Improving Administrative Efficiency Using Image Processing Technology Through Fingerprint Attendance System

Slamet Riyadi[1], *Annisa Divayu* Andriyani[1], *Ahmad Musthafa* Masyhur[1], *Cahya* Damarjati[1*], *Dyah* Mutiarin[2], *Yessi* Jusman[3] and *Shofwatul* 'Uyun[4]

[1]Department of Information Technology, Faculty of Engineering, 55183 Universitas Muhammadiyah Yogyakarta, Indonesia

[2]Department of Government Studies, Doctorate Program, 55183 Universitas Muhammadiyah Yogyakarta, Indonesia

[3]Department of Electrical Engineering, Faculty of Engineering, 55183 Universitas Muhammadiyah Yogyakarta, Indonesia

[4]Department of Informatics, Faculty of Science and Technology, 55281 Universitas Islam Negeri Sunan Kalijaga, Indonesia

Abstract. SD Muhammadiyah Sangonan 1 has implemented fingerprint attendance, where teachers and staff record their attendance when they arrive and leave. Attendance records are still manually recorded by administrative personnel, and attendance reporting is limited to attendance recapitulation. In short, the efficiency of managing teacher and staff attendance administration is still low. Therefore, this research aims to improve the efficiency of teacher and staff administration through the implementation of image processing technology for fingerprint attendance. The planned stages of the research are planning, fingerprint attendance system development, administration system training, and program evaluation. In its implementation, this program has proven to be effective in improving the effectiveness of SD Muhammadiyah Sangonan 1 Godean's school administration in terms of easier and faster attendance data processing. The outputs achieved include mass media news and videos.

1 Introduction

SD Muhammadiyah Sangonan 1 is a school under the Persyarikatan Muhammadiyah in Sangonan Hamlet, Sidorejo, Godean. This school is classified as old because it has been operating since 1977. Every year, SD Muhammadiyah Sangonan 1 receives 25-36 new students **(Table 1)**. This number is classified as stable even though the school hopes the number of registrants will be higher, so it is relevant to improve the selection quality and financial revenue. A total of 11 teachers and employees serve in this school **(Table 2).** The small number of teachers is the main problem of this school. Moreover, there is still a lack of teacher welfare level. Physically, SD Muhammadiyah Sangonan 1 already has its building **(Fig. 1)** and rooms **(Table 3)**. To the north of the school building is a large mosque that can

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* Corresponding author: cahya.damarjati@umy.ac.id

be used for various school activities. Regarding information technology capacity, schools have been equipped with Wi-Fi internet in two classrooms.

School administration is the arrangement and utilization of school resources effectively and efficiently in implementing education so that educational goals are achieved optimally [1]. School administration activities are categorized as teacher administration by each teacher, Dapodik administration by school operators, teacher performance appraisal by the principal, and finance **(Table 4)** by the school treasurer.

Table 1. New student registration data

Year of Education	Number of registrants	Accepted	Percentage (%)
2013/2014	31	31	100
2014/2015	29	29	100
2015/2016	26	26	100
2016/2017	36	36	100
2017/2018	22	22	100
2018/2019	36	28	100
2019/2020	26	26	100

Table 2. Educators and education staff

Assignment Type	Number	Status			Needed
		PNS (Civil Servant)	GTT/PTT	GTY/PTY	
Headmaster	1	-	-	1	
Classroom teacher	6	1	1	4	
Religion teacher	1	-	1	-	
English teacher	-	-	-	-	1
Physical education teacher	-	-	-	-	1
Administration	1	-	-	1	
Guard	1	-	-	1	
Librarian	1	-	-	1	
Gardener	-	-	-	-	
Number	**11**	**1**	**2**	**8**	

Fig. 1. Building of SD Muhammadiyah Sangonan 1

Table 3. Infrastructure

Type of Space	Number of spaces	Width (m^2)
Class/theory room	6	260
Library room	1	42
School health unit room	1	12
Computer lab room	-	-
Props room	-	-
Counseling guidance room	-	-
Headmaster room	1	24
Teacher room	1	42
Praying room	Public	Public2
Student's bathroom	4	2
Teacher's bathroom	2	-

Table 4. School budget

Academic Year	Government	Parent/Public	Amount
2012/2013	390.678.316	17.156.000	407.834.316
2013/2014	388.562.987	17.100.000	405.662.987
2014/2015	396.617.728	19.872.000	416.489.728
2015/2016	183.770.100	17.040.000	200.810.100
2016/2017	385.365.020	25560.000	410.925.020
2017/2018	377.990.020	42.050.000	420.040.020
2018/2019	182.875.000	61.250.000	244.125.000

Based on the results of a discussion with the principal of SD Muhammadiyah Sangonan 1, the main problems faced by the partner are summarized as follows:
1. The number of registrants and students accepted is small.
2. The number of teachers is small.
3. Teacher welfare is still lacking.
4. Teacher information technology capacity is still lacking.
5. Administration is less efficient.

Based on the analysis of the situation, the main problem of relevant partners and priorities with the priority of the progress is an inefficient administrative problem, especially related to the presence. Teacher and education staff presence has used fingerprints, but the recording is still carried out manually and the reporting is only limited to attendance. This problem is very important to be raised because this activity is repeated where the presence is carried out every working day and the recording and reporting is carried out every month. This priority selection is the result of an agreement between the researcher and the principal of SD Muhammadiyah Sangonan 1.

The solution proposed to overcome the problem of partners regarding the lack of presence of the administration of the presence is the creation of a fingerprint presence system that will have a fingerprint presence system, administrative training of the fingerprint presence system that will produce a training activity report, as well as the assistance of the making of the presence administrative report that will produce a report of the administration of presence [2], [3]. The fingerprint presence system has been widely developed [4]–[6]. Fingerprint presence has been applied in various institutions and has been proven effective in increasing work motivation and employee performance [7], [8]. Another study also shows that fingerprint attendance influences employee discipline [9], [10]. The results of the team research which are in accordance with this program are as follows:

a. Design of deep learning-based fingerprint classification algorithms [11]
b. Prototype of smart Covid detection system based on image analysis [12]–[14]
c. Village government performance accountability model [15]

2 Methodology

This research is carried out through four stages, namely 1) Planning and pre-test. 2) Development of fingerprint attendance system. 3) Training in the administration of the fingerprint attendance system. 4) Assistance in creating attendance administration reports.

2.1 Planning and pre-test

The research planning stage was conducted through a Focus Group Discussion (FGD) between the researcher and the principal of SD Sangonan 1 Godean. The results of the FGD are as follows:

- Previously, the school had implemented a fingerprint attendance system. However, the existing fingerprint system only recorded the arrival and departure times of teachers. To retrieve the data, the assigned staff had to manually view and capture photos of each name, date, arrival time, and departure time. The captured photos were then recorded in separate documents and later compiled into a teacher attendance report. This process was time-consuming. The attendance report was planned to be generated monthly, but often the staff did not complete it due to other tasks that needed to be completed earlier.
- The attendance report, which consists of a list of teacher/staff names, dates, and arrival and departure times, is used to monitor the attendance of teachers/staff and the assigned duty teacher. The school has set the attendance rules for teachers/staff to arrive by 07:00 and depart by 13:00 while the assigned duty teacher's schedule is from 06:35 to 14:00. The attendance report is reviewed monthly, and teachers/staff who comply with these rules are given attendance incentives. Teachers/staff who are late for one day in a month will have their attendance incentives reduced by Rp. 15,000.00, and those who are late for a minimum of four days will not receive any incentives. The attendance report is also submitted to the Education Office of the Sleman Regency.
- The pre-test was conducted in the second week of March 2023.

2.2 Development of fingerprint attendance system

The fingerprint device used is the LX50 model with specifications including a fingerprint capacity of 500, transaction capacity of 50.000, and USB-host transaction capability. The scanner is connected to a computer device to retrieve attendance data. The attendance system software has been customized to meet the school's needs. A user guide module for the fingerprint attendance system has been created and provided to the teachers and staff of SD Muhammadiyah Sangonan 1 Godean.

2.3 Training on the administration of the fingerprint attendance system

The training on the administration of the fingerprint attendance system was conducted on Saturday, April 8, 2023, from 08:00 to 11:00 AM (WIB) at SD Muhammadiyah Sangonan 1 Godean. The activity began with a socialization session on digital-based school administration management and an introduction to image-processing technology for fingerprint attendance. Following that, the teachers and staff participated in training on how

to use the fingerprint attendance device, which was followed by the fingerprint enrollment process. The teachers and staff recorded their fingerprints one by one and tried using the fingerprint attendance device **(Fig. 2)**.

Fig. 2. Simulation of using the fingerprint attendance device assistance in creating attendance administration reports

The responsible admin for attendance data reporting received training on how to process fingerprint attendance data **(Fig. 3)**. The researcher also provided guidance and support to the admin in creating attendance administration reports more efficiently and quickly.

Fig. 3. Presentation on the use of the device from the administrator's perspective

3 Results and Discussion

The implementation of the research was evaluated through a comparison of pre-test and post-test results. A total of 16 participants took the pre-test. However, only 6 participants took the post-test. The profile data of the teachers and staff of SD Muhammadiyah Sangonan 1 Godean are shown in **Fig 4**. It indicates that 6.3% of the teachers and staff are below 20 years old, 37.5% are between 20 and 30 years old, 25% are between 31 and 40 years old, 12.5% are between 41 and 50 years old, and 18.8% are above 50 years old. Among the teachers and staff of SD Muhammadiyah Sangonan 1 Godean, 62.5% are female and 37.5% are male. Regarding the length of service for each teacher and staff member, 18.8% have less than 1 year of experience, 31.3% have 1 to 5 years of experience, 12.5% have 6 to 10 years of experience, 12.5% have 11 to 15 years of experience, and 25% have more than 15 years of experience.
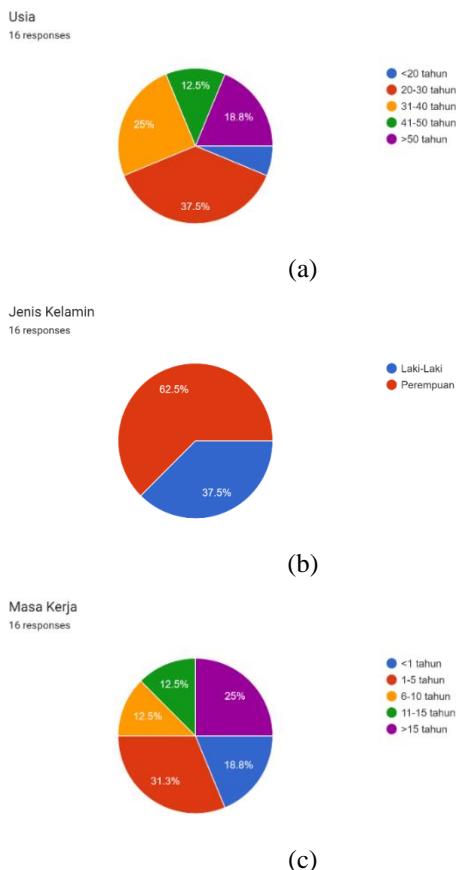
(a)

(b)

(c)

Fig. 4. The data of the teachers and staff of SD Muhammadiyah Sangonan 1: age (a), gender (b), and work duration (c)

Table 5 shows six items that were assessed through the pre-test and post-test. The results indicate that the socialization activities and training on fingerprint attendance have increased for the teachers and staff who previously had a utilization rate of only 68.8% for fingerprint attendance. This shows a significant improvement of 31.2%, reaching 100% utilization by all teachers and staff. The ease of using the fingerprint attendance device also increased by 31.2% from the initial 68.8% to 100%. The percentage of device usage quickly increased by 25% from 75% to 100%.

Regarding the process of fingerprint attendance recapitulation by the personnel, there was a rapid improvement. Initially, it was only 6.3%, but after implementing this program, there was an increase of 77%, reaching 83.3%. The results also indicate a significant increase in the percentage of personnel who were able to perform the recapitulation of fingerprint attendance quickly, rising from 12.5% to 83.3%, an increase of 70.8%. Furthermore, there was a significant improvement in the speed of compiling attendance recapitulation, which increased by 70.7% from 12.6% to 83.3%. Based on the results, the socialization activities and training on fingerprint attendance have improved all six items with an average increase from 40.6% to 91.65%, representing a significant rise of 50.99% compared to the previous results.

Table 5. Comparison of pre-test and post-test results

No.	Statement	Pre-test	Post-test	Difference (Post–Pre)
1	Teachers and employees have used fingerprints.	68.8%	100%	+31.2%
2	Teachers and employees do fingerprint presence easily.	68.8%	100%	+31.2%
3	Teachers and employees do a fingerprint presence quickly.	75%	100%	+25%
4	The officer recapitulates the fingerprint presence easily.	6.3%	83.3%	+77%
5	Officers do a fingerprint recapitulation quickly.	12.5%	83.3%	+70.8%
6	Presence recapitulation is compiled in a short time.	12.6%	83.3%	+70.7%
Average		40.6%	91.65%	+50.99 %

In addition to the results in **Table 5**, evaluation is also carried out on the following matters. **Fig. 5** shows the form of the presence report needed by SD Muhammadiyah Sangonan 1 Godean based on the pre-test and post-test that has been implemented. From the results obtained, the index will be calculated using the formula in equation 1 with the caption *a* is the highest score and *b* is the Likert score.

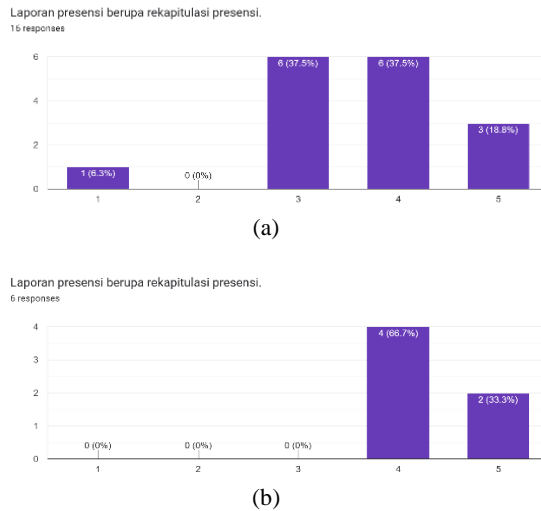$$Index = \frac{a}{b} \times 100 \qquad (1)$$

(a)

(b)

Fig. 5. Attendance reports in the form of recapitulation of pre-test (a) and post-test (b)

For the results of the presence report in the form of recapitulation of presence, the pre-test results obtained are the following data in **Table 6**:

Table 6. Pre -Test Data Presence Report in the form of Presence Recapitulation

No.	Statement	Score	Number of respondents	Likert score (score x number of respondents)
1	Teachers and employees who answer strongly agree (5)	5	3	15

No.	Statement	Score	Number of respondents	Likert score (score x number of respondents)
2	Teachers and employees who answer agree (4)	4	6	24
3	Teachers and employees who answer neutral (3)	3	6	18
4	Teachers and employees who answer disagree (2)	2	0	0
5	Teachers and employees who answer strongly disagree (1)	1	1	1
	Total		**16**	**58**

Total score = 58

Index = 6.25% is in the category of "Strongly Disagree".

For the results of the presence report in the form of recapitulation of presence, the results of the post-test obtained are the following data in **Table 7**:

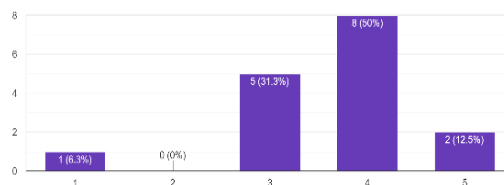**Table 7.** Post-Test Data Test Presence Report in the form of Presence Recapitulation

| No.	Statement	Score	Number of respondents	Likert score (score x number of respondents)
1	Teachers and employees who answer strongly agree (5)	5	2	10
2	Teachers and employees who answer agree (4)	4	3	12
3	Teachers and employees who answer neutral (3)	3	0	0
4	Teachers and employees who answer disagree (2)	2	1	2
5	Teachers and employees who answer strongly disagree (1)	1	0	0
	Total		**6**	**24**

Total score = 24

Index = 33.3% is in the category of "Disagree".

Fig. 6. shows the pre-test and post-test results from the presence report in the form of recapitulation of presence and process other data.

(a)

Laporan presensi berupa rekapitulasi presensi dan olahan data lain.
6 responses
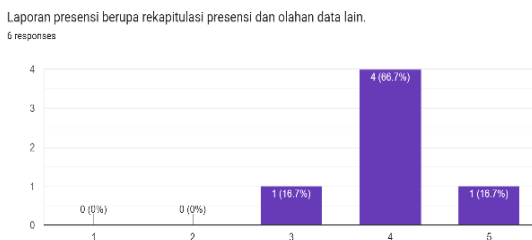
(b)

Fig. 6. Attendance reports in the form of recapitulation of presence and other processed data pre-test
(a) and post-test (b)

For the results of the presence report in the form of recapitulation of presence and other processed data, the pre-test results obtained are the following data in **Table 8**:

Table 8. Pre -Test Data Presence Report in the form of recapitulation of presence and other processed
data

No.	Statement	Score	Number of respondents	Likert score (score x number of respondents)
1	Teachers and employees who answer strongly agree (5)	5	2	10
2	Teachers and employees who answer agree (4)	4	8	32
3	Teachers and employees who answer neutral (3)	3	5	15
4	Teachers and employees who answer disagree (2)	2	0	0
5	Teachers and employees who answer strongly disagree (1)	1	1	1
Total			**16**	**58**

Total score   = 58

Index   = 6.25% is in the category of "Strongly Disagree".

For the results of the presence report in the form of recapitulation of presence and other processed data, the results of the post-test are the obtained data as follows in **Table 9**:

Table 9. Post-Test Data Present Report in the form of recapitulation of presence and other processed
data

No.	Statement	Score	Number of respondents	Likert score (score x number of respondents)
1	Teachers and employees who answer strongly agree (5)	5	1	5
2	Teachers and employees who answer agree (4)	4	4	16
3	Teachers and employees who answer neutral (3)	3	1	3
4	Teachers and employees who answer disagree (2)	2	0	0
5	Teachers and employees who answer strongly disagree (1)	1	0	0

Total	6	24

Total score = 24

Index = 33.3% is in the category of "Disagree".

Pre-test and post-test have shown cognitive program evaluations. In addition, evaluation is also carried out with FGD during the activity. Teachers and employees enthusiastically welcomed the activity. After the FGD and experimenting with the use of a fingerprint presence, teachers and employees stated that the fingerprint presence was proven effective in increasing the effectiveness of school administration. Teacher and employee presence data can be easily and quickly taken and processed according to school needs. This is also supported by the results of the increase from the pre-test and post-test that has been done.

4 Conclusion

The research on improving administrative efficiency using image processing technology through fingerprint attendance was successfully conducted. The use of fingerprint attendance has increased the effectiveness of school administration. Teacher and employee's presence data can be easily and quickly taken and processed according to school needs. This is also supported by the results of the increase from the pre-test and post-test. Based on the results, the socialization activities and training on fingerprint attendance have improved with an average increase from 40.6% to 91.65%, representing a significant rise of 50.99% compared to the previous results.

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