

# Image Processing Application to Know the Dawn of Shadiq Using Matlab Software

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## ABSTRACT

Determination of preliminary prayer time is a fundamental thing because praying must be done in a specific time, not too fast and also too late. Several researchers said that the beginning of Dawn prayer in Indonesia was too fast and required re-assessment. The main factor related to determining prayer times is the height of the sun (dip). Some scientists and ulama' have a different opinion about the value of the altitude at true dawn appears, ranging from  $-14^{\circ}$  to  $-20^{\circ}$ . This research uses image processing techniques using the Canny method of edge detection by utilizing the Graphical User Interface (GUI) feature of the Matlab Software. Data was collected in Dampit Sub-District, Malang Regency, and ten days every half hour before dawn prayer times based on the Ministry of Religion schedule until half an hour after that. The results of the research can detect images well and obtained dip values ranging from  $-17.588^{\circ}$  to  $-20.8194^{\circ}$  and time ranges from 04.25 to 04.12 WIB. From the ten data, the earliest dip value was taken as a result of research for caution because it was feared that the dawn would be obstructed by cloudiness, namely when the dip was greater than  $-20.8194^{\circ}$ . The accuracy value of the dawn time in Dampit Sub-District compared to the Ministry of Religion has a difference of one to ten minutes. However, the dip range of the research results with the dip used by the Ministry of Religion has the same value, namely  $-20^{\circ}$ .

**Keywords:** Dawn of Shadiq, Canny Edge Detection, Dip, Dawn Prayer.

## 1. INTRODUCTION

One of the main obligations for Muslims is to pray. Prayer is a muwaqqat practice, which has a clear time of the beginning and the ending. Praying at the beginning of time is the most important practice, so knowing the start of prayer time is fundamental.

Determining the prayer time is inseparable from the phenomenon of the sun's movement. The phenomenon of the sun's movement, rotation, or earth's revolution is relatively constant, so it can be calculated with certain equations. Likewise, the time when the sun will make the shadow of an object at the same length, twice as the object, it can also be calculated. So that the beginning or the end of prayer times can be calculated using the method of arithmetic.

Time determination for the dawn prayer is marked by the appearance of the dawn rays. There are two types of

dawn, namely the dawn of Shadiq and the dawn of Kadzib. The dawn of Shadiq is a phenomenon of a bright light before morning that extends on the eastern horizon from north to south. This dawn shows the true dawn. Meanwhile, the dawn of Kadzib (false dawn) is a phenomenon of the sun ray's reflection right before the morning, which forms an atmosphere of bright rays that extend upwards. Dawn prayer time starts from the dawn of Shadiq.

Al Buhairi's research states that dawn in Indonesia is too fast 20 minutes of the dawn of Shadiq seemingly rays. Utari, in her research, also states that the reference for calculating the beginning of dawn in the form of dip values used by the Ministry of Religion (KEMENAG) is very frail. Meanwhile, Saksone found that the altitude of the sun against the horizon (dip) used by the Ministry of Religion to determine early dawn should be corrected immediately. The results of his research using the Sky Quality Meter (SQM) sensor state that the dawn of shadiq

appears when the sun's height is  $-13.06^\circ$  below the horizon. Whereas the dip used by the Ministry of Religion to determine early dawn is  $-20^\circ$ .

Allah's commandment, which explains the beginning of dawn, is found in QS Al Baqoroh: 187.

وَكُلُوا وَاشْرَبُوا حَتَّىٰ يَبَيِّنَ لَكُمُ الْخَيْطُ الْأَبْيَضُ مِنَ الْخَيْطِ الْأَسْوَدِ مِنَ الْفَجْرِ

Meaning: "And eat, drink until it is bright to you the white thread of the black thread of dawn".

The word "white thread" is a figurative word for the dawn on the eastern horizon. Because when the dawn of Shadiq comes, the first visible light extends on the eastern horizon like a white thread from north to south. In this case, it can be seen later in image processing, when the dawn of Shadiq image shows a white line extending like a thread on the eastern horizon. Meanwhile, the word "black thread" is an allusion to the darkness of the night.

Image processing techniques can be utilized to facilitate the identification of different natural phenomena in a short time difference. Saksono utilizes image processing to determine the dawn based on images taken on the eastern horizon. However, the results are different from previous studies. Therefore, there are still differences in results of the dip value; it is necessary to do further research to find out the dip at the time of the dawn of Shadiq.

## 2. RESEARCH METHOD

The research method used is field observation, and data collection is in the form of digital images. Research is located in a rural area to avoid excessive light pollution. To observe the dawn light, the research location must be a field with the eastern horizon clearly visible and unobstructed. So a large area of rice paddy fields was chosen to find out the dawn light that first appeared on the horizon. Figure 1 shows the research location taken from Google Earth, while Figure 2 is the eastern horizon of the study area.



Figure 1 Research location is seen from the Google Earth application.



Figure 2 The eastern horizon of the research location.

The tools and materials utilized in this study consisted of, among others, a Canon 1200D DSLR cameras, a camera tripod, the 2017 version of the Matlab Software, the WINHISAB and Shollu applications.

Data were collected in Ubalan Village, Dampit Sub-District with coordinates  $8^\circ 12'07''$  North Latitude and  $112^\circ 44'58''$  South Latitude 743 meters above sea level. The duration of data collection was approximately one hour, half an hour before dawn, according to the Ministry of Religion to half an hour thereafter. Meanwhile, image retrieval is enforced with a time span of one minute.

Research data in the form of digital images are processed using image processing techniques, with the Canny operator's edge detection method. The Canny method is chosen because it has optimal accuracy and has a small probability of an error occurring. Meanwhile, the Graphical User Interface is used to beautify the appearance of the application and to make it easier for users to process data.

Data processing is done after making the Graphical User Interface display and programming. Image data is processed one by one to determine the time at the beginning of dawn, which is indicated by the detection of longitudinal rays on the eastern horizon. Figure 3 is the GUI algorithm in the Matlab software. While Figure 4 is the GUI layout in the Matlab software.

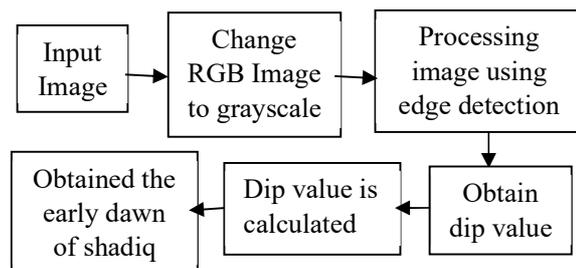


Figure 3 GUI Algorithm in Matlab Software.

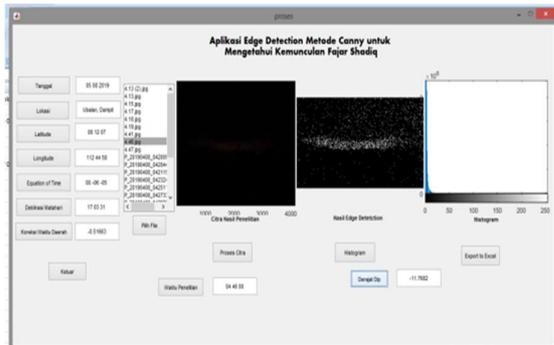


Figure 4 GUI Layout Design in Matlab Software.

The results obtained were compiled in Microsoft Excel for data analysis purposes. Data analysis was carried out by collecting all the data obtained to formulate a dip value that corresponds to the appearance of the dawn Shadiq rays. The dip value taken is the earliest value of all data to avoid noise from erratic weather. Sky image, which is influenced by weather factor, has a big effect on the resulting image.

### 3. DISCUSSION

The research is carried through with aim to determine the height of the sun against the horizon when the dawn of Shadiq appears. The value of this height or among astronomers is called the dip value. The dip is a very crucial component because it acts as one of the determinants of early dawn.

Image processing using the Canny operator's edge detection method can be used to detect the dawn Shadiq rays on the eastern horizon of the research location. The Graphical User Interface application is made first to process the research image. GUI is one of the tools in Matlab Software that can be used as a user interface to simplify image processing, as well as calculate the desired value.

The program created in the GUI includes image processing to calculate the sun's height (dip) according to the image taken. Some of the variables needed are the equation of time, the declination of the sun, the latitude and longitude of the location, and the time coefficient of the area. So that, based on the image processing, it can be seen when the time of dawn Shadiq appears.

Figure 5 (a) shows the results of image processing before the dawn of Shadiq. Meanwhile, Figure 5 (b) shows the results of image processing when the dawn of Shadiq rays come into view. The straight line in the center of the image is the interpretation of the light that extends across the horizon.

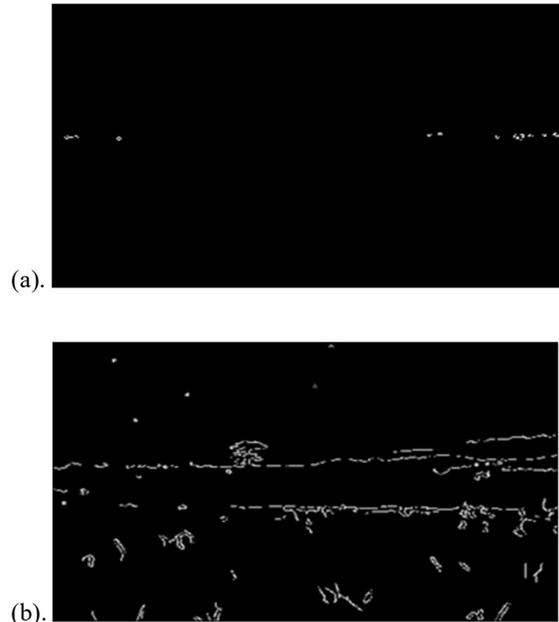
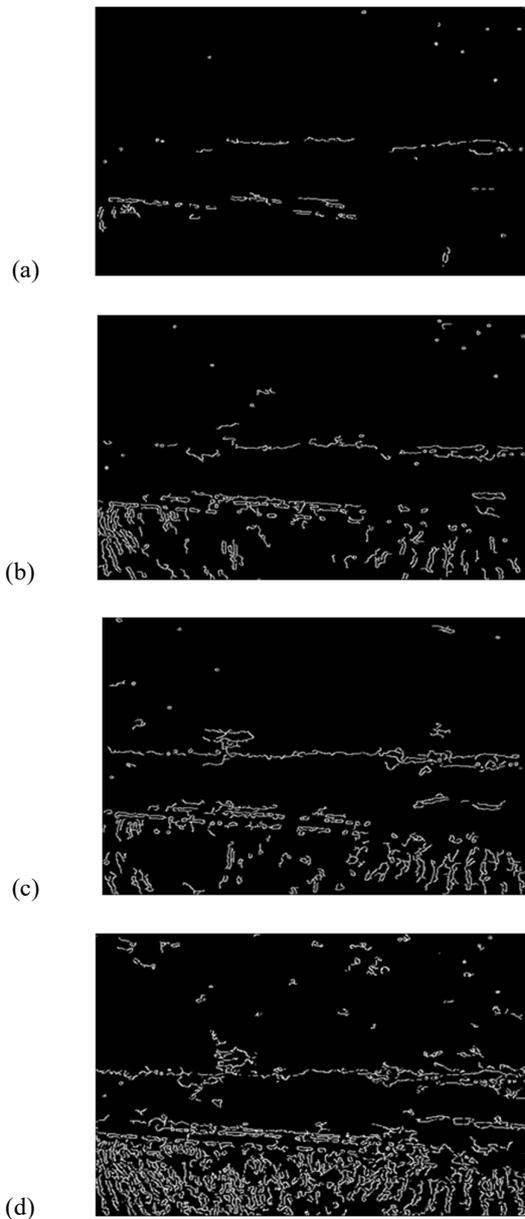


Figure 5 (a) the image processing results before the dawn of Shadiq appears (b) the image processing results at the dawn of Shadiq, which is starting to emerge.

Figure 6 part (a) is the beginning of the dawn of Shadiq ray's appearance until the rays gradually extend, as shown in figure (b). When the image line starts to stretch and emerge in clear condition, as shown in figure (c), then the dawn of Shadiq has appeared and entered at the dawn prayer time. Meanwhile, figure (d) shows the image approximately twenty minutes after the dawn of Shadiq or at the end of the research period.

The appearance of the dawn rays affects the value of the sun's altitude below the horizon or is called the dip. Dip degree values are used as a reference for calculating the initial determination of the dawn prayer time. The lower the dip value of the sun, the more advanced the time of the dawn prayer, vice versa. The higher the dip value, the slower the time of the dawn prayer.

The research was conducted in the range of May to early August. The data earned as many as 10 data, with the details, are described in Tabl 1. The dawn prayer time obtained in the research results based on the table above ranges from 04.12 to 04.25 WIB. The time data has a distance of one to ten minutes with a schedule from the Ministry of Religion (KEMENAG), which is taken from the WINHISAB and Shollu application. Meanwhile, based on the table, the degree of dip obtained ranges from  $-20.8194^{\circ}$  to  $-17.588^{\circ}$ .



**Figure 6** One of the imagery detection trips on August 6th, 2019.

The result of the research makes use of the dip value first appeared to be a precaution. The dip value which greater than  $-20^\circ$  can be caused by several factors, such as cloudy weather conditions or moonlight. Both of these noises can cause poor image quality, and the detected dip value is slower than  $-20^\circ$ .

In addition, the position of Indonesia is crossed by the equator. The area around the equator has low latitude, so the atmosphere is thicker. These conditions allow light scattering to occur in the atmosphere which higher than other latitudes so that the dawn equator area can be seen earlier, which is less than  $-18^\circ$ .

**Table 1.** The results of research data that have been carried into effect

Date	Dawn Time			Dip
	Research	WINHISAB	SHOLLU	
May 9 <sup>th</sup> , 2019	4:12	4:13:00	4:13:37	-20.61
May 10 <sup>th</sup> , 2019	4:19	4:13:00	4:13:37	-18,938
May 13 <sup>th</sup> , 2019	4:20	4:13:00	4:13:41	-18,718
May 16 <sup>th</sup> , 2019	4:22	4:13:00	4:13:48	-18,281
May 17 <sup>th</sup> , 2019	4:25	4:14:00	4:13:51	-17,588
June 12 <sup>th</sup> , 2019	4:25	4:17:00	4:17:35	-18,5057
July 9 <sup>th</sup> , 2019	4:20	4:23:00	4:23:04	-20.8194
August 4 <sup>th</sup> , 2019	4:33	4:23:00	4:23:47	-17.8314
August 5 <sup>th</sup> , 2019	4:30	4:23:00	4:23:39	-18.5518
August 6 <sup>th</sup> , 2019	4:24	4:23:00	4:23:30	-19.5207

The research results at dawn prayer time obtained have a time difference with the schedule circulating in the community, so the value of research accuracy is required. The accuracy value is also needed to determine the quality of the research that has been done. The accuracy value can be calculated by calculating the error value—the lower the error value, the better the research.

The error percentage from the research results ranged from 0, 1% to 4%. This value is claimed as a fairly good value because the higher and lower the error value, the results of the study are closer to the value of the reference variable. The error range between 0, 1%, and 4% indicates that the dawn time obtained at the time of the study is not too different from the reference. In other words, the research results at dawn are not much different from the Ministry of Religion and digital applications used in the community.

#### 4. CONCLUSION

The Canny operator edge detection type image processing method can detect the dawn images well in the MATLAB GUI Software feature. GUI can run well with the algorithms that have been used. The dawn time obtained from the research results is between the time range 4.12 to 4.25 WIB, and the dip value is in the range of  $-20.8194^\circ$  to  $-17.588^\circ$ . The obtained dawn time ranges from one to ten minutes according to the schedule circulating in the community. This can be caused by changing weather and affecting the image. However, the

resulting reference for the height of the sun obtained is the same as that of the Ministry of Religion, which is -20° below the horizon.

#### **AUTHORS' CONTRIBUTIONS**

The data of this research were collected and analyzed by Rusli and Niswatul Kariimah. Then, Asni Furaida, as the researcher's co-author, gave their assistance to finish the research.

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