



## STEM-BASED FACILITATOR IN WEATHER OBSERVATION TO DETERMINE PRAYER TIME

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### Abstract

Detecting whether with tools based on science, technology, engineering, and mathematics (STEM) is one of the tools that can be used to determine prayer times for people who are in small (backward) villages. The objective of this study is to facilitate the people of Situpete village to determine prayer times through science, technology, engineering, and mathematics (STEM). This research method uses qualitative involving five people. The data and data sources used are in-depth interviews and observations. The results of the interview are analyzed with these techniques. The results of this study found that with assembly using PVC pipes, Coaxial cables type RG58, Terminal Blocks, PCB boards, *Sound Cards*, RPI, and LCD the community became educated in determining the time of prayer through STEM-based weather detection tools. Not only that, but the community can also use the tool themselves to determine the time of prayer according to weather conditions in the Kampung Situpete environment. Educational themes felt by the community such as (1) the need for equipment, (2) accessibility, and (3) technological knowledge. Implication: the integration of STEM learning is very important to be carried out in schools to educate the public in meeting their daily needs. Teachers (academic circles) need to emphasize that STEM science is not only studied as a theory but is important to apply in real life. Future studies should use simpler tools at a lower cost and use more study participants.

**Keywords:** *STEM education, Integration, Weather Observation, Prayer time, Assembly*

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### INTRODUCTION

Indonesia is a country with religious diversity in it. Data from the Directorate General of Population and Civil Registration (Dukcapil) of the Ministry of Home Affairs revealed that there were 272.23 million Indonesians and 236.53 Muslims (Kusnandar, 2021). This is equivalent to 86.88% of the Indonesian population being Muslim. In carrying out their activities, Muslims have a different calendar from the calendar in general. The calendar is called the Hijri calendar. The difference between the gregorian calendar and the Hijri calendar is in the rotation of the earth, if the gregorian calendar is based on the calculation of the rotation of the earth with the sun, while the Hijri calendar is based on the calculation of the rotation of the earth around the moon. In Islam, the rotation of the earth, extraterrestrial events, and astronomical knowledge is gathered in science, namely phallic science. Falak science provides knowledge for Muslims to determine the time of prayer through the pseudo-position of the sun in circling the *Ecliptic* (Zainuddin, 2020). Unfortunately, in this modern era, Falak science is widely abandoned by Muslims. Only some people know and apply it to determine the schedule of prayers.

The majority of major mosques in Indonesia already use digital clocks in determining the time of prayer, but besides that, there are also mosques in rural villages that rely on sunlight in determining the time of prayer. Based on field surveys and the results of interviews with the mosque prosperity council (DKM) of Mushola Al-Hidayah, it is known

that the problems faced by the azan officers and the mosque prosperity council (DKM) do not use Falak science in determining the time of prayer. Al-Hidayah Mosque relies solely on shadow knowledge in sunlight and WhatsApp Group information about prayer times. This is a limitation for the mosque administrators to invite the local community to understand the time of prayer with weather reference. If the weather is clear or the sun is visible, it will be easy to determine the prayer time, but if it enters the rainy season, it will be difficult to determine the prayer time of zuhr, asr, maghrib, isha, and dawn. Not only that, clerics or shops of the local community are not domiciled in this village. Therefore, this study carried out the assembly of STEM-based weather detection antennas (*Science, Technology, Engineering, and Mathematics*) to facilitate the process of educating Muslim residents of Situpete Village in understanding how to determine the time of prayer based on weather conditions in their environment

## **METHODS**

The research method used is qualitative. The data and data sources used are interviews and observations. STEM-based facilitators in weather observations to determine prayer times involved 5 people consisting of one person from the mosque prosperity council (DKM) of Al-Hidayah Mosque, one parent of permanent worshippers of Al-Hidayah Mosque, and three teenagers of Al-Hidayah Mosque. During this process, the author was presented as a facilitator as well as an observer. The procedures for implementing this study are (1) socialization of what materials are needed, (2) facilitating and explaining the process of installing devices to observe the weather in determining prayer times, and (3) the process of observing the weather for 24 hours (01 September 2022), (4) analyzing data with the help of Microsoft Excel, (5) concluding. This process is adapted from modules published by Universiti Kebangsaan Malaysia (UKM) through educational activities (Rosli et al., 2020, 2019).

## **RESULTS AND DISCUSSION**

### **Results**

The STEM method is a learning method that integrates the four components of science in the form of *Science, Technology, Engineering, and Mathematics* (Ismail, I. (2015). The STEM method is implemented in the field of *science* with the process of observing the sun, then *technology* is applied through the materials and tools used, *Engineering* in the antenna assembly step, and the field of *mathematics* in the process of calculation and analysis based on graphs.

This assembly uses PVC pipes, RG58 type Coaxial cables, Terminal Blocks, PCB boards, *Sound Cards*, RPI, and LCD. A rough device in the form of an antenna will be used to detect the weather in the environment around Musholla Al Hidayah. Then the activity is continued by connecting the weather detection antenna with SuperSID software. The signal received by the SuperSID software will generate graph data in the form of a date and time to be *input* into Microsoft Excel. All data that has been compiled in Microsoft Excel will be associated with the coordinates of prayer room Al-Hidayah belonging to the Muslim residents of Situpete Village to conclude the time of prayer. The process of installing this device refers to the results of research from Rosli et al. (2020, 2019). The steps in detail are as follows.

*Installation Stage of the UKM-SID $\pi$  System:* At this stage make sure all the components of the tool are available and then design it into an SME-SID $\pi$  system, the steps are as follows:

- a. Make sure that the equipment and components for antenna construction are sufficient and then set them according to the same shape and size.
- b. Make part of the site and antenna mast by connecting a round pipe with a long pipe. Next, connect the pipe size and the antenna pole.
- c. Make the antenna wire wrapping, namely by rolling the wire in 42 turns, starting from the left of the pipe. The antennae pack is neatly and tightly rolled up.
- d. Connect the antenna wire with a cable. Cut off the excess wire and remove the layer at the end of the wire
- e. Connect the fusion cable on the pre-gain input cable of THE SMB-SID-SID $\pi$
- f. Connect the power plug cable on the pre-amplifier and sam Jack 3.5 Mm Audio in the SMB-SID $\pi$  System Entry
- g. Finally, turn on the pre-enforcement power plug and Raspberry Pi

*Software Operation Stage:* At this stage, it is to design the SuperSID software and make a design to be able to operate it in detecting weather.

- a. Download SuperSID software
- b. Set the time and date correctly by way of Open LXTerminal software, enter the command [sudo date -s "bb/hh/tttt jj:mm"] enter the correct time and date according to today's date. As [sudo -s date "09/04/2020 12:20"]. Press "Enter". To check the time and date entered are correct, enter the [date] command and press "Enter" in LXTerminal.
- c. Next, download the file that has superSID filling. Open LXTerminal and enter the command [sudo git clone https://github.com/ericgibert/supersid.git] and press "Enter". Make sure the file is downloaded, open File Manager, and find the folder named 'supersid'
- d. Change the resolution in the SuperSID file by creating a special folder for the data store. Open LXTerminal, and type the command [cd supersid] to enter the folder directory.
- e. Then, type the command [sudo mkdir Data] to create a new folder named 'Data'
- f. Type the command [cd] and press "Enter" to exit the folder directory.
- g. Obtaining the name of the sound card of the system UKM-SID $\pi$ . Open LXTerminal, and the command type [cat /proc/asound/cards]. Will exit the list of sound cards that have been connected to the Raspberry Pi, Write down its name, 'audioinjectorpi' to include in the software resolution later.
- h. Go to LXTerminal, type the command [sudo leafpad /home/pi/supersid/Config/supersid.cfg] and press "Enter". When the file is opened, change all the settings in the file, such as the list of settings in the diagram below. Enter the name of the sound card.
- i. Go to the 'File' menu and click 'Save'.
- j. Change the resolution by going to LXTerminal, type the command [sudo leafpad /home/pi/supersid/supersid/wxsidviewer.py], and press "Enter". When the file is opened, find the #Default view and change the value from 600 to 530. Go to the 'File' menu and click 'Save'.

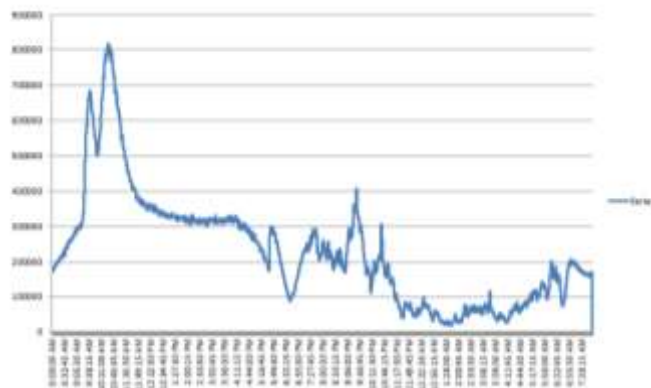
*Weather Condition Retrieval Stage;* At this stage after the cable and the Super SID device has been installed, connect the two so that the data is immediately obtained, here are the steps:

- a. Make sure the output antenna is connected to the UKM-SID $\pi$  system and that the pre-amplifier power plug is turned on.
- b. Open LXTerminal and type the command "sudo idle" to open python software.
- c. Click the 'File' and 'Open' menus. Open the 'su-persid' folder, and click on the 'supersid.py' file. Click on the 'Run' bar and click on 'Run Module'. A piece of software will run. Within 24 hours, the data will be in the folder. The data that has been created before, is saved in a .csv file format where researchers can plot data using Microsoft Excel software.

*Weather Observation Result Interpretation Stage:* For the data to be read easily at this stage, it will be attached to Microsoft Excel, namely by:

- a. Open the 'supersid' folder via File Manager, open the 'Data' block and select all files to move
- b. Open the data file that has been moved to a personal laptop using Microsoft Excel. To get started, we need to look at the time and date display. Convert the time and date format to "hh:mm:ss AM/PM".

The results of weather observations obtained are as Figure 1.



**Figure 1.** The M2.0 beacon was quickly followed by the M2.6 event at 02:34 UTC (0934 UTC)

Based on Figure 1 above, the prayer time gains are Fajr (04:38 AM), Dhuhur (11:56 AM), asr (03:14 PM), Magrib (06:00 PM), and Isha (07:05 PM).

In general, the results of this study found that the community became educated in determining the time of prayer through STEM-based weather detection tools. Not only that, but the community can also use the tool themselves to determine the time of prayer according to weather conditions in the Kampung Situpete environment. The education that was felt in detail found by the community was described according to the themes that had been analyzed based on the results of interviews with five study participants to five people, namely ZA, TMEP, HW, SMA, and KAI. The educational

themes in question are (1) the need for equipment, (2) accessibility, and (3) technological knowledge.

*The need for equipment:* This sub-theme arises around the use of equipment in the assembly of STEM-based weather detection devices. Society is very limited in its knowledge and use. The community is very grateful for this education. These results are corroborated by the following interview excerpts:

*... honestly, I just understood the meaning of the function of each of these pieces of equipment. I strongly support this program being introduced to all elements of society [TMEP]*

*It is very useful for this activity to be carried out, I just understood that the determination of this prayer time can use such simple equipment, I think this prayer time determination uses sophisticated equipment [ZA]*

*Accessibility:* People recognize how very difficult access is to enter their villages so that technological developments are less accessible to all communities. Even listening to the radio and television is very difficult to reach. It can only be accessed at certain times, so we only think that the prayer time is by the position of the sun. These results correspond to the excerpts of the interview:

*In this village, we have a very difficult time accessing information, because the signal is very limited. So that I as a DKM of the mosque often azan with my estimates or I see the position of the sun itself, but if the weather is not favorable then I only rely on forecasts [TMEP]*

*... If the weather is bad, I have a very difficult time determining the time for prayer. My day job is gardening and farming so access to technology in rice fields and gardens is completely absent. I just rely on my estimation. But if the weather is clear, it is easier for me to determine the prayer time by looking at the position of the sun [ZA]*

*Technological knowledge:* This sub-theme is the aspect that most often appears during interviews with the five study participants. They revealed that they were aware of the importance of knowledge of technology at present, especially in determining the time of their prayers. People are aware that with technology their lives can become easier. However, the problem they face is that the village where they are not yet optimal to be able to use the technology due to several factors such as the location of the village far from the city so that the infrastructure is not yet supported. The use of this technology can be used if it is close to the city. For students studying in the city, they can still use the technology to the fullest, but if they come home from school, they find it very difficult to use this technology for example surfing the internet. The results of the interviews with the study participants were:

*... I strongly agree that education is carried out using technology, but in this village, it is still very difficult to implement optimally [TMEP]*

*... education through STEM helps me to easily determine prayer times, but the use of this technology has not been maximized in this village [ZA]*

*I am very interested in this knowledge of technology because it can help me in completing schoolwork, but with this education, I understand more that this STEM-based technology can determine the prayer time in my village [HW]*

*In my opinion, all teenagers should be literate with technological knowledge even though they cannot be used optimally in this village [sma]*

*This kind of education needs to be followed up to foster a sense of interest in learning technology because with this education I think that having these four pieces of knowledge can help the community with various problems, especially in determining the time of prayer [KAI]*

## **Discussion**

Salat is mandatory worship that always takes precedence and requires all adherents of the Islamic religion to carry it out promptly under any applicable conditions. Islam places prayer as a solid foundation that can build faith in every adherent (Zainuddin, 2020). In the urgency of the implementation of these prayers, there are still many Muslims who do not understand the basic methods of determining the time of prayer.

The method of determining the time of prayer has been contained in the Qur'an and Sunnah which was then concocted by previous scholars into Falak science (Alamsyah et al., 2022; Hastomo & Yuhana, 2013; Jamil, 2022; Jayusman, 2022). In phallic science, the weather is one of the determining factors for prayer times in addition to the daily pseudo-motion of the sun and the level of brilliance of the sky (Ahmad et al., 2022; bin Zakaria & Mrism, 2022; Putraga et al., 2022; Sado, 2015). The determining factor will be associated with the coordinate point of the region to infer the time of prayer in the region.

The pace of technological development gives birth to many conveniences in everyday life. The ease of technology also encourages some Muslims to behave practically, one of which is when determining the time of prayer. The presence of a digital clock that determines the time of prayer and then the ease of application of prayer time is often a factor in the dependence of Muslims on this convenience in ensuring the entry of prayer time. However, it is undeniable that the equitable distribution of technology in Indonesia is still unequal. Some people still find it difficult to keep up with technological developments due to certain factors such as location, economy (need for equipment), accessibility, and knowledge. This applies to the Situpete Village Community. Muslims in the village usually determine the time of the call to prayer by predicting based on the time on the wall clock or information from WhatsApp groups owned by residents.

The Muslim community of Situpete Village does not yet have insight into how to determine the time of prayer by observing the weather based on Falak science. This will affect sooner or later the call to prayer is held in Situpete Village. So, it is necessary to carry out socialization and education about the application of phallic science to weather observation to determine the time of prayer. Based on the results of previous research, education based on STEM has many benefits that can be obtained by the community such as education on the need for equipment (Hrynevych et al., 2022; Nikitina &

Ishchenko, 2022; Rosli et al., 2019; Siregar et al., 2022) and technology knowledge education (Rosli et al., 2020, 2019). Education runs smoothly if accessibility to technology can be done easily (de Freitas Almeida et al., 2022; Kulkarni, 2019; Mäkipää et al., 2022).

## CONCLUSIONS

The implementation of STEM learning is one of the disciplines that are incorporated into one unit, therefore someone must have qualified cognitive abilities in learning STEM. STEM applications can answer various problems that exist in the wider community, especially Indonesians, the majority of whom convert to Islam. STEM science is one of the sciences that can solve problems in determining prayer times for residents living in the interior which is very difficult to reach by information technology.

## REFERENCES

- Ahmad, F., Margiantono, A., Hilal, Y. N., & Widiatmoko, K. W. (2022). Pelatihan instalasi pembuatan jadwal waktu sholat (jws) otomatis bagi santri dan pengurus musholla Darul Muttaqin Sembungharjo kecamatan Genuk kota Semarang. *Selaparang Jurnal Pengabdian Masyarakat Berkemajuan*, 6(3), 1244-1247.
- Alamsyah, M. F., Hambali, Y., & Shabah, M. A. A. (2022). Webinar mengenai konsep ilmu falak dan mempraktekkan tata cara menghitung arah kiblat. *Al-Ihsan: Journal of Community Development in Islamic Studies*, 1(1), 32-37.
- bin Zakaria, S. A., & Mrism, M. (2022, April). Implikasi penentuan waktu solat dengan kaedah titik berbanding dengan kaedah zon bagi daerah kuantan. In *International Conference On Global Education* (pp. 446-453).
- de Freitas Almeida, J. F., Conceição, S. V., & Magalhães, V. S. (2022). An optimization model for equitable accessibility to magnetic resonance imaging technology in developing countries. *Decision Analytics Journal*, 4, 100105.
- Hastomo, F., & Yuhana, U. L. (2013). Perancangan dan pembuatan perangkat lunak aplikasi android untuk pengolahan data transaksi pada perusahaan telekomunikasi" X" dengan menggunakan Pentaho. *Jurnal Teknik ITS*, 2(1), A77-A82. <https://doi.org/10.12962/j23373539.v2i1.2733>
- Hrynevych, L. M., Khoruzha, L. L., Rudenko, N. M., & Proshkin, V. V. (2022, June). STEM education in the context of improving the science and mathematics literacy of pupils. In *Journal of Physics: Conference Series* (Vol. 2288, No. 1, p. 012031). IOP Publishing.
- Ismail, I. (2015). Metode penentuan awal waktu salat dalam perspektif ilmu falak. *Jurnal Ilmiah Islam Futura*, 14(2), 218-231. <https://doi.org/10.22373/jiif.v14i2.330>
- Jamil, A. (2022). *Ilmu Falak (Teori dan Aplikasi) Edisi Revisi*. Amzah.
- Jayusman, J. (2022). *Ilmu falak 1 fiqh hisab rukyah penentuan arah kiblat dan awal waktu salat* (Doctoral dissertation, Uin Raden Intan Lampung).
- Kulkarni, M. (2019). Digital accessibility: Challenges and opportunities. *IIMB Management Review*, 31(1), 91-98.
- Kusnandar, V. B. (2021). Sebanyak 86,88% Penduduk Indonesia Beragama Islam. <https://databoks.katadata.co.id/datapublish/2021/09/30/sebanyak-8688-penduduk-indonesia->

