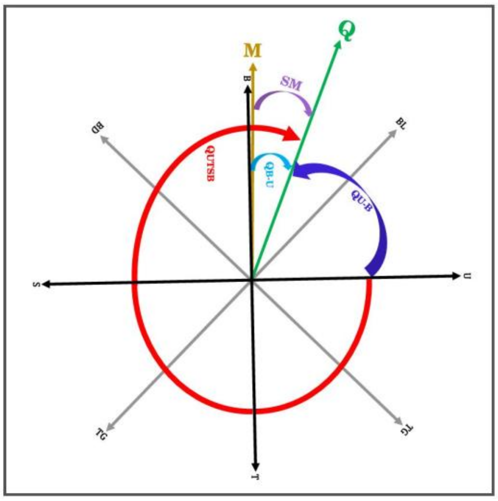

Figure 02, 2D Mapping Visualization of Nuru Huda Mosque Samal Village (Source: Research Data, 2024)

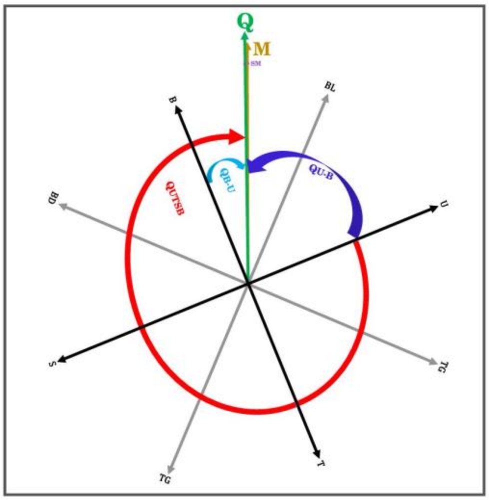

Figure 03, 2D Mapping Visualization of An Nur Mosque Mandiri Baru Village (Source: Research Data, 2024)

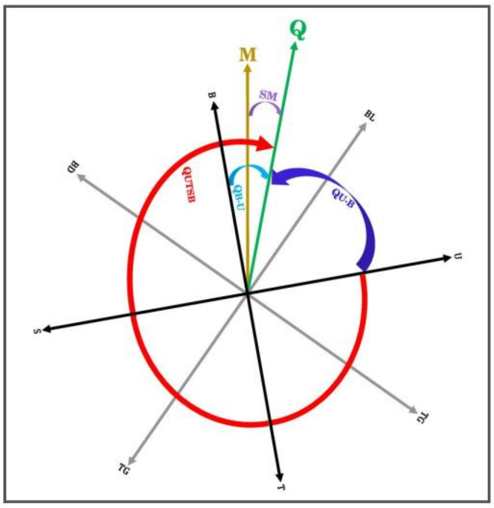

Figure 04, 2D Mapping Visualization of Baburahman Mosque Samal Village (Source: Research Data, 2024)

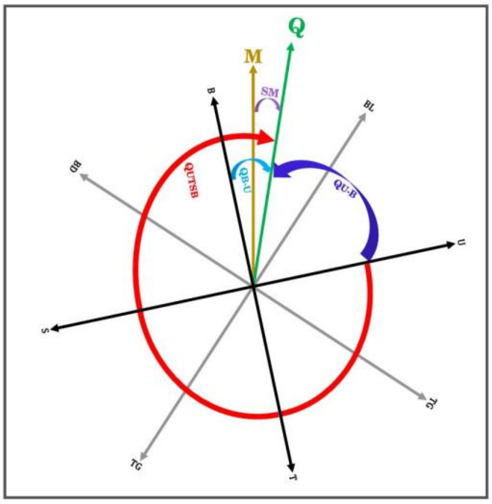

Figure 05. 2D Mapping Visualization of Al Muhajirin Mosque Leawai Village (Source: Research Data, 2024)

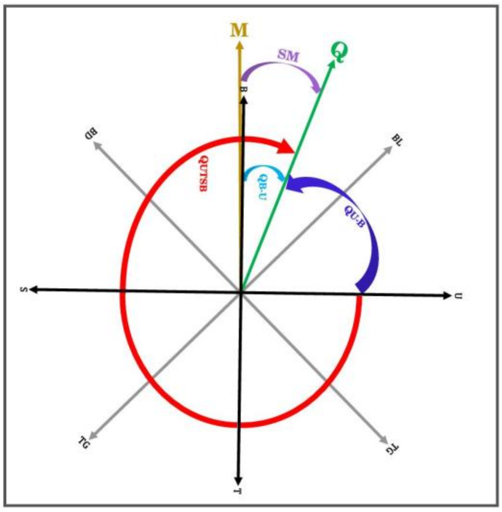

Figure 06. 2D Mapping Visualization of Sabilunnaja Mosque KTM Kobi Village (Source: Research Data, 2024)

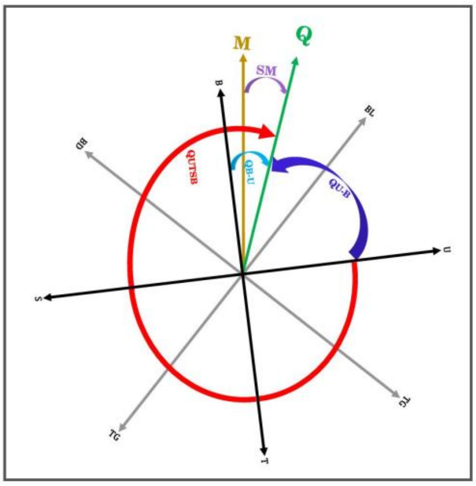

Figure 07. 2D Mapping Visualization of Baiturrahman Mosque Mandiri Lama Village (Source: Research Data, 2024)

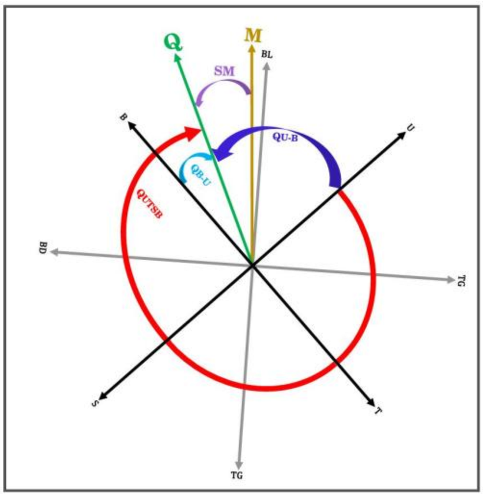

Figure 08. 2D Mapping Visualization of Al Falah Mosque Kobi Mukti Village (Source: Research Data, 2024)

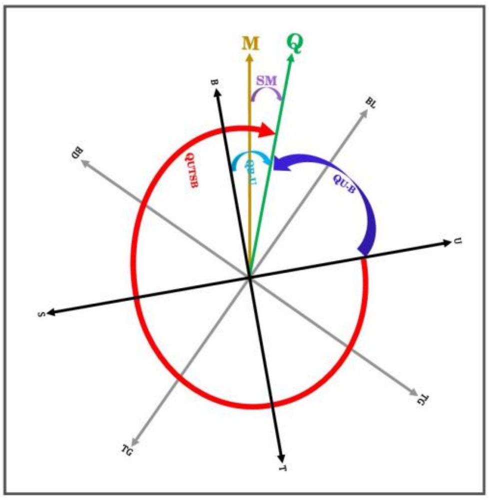

Figure 09. 2D Mapping Visualization of An Nur Lama Mosque Kobi Mukti Village (Source: Research Data, 2024)

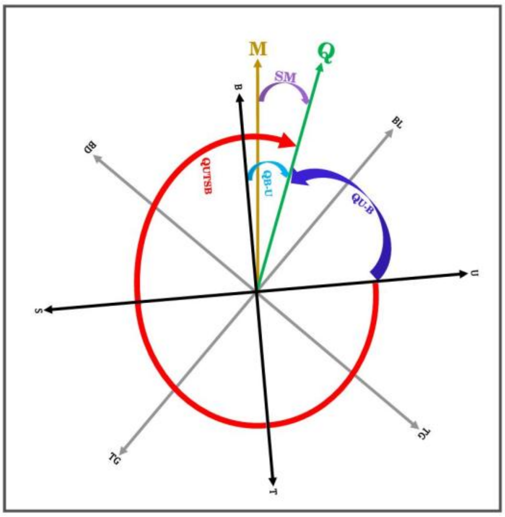

Figure 10. 2D Mapping Visualization of An Nur Mosque Sariputih SP 4 Village (Source: Research Data, 2024)

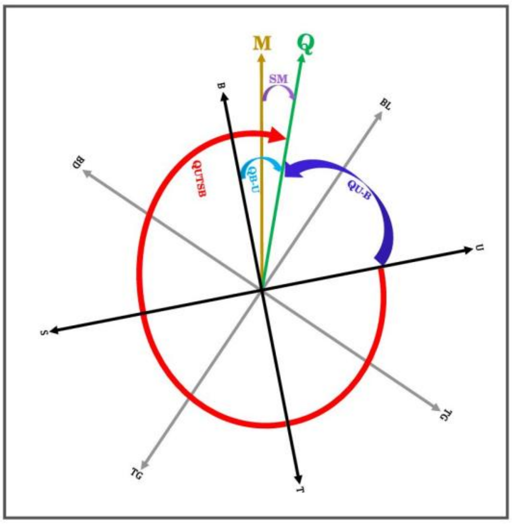

Figure 11. 2D Mapping Visualization of Jabar Nur Mosque Sariputih Unit O Village (Source: Research Data, 2024)

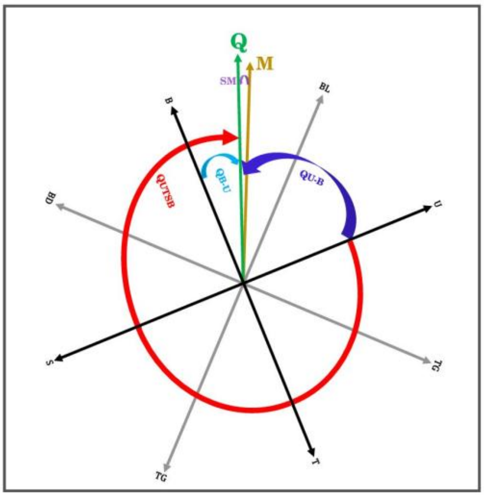

Figure 12. 2D Mapping Visualization of Misbakhul Falah Mosque Sariputih Unit N Village (Source: Research Data, 2024)

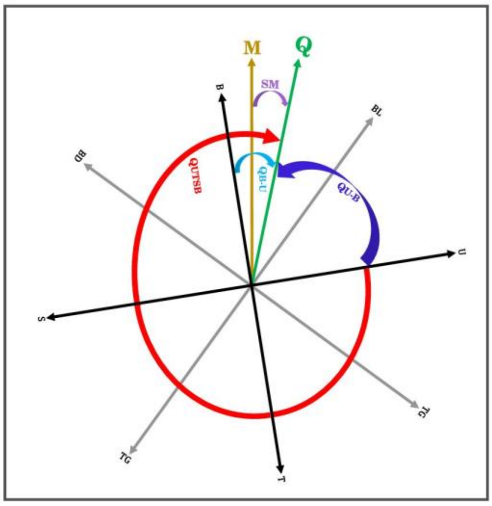

Figure 13. 2D Mapping Visualization of Riadusolihin Mosque Sariputih Unit N Village (Source: Research Data, 2024)

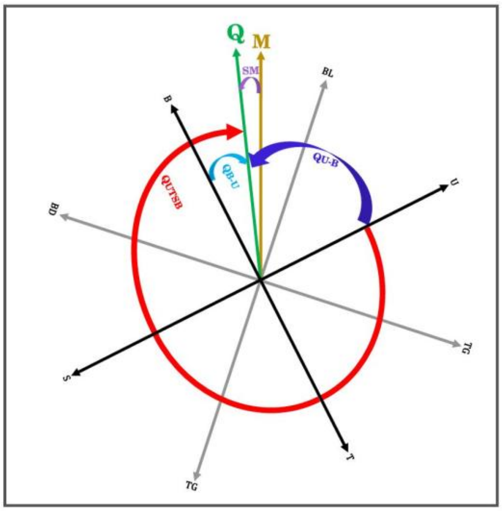

Figure 14. 2D Mapping Visualization of Hayatul Iman Mosque Sariputih Village (Source: Research Data, 2024)

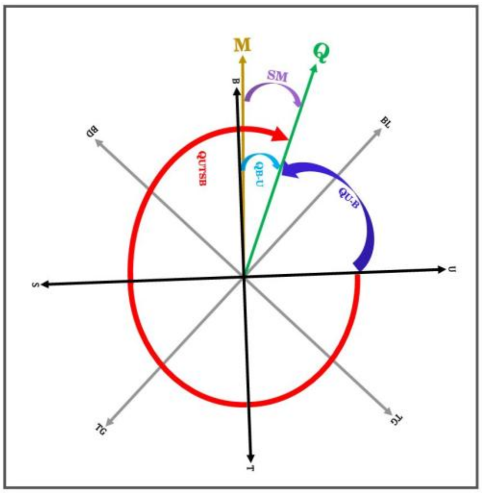

Figure 15. 2D Mapping Visualization of Al Ansor Mosque Marasahua Village (Source: Research Data, 2024)

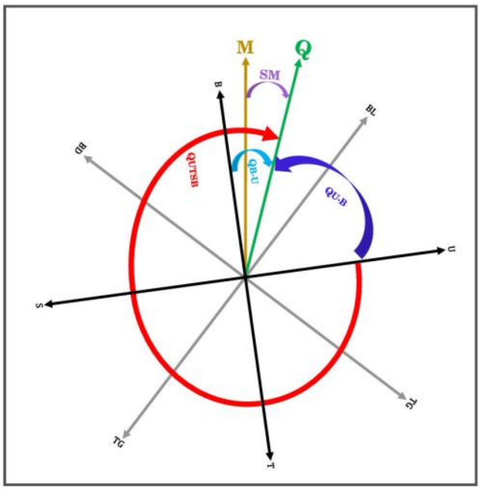

Figure 16. 2D Mapping Visualization of Ittikhadul Mubhaligin Mosque Morokay Village (Source: Research Data, 2024)

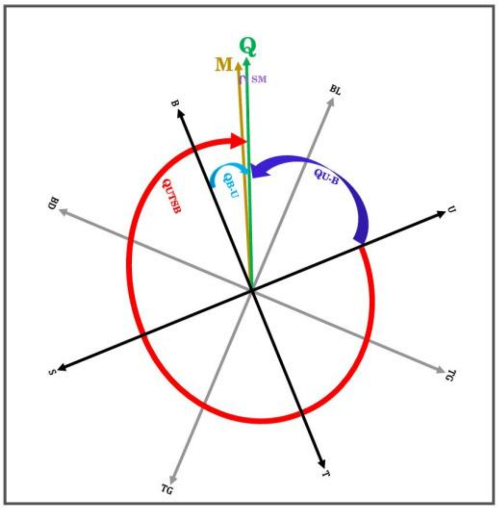

Figure 17. 2D Mapping Visualization of Al Fatah Mosque Waimusi Village (Source: Research Data, 2024)

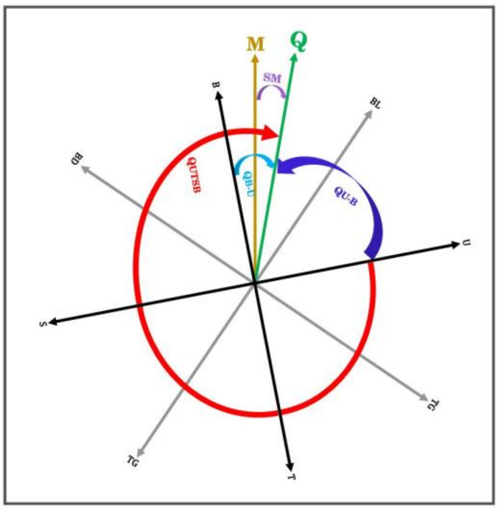

Figure 18. 2D Mapping Visualization of Baitul Makmur Mosque Waiasih Village (Source: Research Data, 2024)

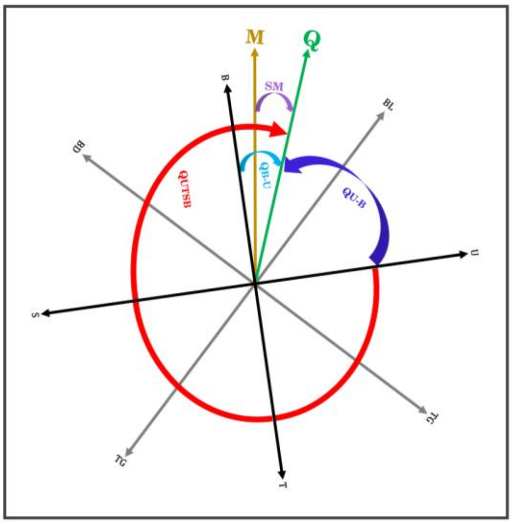

Figure 19. 2D Mapping Visualization of At Taqwa Mosque Waitonipa Village (Source: Research Data, 2024)

The mapping visualization was created in a highly realistic manner, where the black rectangular shape represents the visual form of the mosque's main prayer hall. The green Q vector indicates the value and direction of the Qibla azimuth based on calculation results, while the golden-yellow M vector shows the azimuth direction of the mosque building. The purple SM arrow illustrates the angular deviation between the mosque's azimuth and the measured Qibla azimuth. This visualization indicates that mosque buildings should ideally be oriented between west and northwest, commonly referred to as west-northwest (WNW). However, in reality, most mosque buildings in the Seram Utara Timur Kobi District tend to face directly west. This is because the general perception among Indonesians is that the Qibla lies due west. As a result, it is not surprising that nearly all Islamic places of worship in Indonesia, including mosques and prayer rooms (mushalla), face west—the direction associated with the sunset (Siregar & Muhammad, 2024). Furthermore, the Qibla azimuth accuracy data in the sixth column of Table 02 can be interpreted in graphical form to clearly show which mosques in Seram Utara Timur Kobi District, Central Maluku Regency, have the highest levels of accuracy.

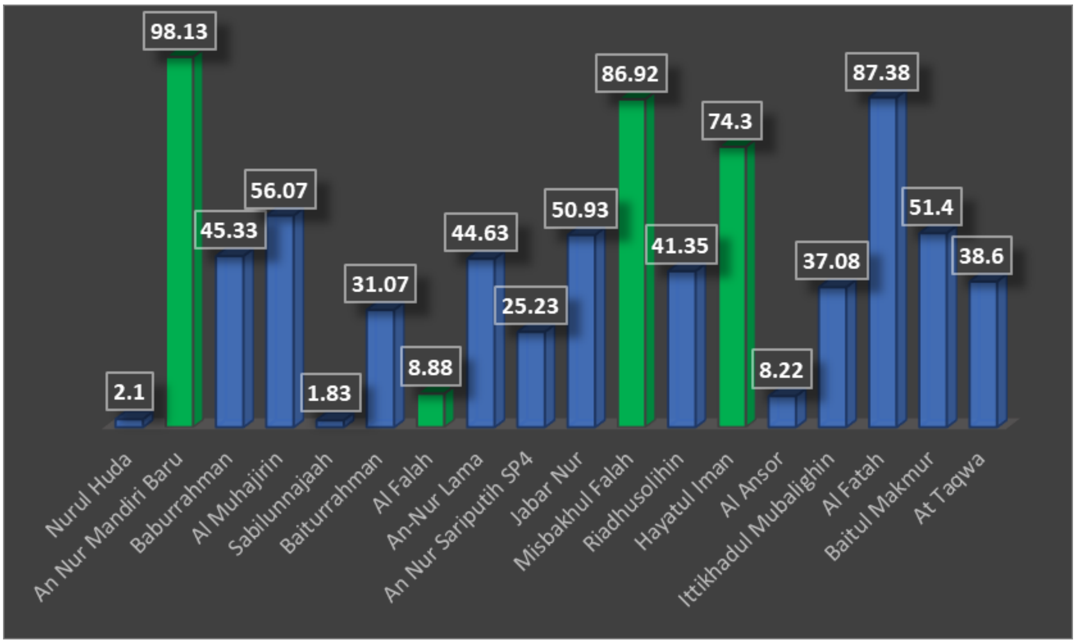

Figure 20. Qibla Azimuth Accuracy Graph of Mosques in Seram Utara Timur Kobi District (Source: Research Data, 2024)

The graph above shows that in the Seram Utara Timur Kobi District, most mosque qibla azimuths are inaccurate. Based on the identification results, only one mosque has a highly accurate qibla azimuth, namely An-Nur Mosque in Mandiri Baru Village. Two mosques have azimuth accuracy that can be categorized as good, namely Misbakhul Falah Mosque in Sariputih Unit N Village and Al-Fatah Mosque in Waimusi Village. These findings indicate the need for realignment of the qibla direction in those mosques, since an angular deviation of 1 arcminute equals 1.85 km, while a deviation of 1 degree corresponds to 111.111 km. Mosques with even greater deviations can be confirmed to no longer face the Masjid al-Haram in Mecca. However, realigning the qibla azimuth of a mosque does not require demolishing or destroying the structure; it is sufficient to adjust the angle of the prayer rows (shaf) within the mihrab and interior prayer space of the mosque (Friatna et al., 2023).

Conclusion

Based on the results and discussion, it can be concluded that the two-dimensional mapping using the four-direction laser system on the azimuth of mosque buildings shows that, although located in the same region, the mosques in Seram Utara Timur Kobi District do not face a uniform qibla direction. Many mosques are overly oriented toward the west. Most of the qibla azimuths of the mosques in this district are inaccurate and therefore need to be realigned to accurately face the Kaaba in the city of Mecca.

References

Butar-Butar, J. R., & Setiawan, H. R. (2018). Pengakurasian arah kiblat di lingkungan Cabang Muhammadiyah Medan Denai. *Al-Marshad: Jurnal Astronomi Islam dan Ilmu-Ilmu Berkaitan*, 4(1), 12–30. https://doi.org/10.30596/jam.v4i1.1932

Friatna, I., Mustaqim, R. A., & Putra European, E. (2023). Penentuan arah kiblat Masjid Al-Mukarramah di Gampong Punge Jurong Kecamatan Meuraxa Kota Banda Aceh. *Jurnal El-Hadhanah: Indonesian Journal of Family Law and Islamic Law*, 3(2), 153–172. https://doi.org/10.22373/hadhanah.v3i2.2548

Hamdani, F. F. R. S., Rojak, E. A., Amalia, R., Hutami, A., & Rosyidah, U. (2020). An accuracy test of Qibla direction measurement of mosques and prayer rooms. *Advances in Social Science, Education and Humanities Research*, 409(SoRes 2019), 82–87. https://doi.org/10.2991/assehr.k.200225.018

Hosen, H., & Ghafiruddin, G. (2018). Akurasi arah kiblat masjid di wilayah Kecamatan Pademawu Kabupaten Pamekasan dengan metode Mizwala Qibla Finder. *Al-Ihkam: Jurnal Hukum & Pranata Sosial*, 13(2), 364–384. https://doi.org/10.19105/al-ihkam.v13i2.1837

Iskandar, M. F., Nugroho, M. H., & Laehka, A. (2024). Peran otoritas keagamaan dalam penetapan 1 Syawal di Indonesia dan Thailand serta implikasi sosialnya. *Azimuth: Journal of Islamic Astronomy*, 5(2), 1–12. https://doi.org/10.15642/azimuth.v5i2.2658

Lailiyah, N., Timisela, N. R., & Kaplale, R. (2018). Analisis produksi padi sawah (Oryza sativa L.) tadah hujan di Desa Lea Wai Kecamatan Seram Utara Timur Kobi. *Agrilan: Jurnal Agribisnis Kepulauan*, 5(2), 151–165. https://doi.org/10.30598/agrilan.v5i2

Mahaendra, I., & Rofiuddin, A. A. (2024). Robot pengukur arah kiblat berbasis offline untuk penyandang tuna netra. *Jurnal Alwatzikhoebillah: Kajian Islam, Pendidikan, Ekonomi, Humaniora*, 10(2), 388–401. https://doi.org/10.37567/alwatzikhoebillah.v10i2.2728

Muhajir, M., Yahya, I., & Suleman, F. (2022). Analysis of Qibla direction at Jami Al Iman Mosque Sunan Geseng Loano Purworejo. *Jurnal Ilmiah Al-Syir'ah*, 20(2), 101–115. https://doi.org/10.30984/jis.v20i2.2013

Nurmila, I. (2017). Metode azimuth kiblat dan rashdul kiblat dalam penentuan arah kiblat. *Istinbath: Jurnal Penelitian Hukum Islam*, 15(2), 191–212. https://doi.org/10.36667/istinbath.v15i2.26

Padil, A. (2013). Dasar-dasar ilmu falak dan tata koordinat: Bola langit dan peredaran matahari. *Al Daulah: Jurnal Hukum Pidana dan Ketatanegaraan*, 2(2), 195–214. https://doi.org/10.24252/ad.v2i2.1476

Putri, Z. S., & Rosyidi, M. (2024). History development instruments measuring the Qibla in Indonesia. *Al-Afkar, Journal for Islamic Studies*, 7(2), 123–135. https://doi.org/10.31943/afkarjournal.v7i2.966

Rauf, N. S. A., & Supardin. (2020). Akurasi arah kiblat masjid di Kelurahan Alliritengae Kabupaten Maros. *Hisabuna: Jurnal Ilmu Falak*, 1(1), 45–58. https://doi.org/10.24252/hisabuna.v1i1.13102

Rohana, N. P. P. (2024). Accuracy of Qibla direction of the mosque with the Qibla shadows and Rashdul Qibla methods. *Al-Marshad: Jurnal Astronomi Islam dan*

Ilmu-Ilmu Berkaitan, 10(1), 35–49. https://doi.org/10.30596/jam.v10i1.17117
Sakirman, S. (2018). Formulasi baru arah kiblat: Memahami konsep Rasydul Kiblat harian Indonesia. *Al-Qisthu*, 16(1), 1–8. https://doi.org/10.32694/qst.v16i1.781
Sayehu, S., & Aspandi, A. (2023). Fiqh and astronomical Rashdul Qibla: Determining the direction of the Qibla by using Stellarium. *Al-Marshad: Jurnal Astronomi Islam dan Ilmu-Ilmu Berkaitan*, 9(1), 41–58. https://doi.org/10.30596/jam.v9i1.14554
Siregar, M. H., & Muhammad, M. (2024). Kiblat dan perubahan persepsi sosial pasca gempa tahun 2004 di Indonesia. *Jurnal Pemberdayaan Masyarakat*, 12(2), 92–100. https://doi.org/10.37064/jpm.v12i2.21535
Solehuwey, E., Mardiatmoko, G., & Boreel, A. (2024). Analisis deforestasi dan degradasi hutan di Kecamatan Seram Utara Timur Kobi, Kabupaten Maluku Tengah. *Jurnal Hutan Pulau-Pulau Kecil*, 8(1), 37–50. https://doi.org/10.30598/jhppk.v8i1.12774
Sriani, S. O., & Ukhti, L. (2022). Uji akurasi arah kiblat menggunakan fitur kompas kiblat pada aplikasi Quran Kemenag versi 2.1.4. *Astroislamica: Journal of Islamic Astronomy*, 1(2), 213–231. https://doi.org/10.47766/astroislamica.v1i2.951
Syukur, M., & Basri, M. H. (2019). Formulasi trigonometri dalam pembuatan software penentuan arah kiblat berbasis Visual Basic. *Jurnal Intake: Jurnal Penelitian Ilmu Teknik dan Terapan*, 10(2), 79–82. https://doi.org/10.48056/jintake.v10i2.56
Thoyfur, M. (2021). Perkembangan metode dan instrumen arah kiblat abad pertengahan: Studi kajian historis perspektif David A. King. *Al-Afaq: Jurnal Ilmu Falak dan Astronomi*, 3(1), 41–58. https://doi.org/10.20414/afaq.v3i1.2879
Zellatifanny, C. M., & Mudjiyanto, B. (2018). The type of descriptive research in communication study. *Jurnal Diakom*, 1(2), 83–90. https://doi.org/10.17933/diakom.v1i2.20