

INTEGRATING METHODS FOR MEASURING QIBLA DIRECTION A Comparative Analysis of Google Earth and Mizwala

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Abstract

The accuracy of measuring the qibla direction of the mosque in Kendal, Central Java, needs attention from astronomy because the majority of people only know the traditional qibla direction measurement tool namely using a compass and the sun's shadow even though errors in the use of these methods often results in inaccurate measurement and have an impact on the validity of the prayers performed. Therefore, this study compares two methods that are easy for the public to use, namely Google Earth and Mizwala. Google Earth is a method to check the qibla direction while Mizwala is a comparison method to improve Google Earth. Through mathematical qualitative methods with data collection techniques through observation and interviews this study found that these two methods are the easiest and most accurate to determine the qibla of all mosques. The method of data collection was carried out by calculating and measuring the qibla direction

towards 1 mosque and 5 mushollas. Although the two methods differ in terms of appearance, with Google Earth using a satellite network while Mizwala using the sun's shadow, both of them can be used in an easy and integrative way. The result of Mizwala's measurements with Google Earth conclude error tolerance that is a range of minutes of angle. In the end, the two methods can be integrated to help and increase public awareness about the importance of correct qibla direction accuracy.

Keywords: *qibla direction; Google earth; Mizwala.*

A. INTRODUCTION

Studies on measurement methods have long been carried out by researchers. Among these studies is a writing about a simple method of determining the Qibla, namely using the shadow of the Sun above the zenith of the Kabba or the Grand Mosque.¹ This article proves the best clock solution for Qibla measurement using shadows in the city of Bandung. Another study in the form of a dissertation examines the accuracy of each method of determining Qibla in the perspective of astronomy and navigation scientific theory, the accuracy of each method of determining Qibla in the perspective of astronomy and navigation scientific theory.² Another study by A. Djamil examines the application of *Rasydul qiblah* in a number of locations in Metro Lampung and several places in Indonesia.³ However, research on the collaboration of two Qibla measurement methods that can be understood by rural communities has not been carried out.

Determination of the qibla direction of mosques and prayer rooms in the community in general uses a compass as a practical tool. Qibla determination with this method clearly shows inaccuracies because the compass shows magnetic north, even though in measuring the qibla direction a true north point is needed

¹ Moedji Raharto, *Telaah Indikator Arah Kiblat Melalui Bayang-Bayang Oleh Matahari Pada Saat Di Dekat Zenith Ka'bah* (Yogyakarta, 2007).

² Ahmad Izzuddin, *Kajian Terhadap Metode-Metode Penentuan Arah Kiblat Dan Akurasinya* (Jakarta: Kementerian Agama RI, 2012).

³ A. Jamil and Sakirman, *Rasydhul Qiblah Global Dan Lokal (Teori dan Praktik)* (Yogyakarta: Idea Press, 2019).

so that the qibla azimuth can be applied correctly. As the results of the study which states that there is a correlation between the magnetic declination of the compass and the accuracy of the qibla direction of a place.⁴ In addition, the most familiar method known to the public is *rashdul qibla* because this method simply uses a *Bencet* or an upright building to find out the shadows of the qibla direction. However, if the application of this method is not in accordance with the accurate time, the qibla shadow shows incorrectly.

In urban communities, the community's mindset towards the qibla direction, especially in public spaces in Sleman Regency, is considered to have an Islamic quality of life. This is as the qibla direction of the mosque in Jogja International Hospital, the mosque and prayer room at Adisujipto Airport, and the mosque in Ambarukmo Mall have deviations of less than one degree which means they have a good understanding as a reflection of the quality of Islamic life.⁵ In other studies, there are also those that discuss the qibla accuracy of supermarkets in Cirebon.⁶ The study concluded that the direction of the mosque in the supermarket in Cirebon has been measured using a compass and qibla application on a smartphone. This clearly has inaccuracies on the grounds of not knowing astronomy and not knowing the approximate angle of the qibla magnitude in the city of Cirebon.

There are also several studies related to the qibla direction of mosques and prayer rooms where the qibla deviation occurred due to the condition of the building structure such as following the alley and following the shape of the size of the land. The mapping of the qibla direction of mosques and prayer rooms in Bandung Wetan District concluded that 70.1% of the qibla deviation was below

⁴ Arino Bemis Sado, "Pengaruh Deklinasi Magnetik Pada Kompas Dan Koordinat Geografis Bumi Terhadap Akurasi Arah Kiblat," *AL-AFAQ: Jurnal Ilmu Falak dan Astronomi* 1, no. 1 (2019): 1–12.

⁵ Anisah Budiwati and Saiful Aziz, "Akurasi Arah Kiblat Masjid Di Ruang Publik," *Jurnal Sains Sosial dan Humaniora* 2, no. 1 (2018).

⁶ Samsudin, Kusdiyana, and Rizal Ramadhan, "Accuracy Test of Supermarket's Mushola Qibla Direction in Cirebon City," *Mizani: Wacana Hukum, Ekonomi, dan Keagamaan* 8, no. 2 (2021): 171–188.

1 degree and the remaining 29.9% was above 1 degree with the farthest deviation of 7 degrees 6 minutes.⁷

Another study on the limits of the deviation of the qibla direction resulted in the conclusion that there are two types of tolerance for the qibla direction, namely mathematically and sociologically.⁸ Mathematically tolerance to lead to the location of the Kaaba, the location of the Grand Mosque, and the location of the Haram. While sociologically tolerance for qibla deviation is defined as 6° arc to the left or right of the Kaaba building. The use of mathematical qibla direction tolerance is intended for the construction of places of worship such as mosques and prayer rooms, while the sociological tolerance for qibla direction in Islamic law is intended for people who perform prayers.

B. METHOD

This study adopted a qualitative type of research with astronomical mathematical analysis, in which this study described the condition of the qibla direction of the mosque and prayer room in Gepor, Sukorejo Kendal, Central Java. An astronomical mathematical approach is used to determine the qibla direction of 1 mosque and 5 prayer rooms using spherical trigonometry theory and two methods, namely Google Earth and Mizwala.

The method used in this research consists of two methods, namely Google Earth and Mizwala. As stated in Efistek.com, Google Earth is a virtual program that can display all images in the world obtained from satellites, aerial photography, and *Geographic Information System* (GIS) applications.⁹ This application is different from ordinary maps that are displayed in 2D. It displays

⁷ Fahmi Fatwa Rosyadi Satria Hamdani, "Verifikasi Dan Pemetaan Arah Kiblat Bangunan Masjid Dan Musola," *HAYULA: Indonesian Journal of Mustidisciplinay Islamic Studies* 4, no. 2 (2020): 171–188.

⁸ Ismail Ismail, Dikson T. Yasin, and Zulfiah, "Toleransi Pelencengan Arah Kiblat Di Indonesia Perspektif Ilmu Falak Dan Hukum Islam," *Al-Mizan* 17, no. 1 (2021): 115–138.

⁹ Ibid.

the entire image in the framework of a globe and can access large cities in detail with high resolution.

The second method is Mizwala. This tool is used to determine the qibla direction based on the azimuth position of the Sun, the start of prayer times and true north. This tool has been modified using acrylic and other materials, making it easier to find the angle unit in degrees.¹⁰ This is different from the results of a study that examined Mizwandroid, which is Hendro Setyanto's Qibla measurement innovation of Mizwala Qibla Finder in 2019.¹¹ This tool is an application that utilizes the device's magnetic compass sensor and camera features on smartphones so that users can immediately find out the Qibla direction according to real environmental conditions. In addition, the latest innovation is the choice of calibration objects with the choice of using the position of the Sun, the shadow of the Sun, and the position of the Moon.

The informants of this study were 6 mosque administrators (*takmir*) and community leaders who knew the conditions and history of determining the qibla direction of mosques and prayer rooms. This study used a purposive sampling technique where the data is selected based on the suitability of the theme with the objectives to be obtained.¹² In this study, interviews were conducted to find out what method was most widely used by the community, then the qibla was checked using Google Earth and verified with Mizwala in the field.

In addition, the data collection method used interviews to find out the history of determining the qibla direction and the choice of measurement methods that were familiar to the community. Meanwhile, observations were made virtually using Google Earth and field observations using Mizwala to measure the qibla direction.

¹⁰ Anisah Budiwati, *Teori Dan Aplikasi Ilmu Falak Di Perguruan Tinggi Islam* (Yogyakarta: Universitas Islam Indonesia, 2017).

¹¹ Nur Sidqon, "Uji Akurasi Mizwandroid Karya Hendro Setyanto" (UIN Walisongo Semarang, 2019).

¹² Raihan, *Metodologi Penelitian* (Jakarta: Universitas Islam Jakarta, 2017).

The data analysis technique was carried out qualitatively mathematically by using the astronomical calculation formula with reference to the spherical triangle theory, namely as follows.¹³

$$\text{Cotan } Q = \frac{\tan \phi_k \times \cos \phi_x}{\sin C} - \sin \phi_x \times \text{cotan } C$$

Annotation:

Q = qibla angle

b = latitude of Kaaba (ϕ_k)

a = latitude of location (ϕ_x)

C = longitude distance between Kaaba and location

C. RESULT AND DISCUSSION

1. Profile of Gepor Kendal Jawa Tengah

Gepor 1 is located in Mulyosari Village, Sukorejo District, Kendal Regency, Central Java Province. It was told that in the past Gepor started with a kiai named Kiai Abdul Gofur who founded the location. Until now the tomb of Kiai Abdul Gofur is still often visited by pilgrims who want to make a pilgrimage to his tomb which is in the tomb of Gepor. Gepor 1 has an area of about 75 km² and is directly adjacent to Jingsang which is to the north of Gepor, to the south it is bordered by Tamanrejo Village, to the east by Pesaren Village, and to the west by Damar Jati Village.

While 100% of the population of Gepor 1 are Muslim, according to Makmun as the head of the Gepor, this area is lacking experts on astronomy (falak).¹⁴ Gepor 1 has a place of worship in the form of a mosque and a small prayer room, totaling 1 mosque and 9 prayer rooms. In addition to places of worship, other public facilities that support community activities are multipurpose buildings, soccer fields, and parks. However, the park is no

¹³ Slamet Hambali, "Metode Pengukuran Arah Kiblat Dengan Segitiga Siku-Siku Dari Bayangan Matahari Setiap Saat" (IAIN Walisongo, 2010).

¹⁴ Participant1, Personal Communication (March 12, 2022).

longer functioning properly because it is not well maintained. The function of the mosque runs optimally in activities related to worship, especially prayers.

According to Makmun, one of the mosque's *takmir*, the mosque is always used for congregational prayers, Friday prayers, Eid prayers and other prayers.¹⁵ Eid prayer is usually done in the mosque or in a large field where *istikharah* prayers is also conducted when people really need rain. During the covid-19 pandemic, prayers were held at the mosque as usual with health protocols. There was no reduction in the number of worshipers in the obligatory prayers and Friday prayers. It is just that from the end of 2021 to the beginning of 2022 Friday prayers were temporarily transferred to another building because the mosque was under construction. All of the mosques and prayer rooms in Gepor 1 have been renovated, however the mosques and prayer rooms in Gepor 1 have never directly invited the ministry of religion to re-measure the qibla direction and for now they are still following the same qibla direction as at the beginning of its construction.

2. History of Mosque and Musholla

2.1. Mosque of Baiturrohim

Baiturrohim Mosque is the only mosque in Gepor 1 (7° 6' 50.2" S, 110° 0' 57.0" E). The mosque was first built around 1942. Takmir Baiturrohim Mosque which is currently led by Ahmad Sifa have lasted for 11 years. This mosque has been renovated three times in the last 80 years. The first renovation was carried out in 1973 and the second time in 1972 and the third in late 2021 to early 2022.

The direction of the current building still follows the structure of the building at the beginning of its construction and the direction of the qibla also follows the direction of the qibla when it was first measured.

¹⁵ Ibid.

At that time, namely in 1942, the measurement of the qibla direction was carried out by the first *takmir* candidate and the builders who would build the mosque. Then after finding the qibla direction of the building, it is adjusted to the predetermined qibla direction, so that the qibla direction is in accordance with the direction of the building so far.

The measurement of the qibla direction was first carried out by *takmir* and craftsmen using the compass method. In 1997, a re-measurement was carried out, but the results remained the same. The re-measurement was carried out using the compass method. In the past, the Ministry of Religion had also been briefed on the correction of the qibla direction of the compass degrees on drawing paper and then the thread was drawn towards the Kaaba, and the second was using shadows from the sun.

When the mosque is re-measured to see the shift in the direction of the qibla with the previous direction, the method using the bent or shadow method is tried from iron that is plugged into the concrete in the form of a beam and n-shaped iron. According to Ahmad Syifa as the mosque's *takmir*, the use of the bench was previously used as a measure of prayer times, not for the qibla direction.¹⁶

2.2. Musholla Baitussalam

The Baitusallam Mosque is the oldest prayer room built around 1948. The current *Takmir* of the Baitusallam Mosque is Rohmadi. Baitusallam Mosque is located in RT 13, RW 04, Gepor, Mulyosari Village, Sukorejo District, Kendal Regency (7° 6' 47.1 S, 110° 0' 58.2 E).

According to the *takmir* of the Baitusallam mosque, Rohmadi, the early history of measuring the direction of the Baitusallam mosque was first carried out by the *takmir* and the builders who built the mosque.

¹⁶ Participant2, Personal Communication (February 27, 2022, 2022).

Measurement of the qibla of the Mosque used a compass and then an agreement was made that the direction was there. The direction of the qibla has been there for a long time, so there has been no change until now. Rohmadi suggested that what is important now in performing worship is to be sure of the qibla. Since before he was born, there has been a prayer room and mosque, so maybe the qibla has already been there (the Kaaba), so new people don't know exactly and just follow what is already there.¹⁷ The mosque has been renovated and the last time it was renovated was around 2010. Until now, the qibla direction has not been re-measured by the previous *takmir*.

2.3. Musholla Nurul Abror

The Nurul Abror Musholla was first established in 2007 with a building area of 8x6 m then an additional building on the north side of 8x4 was made for female worshipers because the previous building could not accommodate worshipers. The Nurul Abror prayer room is located in RT 20 RW 05, Gepor, Mulyosari Village, Sukorejo District, Kendal Regency (7° 6' 55.7 S, 110° 0' 51.4" E). Mashuri has been the head of the *takmir* of the Nurul Abror musholla since the mosque was first built, starting in 2007 until now, which means that he has been the head of the *takmir* of the mosque for 15 years.

The Nurul Abror prayer room was built on waqf land from Mashuri, with the building costs being carried out with joint funds from residents around the mosque. The measurement of the qibla direction was carried out when the mosque was first built using the compass method. Measurements were carried out together with the prospective *takmir* of the mosque and the builder who will build the prayer room. Mashuri said that since 2007 until now the qibla direction has not been

¹⁷ Participant3, Personal Communication (February 25, 2022, 2022).

measured, and the qibla direction has followed what it is from the beginning of construction until now. As he said,

“In the past, it was matched using a picture, but it still fits. If I don't know the measurement method, I only know about the compass and the *Bencet* is the first ancient tool. I only knew that at the time of the Prophet, if the shadow was on the tip of a spear, then it would enter the duha time, but now it is converted into minutes, I don't understand the current models.”¹⁸

2.4. Musholla Al Huda

Al Huda Musholla is located in RT 20, RW 05 Dusun Gepor, Mulyosari Village, Sukorejo District, Kendal Regency (7° 6' 57.2" S, 110° 0' 50.9" E). The mosque was founded around 1950 and the building has been renovated 3 times. From the beginning the prayer room was built and has been renovated several times, the qibla direction of the Al Huda prayer room still follows the direction of the previous measurements.

Based on an interview with Mr. Nastain as the administrator of the Al Huda Mosque, the mosque was originally measured with a compass.¹⁹ Then it was measured again by the annual *rashdul qibla* method, referring to the Muhammadiyah calendar which also included the schedule for the *rashdul qibla* in 2016. In addition, the method known by the *takmir* and some worshipers (jamaah) of the Al Huda Mosque is to use the *Bencet*. The construction of the Al Huda Mosque itself follows the direction of the highway that is next to the mosque and adjusts to the available land in the area. However, at the beginning of its construction, it also used a compass to determine the direction of the qibla itself.

¹⁸ Participant4, Personal Communication (February 26, 2022, 2022).

¹⁹ Participant5, Personal Communication (February 26, 2022, 2022).

2.5. Musholla Baitul Muttaqin

The Baitul Muttaqin Mosque is located in RT 16, RW 05, Gepor, Mulyosari Village, Sukorejo District, Kendal Regency ($7^{\circ} 6' 53.9''$ S, $110^{\circ} 0' 55.8''$ E). Baitul Mutaqin Mosque began to be established around the year 1979, when the prayer room was still a wooden building with a pit or better known as a stage. Then the building was renovated several times and the last time it was renovated was in 2011. Currently the building is a wall with ceramics and has two floors.

Based on the interview with Salamun as the *takmir* of the Baitul Muttaqin musholla, at the beginning of the construction of the prayer room, the determination of the qibla used a compass like any other prayer room. In addition, the current qibla direction has never been measured again. When people explain the direction of the qibla, they tend to say that the qibla direction is facing the northwest direction.²⁰

2.6. Musholla Al Hidayah

Al-Hidayah Mosque is located in RT 16, RW 05 Gepor, Mulyosari Village, Sukorejo District, Kendal Regency ($7^{\circ} 6' 55.3''$ S, $110^{\circ} 0' 54.1''$ E). This Mosque has been around since 1980 but at that time the prayer room was still a wooden stage, just like the Baitul Mutaqqin Mosque. Then in 1980 the mosque began to be renovated by adding walls and after that a major renovation was carried out in 2010.

Measurement of the qibla direction at the beginning of the construction of the Al Hidayah Mosque was done using a compass. The construction of the prayer room cannot be carried out freely because it is blocked by the contours of the land in the area to be built which is on a cliff and on the side of a village road. Therefore, the community agreed that the development would maximize the land area.²¹

²⁰ Participant6, Personal Communication (February 27, 2022, 2022).

²¹ Participant7, Personal Communication (February 27, 2022, 2022).

3. Comparative Analysis of Google Earth and Mizwala

Based on the results of checking the qibla direction using Google Earth and field measurements using Mizwala, there are several parameters that are seen as a comparison concept between two methods.

3.1. Operational Technical Aspect

The technical use of the two methods in this research is seen in the input, process, and output processes. The Google Earth method is a method that uses an internet basis in determining the qibla direction, while the Mizwala method uses the Sun. The process carried out by each method is as follows.

Google Earth is a free application that can help determine the qibla direction of a building whose images are taken from above based on the database provided by Google Earth. Using Google Earth is limited to checking the azimuth of a building and the direction of the qibla which should lead to the Kaaba in Masjidil Haram, Mecca.

The important parts used in this software are

a. Place location search

Search for the coordinates of a place using a cursor that points directly at the mosque or prayer room building

b. Icon to mark location (nail icon)

The nail icon in the software menu bar is used to make it easier to get to the location by just clicking on the place

c. Icon to know direction (ruler icon)

To show a picture of the deviation of the qibla line. This menu is used to see the direction or azimuth of one point to the second point (location of the Mosque/Musholla to the Kaaba in Masjidil Haram, Mecca).

The results of the qibla measurement using Google Earth can be seen in the heading available on the ruler symbol and to find out the

qibla deviation by comparing the two lines between the building direction and the qibla direction that has been connected to the Kaaba point.

Next on the technical aspect of the use of Mizwala which uses the Sun as an aid in defining the qibla direction. The use of this tool is as an instrument for the practice of *rukyyatul hilal* to find out true north based on the position of the sun.

This tool consists of several important parts, namely:

- a. Gnomon (standing stick or so-called *tongkat istiwa'*)
- b. The dial area (circular or circular plane) is equipped with a measure of angle degrees up to 360°.
- c. Small compass in the corner of Mizwala
- d. Three points of support (to adjust the level and elevation of Mizwala)

The procedure for using this tool can be said to be practical because several things are easy to prepare as follows:

- a. Put Mizwala in a place that is exposed to the sun and store it in a flat place (use a waterpass to find out the flatness of the place)
- b. Prepare data in Mizwala software by setting the time zone, latitude and longitude of the place and the calculation of the required time interval, for example 3 or 5 minutes.
- c. Pay attention to the software by looking at the Mizwah data at a certain hour, placing the shadows of the sun on the shadow line contained in the Mizwala.
- d. Pay attention to the opposite direction of the shadow line to find out true north
- e. Use the thread to find the qibla angle number (which has been calculated by the software) on the Mizwala dial area.

3.2. The Accuracy Aspect

The accuracy of the qibla measurement results from these two methods can be said to be close to the same relative value. This can be seen from the measurement results to determine the deviation of each mosque and prayer room. The following are the results of measurements using the Mizwala and Google Earth methods.

Table 1. qibla angle all of Mosque and Musholla

Mosque ^{*)}	Coordinate	qibla angle
1	7° 6' 50,2" S, 110° 0' 57,0" E	294° 37' 41"
2	7° 6' 47,1 S, 110° 0' 58,2 E	294° 37' 40"
3	7° 6' 55,7 S, 110° 0' 51,4" E	294° 37' 44"
4	7° 6' 57,2" S, 110° 0' 50,9" E	294° 37' 44"
5	7° 6' 53,9" S, 110° 0' 55,8" E	294° 37' 42"
6	7° 6' 55,3" S, 110° 0' 54,1" E	294° 37' 43"

*)Mosque Baiturrohim, Musholla Baitussalam, Musholla Nurul Abror, Musholla Al-Huda, Musholla Baitul Muttaqin, dan Musholla Al-Hidayah

Table 2. Deviation angle using Mizwala

Name of Mosque	Deviation Angle
Mosque Baiturrohim	4° 19' 39.53"
Musholla Baitussalam	1° 35' 13.68"
Musholla Nurul Abror	0° 17' 24.37"
Musholla Al-Huda	14° 42' 0.11"
Musholla Baitul Muttaqin	7° 43' 43.09"
Musholla Al-Hidayah	5° 3' 53.35"

Table 3. Deviation angle using Google Earth

Name of Mosque	Deviation Angle
Mosque Baiturrohim	4° 49' 19"
Musholla Baitussalam	2° 57' 7"
Musholla Nurul Abror	0° 13' 19"
Musholla Al-Huda	9° 40' 41"
Musholla Baitul Muttaqin	12° 7' 05"
Musholla Al-Hidayah	4° 43' 05"

From the results of the comparison above, basically there are several things that need to be considered to approach the definition of qibla accuracy, namely as follows.

1. Qibla angle deviation range

The results of Mizwala and Google Earth measurements in each mosque have a difference of 1-3 degrees, except for the Baitul Muttaqin prayer room which has a fairly high angle difference of about 6 degrees. This is a natural thing because deviations from using Google Earth are quite high and Mizwala's results are also high. This shows when there is a difference with the qibla angle which should also be interpreted as tolerance, namely the value of deviation from the direction of the mosque building which is allowed to deviate from the value of the qibla direction.²²

2. Error during data input

The process of entering data in measuring the qibla direction is the coordinates of the mosque or prayer room. When researchers use Google Earth, they have to make sure that the internet signal network is stable as so there are no errors during the measurement process.²³ In field measurements using Mizwala, it should be placed on a flat place so that the shadow of the Sun at the specified hour does not show the wrong shadow of the Qibla.

3. Weakness during measurement

One of the weaknesses of measurement is the problem of human error and natural factors that do not support measurement. First, human error in measuring the qibla direction can be caused by a lack of community competence and skills in using measurement tools.²⁴ Measurement using two methods, both Google Earth and Mizwala, requires good knowledge of how to use both methods. The procedure for using the two methods

²² Ismail, T. Yasin, and Zulfiah, "Toleransi Pelencengan Arah Kiblat Di Indonesia Perspektif Ilmu Falak Dan Hukum Islam."

²³ Laila Zulfa and Putri Rachmadiyah, "Analisis Penggunaan Media Google Earth Di Sekolah Dasar (Studi Kasus Di Siswa Kelas V SD Nurul Huda Surabaya)," *Jurnal Penelitian Pendidikan Guru Sekolah Dasar* 10, no. 2 (2022).

²⁴ Rahmatiah HL, "Pengaruh Human Error Terhadap Akurasi Arah Kiblat Masjid Dan Kuburan Di Kabupaten Gowa Provinsi Sulawesi Selatan," *El-Falaky: Jurnal Ilmu Falak* 4, no. 2 (2020): 170–185.

must be based on knowledge of the theory and stages of the qibla direction measurement method so as to avoid technical errors. Second, natural factors that do not support the measurement, namely the weather conditions that affect the measurement results. The mizwala method (which has the same concept as the qibla measurement method using the Sun's azimuth) is very dependent on sunlight because qibla measurement cannot be carried out when the weather is cloudy and there is no sunlight.²⁵

From the results of research that has been carried out by previous researchers, it can be seen that the majority of research related to the Mizwala method is only limited to its definition and function. For example, Lutfi Nur Fadhilah found in his thesis that the word mizwala is arabic language which means sundial as a tool to know time through the help of a shadow of the sun. His research concludes that the use of a sundial or also known as a *Bencet* still exists and is widely used in Islamic boarding schools and mosques, but in its use, calibration is required that takes into account the coordinates of the location, type of bench, local time correction and clock accuracy.²⁶

Research states that the Mizwala Qibla Finder method has a high enough accuracy so that it can be used anytime and anywhere.²⁷ However, the measurement of Mizwala by the community must still be refined by empowering the human resources owned by the mosque or prayer room because according to research results community empowerment in mastering the science of measuring qibla, especially using the sun and compass with magnetic correction can be

²⁵ Nailur Rahmi and Yoga Agustio, "Pengukuran Arah Kiblat Tempat Ibadah Dengan Aplikasi Arah Kiblat Dan Azimuth Matahari," in Batusangkar Internasional Conference V (Batusangkar, 2020), 251–272.

²⁶ Lutfi Nur Fadhilah, "Eksistensi Penggunaan Jam Bencet Di Pondok Pesantren Dan Masjid Di Jawa" (UIN Walisongo Semarang, 2020).

²⁷ Arwin Juli Rakhmadi Butar-Butar and Hasrian Rudi Setiawan, "Pemanfaatan Instrumen Astronomi Klasik Mizwala Dalam Pengukuran Dan Pengakurasion Arah Kiblat," *Maslahah: Jurnal Pengabdian Maslahah* 1, no. 2 (2020).

considered quite efficient, especially at the mosque in the street or a small alley.²⁸ Meanwhile, according to the results of this research, the integration of the Mizwala and Google Earth methods can provide a clearer understanding in Gepor Kendal Village, Central Java. The community in the village have more understanding because it was assisted by Google Earth to show the position of Kaaba as the center of qibla.

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