



WhatsApp Bot Based Prayer Time Schedule Information System

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Abstract: Nowadays, it is very easy to find out the beginning of prayer times, because there are so many providers of prayer time schedule information, both on the internet and prayer time schedule applications. It would be more interesting if the prayer time schedule could be accessed via the WhatsApp application, which is an instant messaging application that is quite popular among the public today, so there is no need to install a special application or open a specific website to get the desired prayer time schedule. This paper aims to design a prayer time schedule information system based on WhatsApp Bot and test the verification of the current time schedule results obtained from the WhatsApp Bot. This study uses a research and development method with a descriptive approach. The results of this study are in the form of a prayer time schedule information system based on WhatsApp Bot which is built with NodeJS programming. Then from the accuracy test using the Bimas Islam website and several prayer time schedule providers, there is no difference in the results. Because the solar data used has a relatively similar level of accuracy, and the prayer time schedule calculation algorithm used is the same. So that the prayer time schedule produced by WhatsApp Bot has an accuracy that is worthy of being used as a reference for entering prayer times.

Keywords: Prayer Time, WhatsApp Bot, Information System.

Abstrak: Pada masa ini untuk mengetahui awal waktu salat amat sangat mudah, karena penyedia informasi jadwal waktu salat sudah sangat banyak baik yang beredar di internet maupun aplikasi-aplikasi jadwal waktu salat. Akan lebih menarik jika waktu salat dapat diakses melalui aplikasi WhatsApp yang merupakan aplikasi perpesanan instan yang cukup populer di kalangan masyarakat untuk saat ini, sehingga tidak perlu menginstall aplikasi khusus atau membuka website tertentu untuk mendapatkan jadwal waktu salat yang dikehendaki. Tulisan ini bertujuan untuk merancang sistem informasi jadwal waktu salat berbasis WhatsApp Bot serta menguji verifikasi hasil jadwal waktu saat yang didapatkan dari WhatsApp Bot tersebut. Penelitian ini menggunakan metode penelitian dan pengembangan (Research and Development) dengan pendekatan deskriptif. Hasil dari penelitian ini berupa sistem informasi jadwal waktu salat berbasis WhatsApp Bot yang dibangun dengan pemrograman NodeJS. Kemudian dari uji akurasi dengan menggunakan website Bimas Islam dan beberapa penyedia jadwal waktu salat tidak terdapat selisih pada hasilnya. Karena data matahari yang digunakan memiliki tingkat keakuratan yang relatif sama, serta algoritma perhitungan jadwal waktu salat yang digunakan sama. Sehingga jadwal waktu salat yang dihasilkan oleh WhatsApp Bot memiliki keakuratan yang layak untuk dijadikan acuan masuknya waktu salat.

Kata kunci: Waktu Salat, Sistem Informasi, WhatsApp Bot

A. Pendahuluan

As time goes by, methods for determining the beginning of prayer times have also developed. Starting from the calculation method to the method of presenting the results of the initial calculation of prayer times. For this reason, in terms of determining the beginning of prayer times, astronomers make various kinds of calculations which are then presented in such a way as to make it easier for the general public to know the beginning of prayer times, starting from traditional presentations



presented in tables, digital clocks, prayer time information based on web and up to the initial Android-based prayer times application.¹

Meanwhile, information technology is developing very quickly so that with the development of information technology it is hoped that we can do work quickly. Every technology can have positive and negative values, this is also the case with information technology. It has a positive impact because it can provide innovation that makes human life easier. And it can have negative impacts if misused.²

The use of information technology, in this case the use of the internet, which already has various applications such as social media. By using social media, users can search for information, interact with each other and make friends online. As is known, various social media that are currently popular are WhatsApp, Facebook, Instagram, X (Twitter), Line, Telegram, Snapchat and several other social media.³

The social media application that has quite high popularity at the moment is WhatsApp. WhatsApp is a messaging application for smartphones which was called WhatsApp Messenger. WhatsApp Messenger is a cross-platform messaging application that gives us the opportunity to exchange messages without credit, because WhatsApp Messenger uses an internet network or data package to run. According to the Business of Apps website, statistically, WhatsApp users in 2023 will reach more than 2.4 billion users and more than one hundred billion messages every day.⁴

In subsequent developments, WhatsApp was developed with various functions that were able to reply to messages automatically with a program that had been previously set.⁵ For example, a library information service bot that can be used by WhatsApp users to search for a list of books available in the library and information related to borrowing books as well as other functions that can help users get related information just through the WhatsApp application.

The emergence of practical innovations such as WhatsApp, whose use has a large share in society and can provide information needs for users in a simple and very easy way so that sending messages via WhatsApp can be programmed according to the developer's wishes. This paper aims to develop a WhatsApp Bot-based prayer time schedule information program that can provide prayer time schedules according to user requests. It is hoped that this WhatsApp Bot-based prayer time information will make it easier for the general public to access prayer time information practically and easily.

¹TGK. Ismail, *Dinamika Jadwal Waktu Salat Di Indonesia Analisis Peran Dan Wewenang Kementerian Agama* (Yogyakarta: Bildung, 2022).

²Daryanto Setiawan, "Dampak Perkembangan Teknologi Informasi Dan Komunikasi Terhadap Budaya," *Jurnal Simbolika* 4, no. 1 (2018): 67.

³Trisnani, "Pemanfaatan WhatsApp Sebagai Media Komunikasi Dan Kepuasan Dalam Penyampaian Pesan Dikalangan Tokoh Masyarakat," *Jurnal Komunikasi, Media Dan Informatika* 6, no. 3 (2017): 2.

⁴Mansoor Iqbal, "WhatsApp Renew and Usage Statistics (2024)," *Business of Apps*, 2024, <https://www.businessofapps.com/data/whatsapp-statistics/>.

⁵Rizky Parlika et al., "Bot WhatsApp Sebagai Pemberi Data Statistik Covid-19 Menggunakan PHP, FLASK, Dan MYSQL," *Jurnal Informatika Dan Sistem Informasi (JIFoSI)* 1, no. 2 (2020): 282.



B. Method

The research method used in this research is research and development (R&D), namely a research method that aims to create a product and then test how effective the product is.⁶ The approach used in this research uses a descriptive approach, namely a way to find new meanings, explain conditions of existence, determine frequency of appearance, and categorize information.⁷ In this case the author describes the process of creating a WhatsApp Bot-based prayer time information program, then describes descriptively how to test functionality and checking the correctness of the prayer time calculation results produced by the WhatsApp Bot that the author has designed

The primary data source used in this research is the concept of beginning prayer time calculations sourced from the book Ilmu Falak Praktik by the Indonesian Ministry of Religion team and the Astronomical Algorithms book by Jean Meeus as a basic reference for calculating solar data. Other sources are taken from books, journals, papers and writings related to the science of astronomy and programming which are related to the program that the author will design, both in the form of printed documents and electronic books (e-books) as secondary data sources. After the information has been collected, the author describes descriptively the design of the WhatsApp Bot-based prayer time schedule information program and describes how to functionally test and verify the results of the WhatsApp Bot-based prayer time schedule that the author has designed. In this case, the results of the prayer time schedule from WhatsApp Bot are compared with the prayer time schedule from the Bimas Islam website. On the basis that Islamic Guidance is an official state institution which has duties and authority in the field of community guidance, including a prayer time schedule.

C. Hasil dan Pembahasan

1. Algoritma Perhitungan Awal Waktu Salat

The initial prayer time calculation algorithm used as a guideline in this article is the initial prayer time calculation using the Ministry of Religion's ephemeris method, while the calculation of the sun's position data needed for the initial prayer time calculation is taken from the book Astronomical Algorithms by Jean Meeus which has high accuracy. The solar position calculation algorithm given in the Astronomical Algorithm book is a solar position calculation based on the VSOP87 theory consisting of 2425 periodic component components, this number is very large for calculations that are very time consuming and memory consuming. Meanwhile, in the Astronomical Algorithms book, the solar position calculation is given with fewer correction terms because it only adopts important components from the VSOP87 theory.⁸

In developing prayer time schedule information based on WhatsApp bot, this is guided by the ephemeris method prayer time calculation algorithm, because currently this method is used as a

⁶Sugiyono, *Metode Penelitian Pendidikan*, Cet. 1 (Bandung: Alfabeta, 2019), 752.

⁷Raihan, *Metodologi Penelitian* (Jakarta: Universitas Islam Jakarta, 2017), 52.

⁸Jean Meeus, *Astronomical Algorithms*, Second Edi (Richmond: Willman-Bell, Inc, 1991), 206.



reference by the Indonesian Ministry of Religion because the results of this calculation have the most precise level of accuracy. The calculation algorithm is as follows:

a. Beginning of Dzuhur Time

The calculation formula for beginning Dzuhur time can be calculated with the following way :

$$\text{Dzuhur} = 12 - \text{EoT} + (\text{BD} - \text{BT})/15$$

b. Beginning of Ashr Time

To calculate Asar time, there are several steps that must be taken, that is ⁹ :

1. Calculate the zenith distance of the Sun (Z_m) using the formula:

$$Z_m = |\delta_o - LT|$$

If Z_m is negative then it must be made positive.

2. Calculate the altitude of the Sun Ashr using the formula :

$$h_a = \tan^{-1}(\tan Z_m + 1)^{-1}$$

3. The hour angle of beginning Ashr time can be calculated using this formula:

$$\cos t_o = \sin h_a / \cos LT / \cos \delta_o - \tan LT * \tan \delta_o$$

4. Calculating the beginning of Ashr time :

$$\text{Asar} = 12 - e + t_o/15 + (\text{BD} - \text{BT})/15$$

c. Beginning of Maghrib Time

The steps to calculate the beginning of Maghrib time are as follows:

$$h_o = -(\text{ref} + \text{sd} + \text{dip})$$

$$\cos t_o = \sin h_o / \cos LT / \cos \delta_o - \tan LT * \tan \delta_o$$

$$\text{Maghrib} = 12 - e + t_o/15 + (\text{BD} - \text{BT})/15$$

d. The Beginning of Isha' Time

⁹Kemenag RI, *Ilmu Falak Praktik* (Jakarta Pusat: Sub Direktorat Pembinaan Syariah Dan Hisab Rukyat, 2013), 88.



At the beginning of Isha' when the twilight has disappeared with the criteria for the altitude of the Sun being -18° , the calculation can be done in the following way:

$$h_o = -18$$

$$\cos t_o = \sin h_o / \cos LT / \cos \delta_o - \tan LT * \tan \delta_o$$

$$\text{Isya}' = 12 - e + t_o/15 + (BD - BT)/15$$

e. The Beginning of Fajr Time

In the provisions of the Indonesian Ministry of Religion, the start of dawn is when the Sun is at an altitude of -20° ,¹⁰ so the beginning of fajr can be calculated as follows:

$$h_o = -20$$

$$\cos t_o = \sin h_o / \cos LT / \cos \delta_o - \tan LT * \tan \delta_o$$

Then the beginning of the fajr time can be calculated using the formula:

$$\text{Subuh} = 12 - e - t_o/15 + (BD - BT)/15$$

f. Rising Time

The sunrise time can be calculated using the sunset hour angle, namely as follows:

$$\text{Rise} = 12 - e - \text{tomaghrib}/15 + (BD - BT)/15$$

g. Beginning of Dhuha Time

Dhuha time can be calculated in the following way :

$$h_o = 4.5$$

$$\cos t_o = \sin h_o / \cos LT / \cos \delta_o - \tan LT * \tan \delta_o$$

$$\text{Duha} = 12 - e - t_o/15 + (BD - BT)/15$$

2. NodeJs Programing as a WhatsApp Bot Base

Node.js or sometimes simply called Node is a software platform on the server side and network applications for running code written in the JavaScript language, which is then known as the JavaScript runtime environment.¹¹ In carrying out its duties, Node.js uses an engine produced by Google, namely V8. V8 itself is an engine that works to convert JavaScript code into *bytecode* .

¹⁰Karina Aulia Purwanti, "Awal Waktu Salat Subuh Perspektif Kementerian Agama RI" (Universitas Islam Negeri Walisongo, 2022).

¹¹Yuniar Sapardi, *Semua Bisa Menjadi Programmer JavaScript & Node.js* (Jakarta: Elex Media Komputindo, 2021), 1.



This *bytecode* file will later be executed by Node.js.¹² The process of executing bytecode can run faster than executing JavaScript code directly.

With Node.js we can use JavaScript as a programming language to create all types of applications, be it console applications (Command Line Interface – CLI), web applications, GUI-based applications, mobile applications (Android and iOS), even control system applications. and hardware access known as IoT.¹³

The presence of Node.js brought many changes to the world of programming, because Node.js is programming that has many functions, so many problems can be solved with Node.js. In this research, the author wants to build a prayer time schedule information based on WhatsApp Bot. To be able to integrate with WhatsApp through the program that the author will create, an API is needed that allows programs created with Node.js to work with WhatsApp. There are many APIs that have been developed by previous developers. However, here the author uses an API based on Node.js.

When we develop applications with Node.js, we cannot avoid using libraries or modules. The module itself can be likened to a library that contains functions to be used in the application. So there is no need to create your own function from scratch.¹⁴ Currently Node.js has many modules distributed in package form. There are several module packages that can be used to create a WhatsApp API, but this time the author uses the Baileys module which was previously developed in the CS-2362 Project at Ashoka University.¹⁵

Quoting directly from the Baileys website, the developer explains that the Baileys module is a library that allows someone to interact with WhatsApp via web socket. Baileys does not work on selenium or chromium so it can minimize RAM usage, which can speed up application work.¹⁶

From the explanation above, we get that the Baileys library is the most advanced Node.js library that provides a high-level API to control WhatsApp. Baileys is a free library for Node.js or TypeScript application developers which is used to develop WhatsApp client applications which are developed with Node.js programming so that it allows developers to connect to WhatsApp through Node.js programming.¹⁷

¹²Greg Lim, *Begining Node.Js, Express & MongoDB Development* (United States: Greg Lim, 2019).

¹³Budi Raharjo, *Pemrograman Web Dengan Node.Js Dan Javascript* (Bandung: Informatika, 2019), 2.

¹⁴Ahmad Muhandian, “Belajar Nodejs #3: Cara Menggunakan Modul Dalam Aplikasi Nodejs,” Petani Kode, 2018, <https://www.petanikode.com/nodejs-module/>.

¹⁵“GitHub - WhiskeySockets/Baileys,” GitHub, accessed May 9, 2024, <https://github.com/WhiskeySockets/Baileys>.

¹⁶“Baileys,” accessed May 9, 2024, <https://whiskeysockets.github.io/Baileys/>.

¹⁷Daslan Josua Valetino Siahaan et al., *Cara Praktis Membuat Chatbot WhatsApp* (Bandung: Penerbit Buku Pedia, 2023).

3. Implementasi Sistem Informasi Jadwal Waktu Salat Berbasis WhatsApp Bot

This prayer time schedule information system is developed with user-friendly features to ensure accessibility for the general population. Users only need to align their requirements with the system's instructions, such as using specific phrases to identify a reference place and access the daily prayer time schedule. Typically, the author's proposed time schedule information system follows the following sequence:

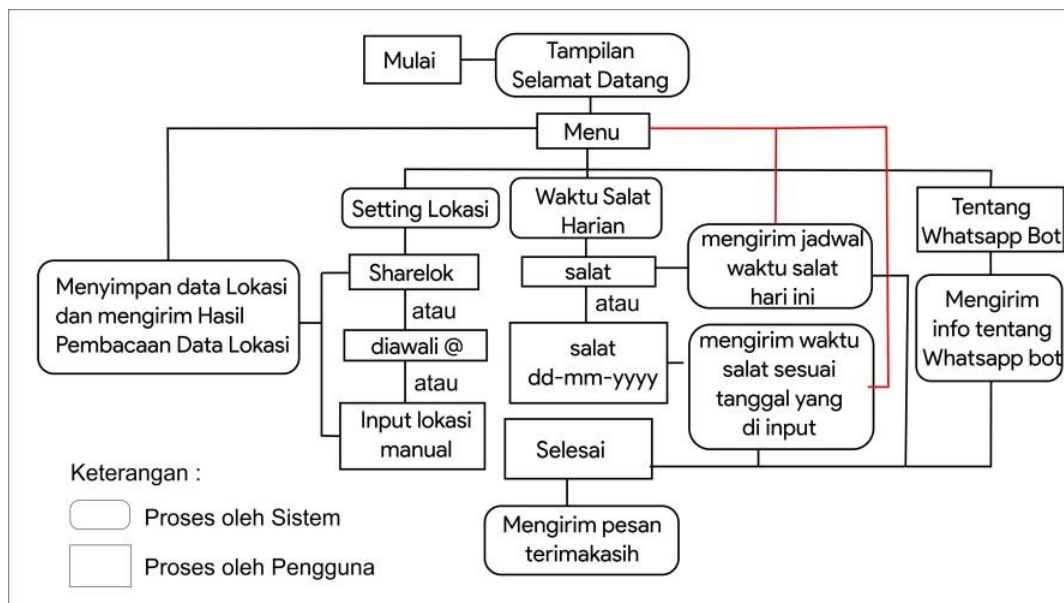


Figure 1 illustrates the flow of the WhatsApp Bot Based Prayer Time Schedule Information System.

Initially, when a user initiates contact with the WhatsApp Bot for prayer times, the system will send a welcome message to introduce the user to the WhatsApp Bot-based prayer time schedule information system. Upon receiving the user's input, they are instructed to provide a menu command. The user can either write "menu" or hit the menu button on the welcome display. In response, the WhatsApp Bot will deliver three primary menu selections from the WhatsApp Bot-based prayer time schedule information system. These options are as follows:

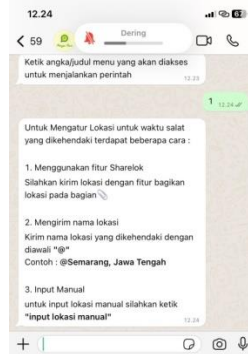
1. Setting Lokasi

In this setting lokasi menu, Users have the ability to designate a specific location as their reference point while searching for information regarding prayer times. In order to establish the reference location for calculating prayer times in the WhatsApp Bot, users have three options provided by the author. These options include utilizing the location sharing feature (which is a default feature in WhatsApp) or manually inputting the location name with keywords starting with the "@" symbol. Users can select location settings that are specifically tailored to optimize user



convenience. When users utilize the location sharing feature, they simply need to send the available location through the built-in WhatsApp feature. However, using location sharing requires accessing the GPS on the smartphone, which may be burdensome for individuals using devices with limited specifications. So the author incorporated an alternative location setting without accessing GPS in the WhatsApp Bot-based prayer time schedule information system that the author built, namely by sending commands with keywords starting with “@” followed by the name of the desired location. Or the user can also set the location manually, adjusting the location name, latitude and longitude of the place according to the user's wishes by sending the command “*input lokasi manual*”, then WhatsApp Bot will send a data form that must be input by the user including the location name, longitude of the place, latitude of the place and the height of the place, all of which must be completed by the user. After transmitting the location correctly using one of the three ways to specify the location that the author has discussed above, the system will read the entered location and record it in a variable which will later be used as a reference in computing the prayer time schedule in WhatsApp Bot later. The system also delivers back to the user the results of the location in question which offers location information data including: location name, location latitude, location longitude, location altitude and time zone. In this method, the user can confirm if the place that will be used as a reference in the computation is in accordance with the location desired by the user or not.

Figure 2 Setting Location Menu Display



2. Daily Prayer Times

In this option the user is directed to send a message using the keyword “salat”. There are two possibilities for getting information about prayer time schedules with this WhatsApp Bot. The first, only transmit the keyword “salat”. After the user sends the keyword “salat”, the WhatsApp Bot will answer by delivering information on the prayer time schedule for that day or the day according to which the message was received, which comprises of Imsak, Fajr, Sunrise, Dhuha, Dzuhur, Asar,



Maghrib and Isha timings. Then secondly, by using the keyword “salat” and followed by the month and year in the format "dd-mm-yyyy", for example a user sends a command with the keyword “salat 18-07-2022” then WhatsApp Bot will read the date. Accompanying the prayer keywords is that the system will send a schedule of prayer times on July 18 2022. And in the appearance of the prayer time schedule, geographic information is included consisting of the name of the location, latitude of the place, longitude of the place, altitude of the place and time zone. So that by displaying the location information, users can find out the prayer times for the region being displayed. To alter the location, you can visit the location settings option that the author has detailed above. And there are also days and dates to find out the prayer times for the days and dates as ordered.

Figure 3 Daily Prayer Times Display

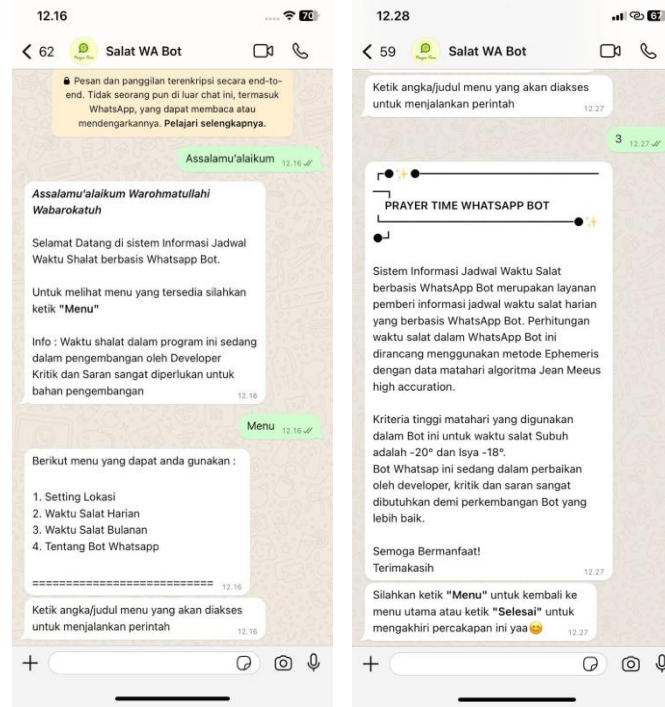


3. About WhatsApp Bot

The on WhatsApp Bot menu offers information on the reference used by the Bot in calculating the initial prayer times, namely the method employed and the criteria for the altitude of the sun at certain prayer times. And also comprises about creator WhatsApp Bot, as well as acceptance of criticism and recommendations for developing the WhatsApp Bot-based prayer time schedule information system to make it even better.



Figure 4 About WhatsApp Bot and Menu Display



4. Verivication Test of Prayer Time Schedule Information Results Based on WhatsApp Bot

This verification test of the results of prayer time schedule information based on WhatsApp Bot aims to check whether the prayer time calculation results on WhatsApp Bot are correct or whether errors still occur, considering the many functions and logic formulas used in designing the prayer time schedule information system based on this WhatsApp Bot.

The verification method that the author uses is to check this calculation by comparing the results of the prayer time schedule calculated manually using the ephemeris method with data on the position of the Sun sourced from the Hisab Rukyat Ephemeris by the Indonesian Ministry of Religion with the results of the prayer time schedule produced by WhatsApp Bot. Apart from that, the author also compared the results of the prayer time schedule produced by WhatsApp Bot with prayer time schedule providers that have been developed such as from the Bimas Islam website and prayer time schedules from the outcomes of workshops organized by UIN Waliosngo. The following are details of the comparison of the three computation sources:

Manual Calculation Table with WhatsApp Bot Semarang City Prayer Times 13 Februari 2022¹⁸, LT = -7° 0' 18.52'', BT = 110° 26' 17.25'', TT = 11 MDPL

Prayer Times	Imsak	Subuh	Rise	Duha	Dzuhur	Ashr	Maghrib	Isha'
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¹⁸Calculations are carried out using the ephemeris system, with solar data sourced from the Ministry of Religion's 2022 ephemeris hisab rukyat



WhatsApp Bot	04:15	04:25	05:39	06:07	11:56	15:09	18:06	19:17
Manual Calculation	04:15	04:25	05:39	06:07	11:56	15:09	18:06	19:17
Difference	0 mnt	0 mnt	0 mnt	0 mnt	0 mnt	0mnt	0 mnt	0 mnt

Comparison Table of Banyuwangi Regency Prayer Times with the Bimas Islam Website on July 18 2023¹⁹

Prayer Times	Imsak	Subuh	Rise	Duha	Dzuhur	Ashr	Maghrib	Isha'
WhatsApp Bot	04:08	04:18	05:35	06:04	11:32	14:52	17:23	18:36
Bimas Islam	04:08	04:18	05:35	06:04	11:32	14:52	17:23	18:36
Difference	0 mnt	0 mnt	0 mnt	0 mnt	0 mnt	0mnt	0 mnt	0 mnt

Comparison table with the results of prayer times on March 12 Imsakiyah UIN Walisongo Semarang workshop²⁰ :

Prayer Times	Imsak	Subuh	Rise	Duha	Dzuhur	Ashr	Maghrib	Isha'
WhatsApp Bot	04:18	04:28	05:40	06:07	11:51	14:58	17:56	19:05
Lokakarya	04:18	04:28	05:40	06:07	11:51	14:58	17:56	19:05
Difference	0 mnt	0 mnt	0 mnt	0 mnt	0 mnt	0 mnt	0 mnt	0 mnt

From the three tables above, it can be verified from the results of the verification test the correctness of the calculation results from WhatsApp Bot with manual calculations provides the same prayer time schedule or there is no difference. This proves that the program that has been built is in agreement with the calculations that are needed.

Then, there is no difference between the results of the initial computation of prayer times created by the WhatsApp Bot-based prayer time schedule information system and the results collected from other sources. Because if you look at the suitability, it cannot be separated from the source of solar data which is used as a reference in calculations, between calculations carried out manually and from other sources, including the website of the Ministry of Religion, Islamic Guidance and also the results of the UIN Walisongo Semarang imsakiyah workshop in 2024 which has relative accuracy. the same because in its construction the author used a high precision

¹⁹Kementerian Agama, "Website Bimas Islam," accessed April 28, 2024, <https://bimasislam.kemenag.go.id/jadwalshalat>.

²⁰Sourced from the distribution of prayer time schedules issued by UIN Walisongo in the 2024 Imsakiyah Workshop



coordianet of the sun algorithm taken from the book *Astronomical Algorithm* by Jean Meeus. Apart from that, the algorithm utilized in computing prayer times is also the same, namely the Ephemeris system of the Indonesian Ministry of Religion. Thus, it can be concluded that the prayer time schedule provided by WhatsApp Bot can be utilized as a guide to find out the start of prayer times.

D. Conclusion

The WhatsApp Bot-based prayer time schedule information system is a prayer time schedule provider service that can be accessed using the WhatsApp application. This program is developed to automate the WhatsApp application, which is the most popular instant messaging application currently, and its use is simple and easy to comprehend by the general public, so that it may be used by many groups today. In building the WhatsApp Bot-based prayer time schedule information system, it employs the NodeJs library so that WhatsApp can be automated by computing prayer time schedules. From the results of the verification test on the results of the prayer time schedule produced from the WhatsApp Bot with the prayer time schedule from various sources including the Bimas Islam website and the prayer time schedule from the Imsakiyah UIN Walisongo Semarang workshop, there were no differences in the results. So it can be concluded that the prayer time schedule information created from WhatsApp Bot can be utilized as a guide for early entry into prayer times because the sun coordinate calculating algorithm used has very high accuracy, which is obtained from the book *Astronomical Algorithm* by Jean Meeus.

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