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Employee Presence Using Body Temperature Detection and Face Recognition

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Abstract

Employee performance can be measured by their presence or attendance, which applies to both civil servants and non-civil servants. Because the attendance system still uses the manual technique, it is considered inefficient due to the potential for data fraud and attendance problems. In addition, the government is adopting precautions against viruses in office buildings to maintain business continuity while the pandemic is being addressed. The goal of this study was to employ a facial recognition system and temperature measurement to lower the danger of COVID 19 transmission while also minimizing paper use by using a facial recognition system as a substitute for presences. It has so far permitted the digitization of formerly manual sights. The OpenCV library allows computers to detect faces using the haar cascade classifier approach and Python as a programming language. A Logitech C930e webcam with a resolution of 1080p at 30fps was used to capture facial data, which was then processed on a Raspberry Pi 4 microprocessor. It uses an MLX90614 sensor to monitor body temperature, which is controlled by an

Volume 4, Issue 2, pages 173 - 184
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Arduino Uno microcontroller. It is well integrated into the database based on body temperature testing and facial recognition. The development of a more accurate temperature sensor reading method for distance and employee body temperature is a priority for future research.

Keywords: arduino uno, haar cascade classifier, presence, temperature detection, face recognition

1 Introduction

The presence or attendance of employees, both civil servants and non-civil servants, is one sign of their performance. It examines the relevance of attendance data collecting, its relationship to performance indicators that become quality standards, and material for evaluating and improving the quality of public services, based on Regulation of Government of The Republic of Indonesia No. 30 of 2019 concerning the Work Assessment of Civil Servants. [1] Manually filling attendance from for recording attendance data is certainly inefficient because of the potential for fraud, such as data falsification or human error. Furthermore, administrative recapitulation is done manually which takes a long time because a lot of data must be entered. Many attendance systems have been built with pattern recognition that recognizes unique human physical traits, such as facial recognition and fingerprint recognition, as technology advances. These distinct reduce fraud during the registration procedure. [2]

There are many biometric identification method used for attendance system. The implementation of biometric recognition systems can be based on physical or behavioral characteristics, such as the iris, voice, fingerprint, and face. [3] One of well-discussed field nowadays in biometric identification is fingerprint. Fingerprint is considered a secured way because it has a unique pattern that is different for each person. [4] Unfortunately, systems that use fingerprints require the user to make direct physical contact with the fingerprint reader for a few seconds to perform fingerprint pattern recognition. This can increase the risk of contamination by harmful pathogenic microbes or cross-contamination of food and air by other users. [5] To avoid contamination by

Volume 4, Issue 2, pages 173 - 184
p-ISSN 2655-8564, e-ISSN 2685-9432

physical contact in Corona Virus Disease (COVID) 19, the presence system can use other bometric identification, one of which is face recognition. Face recognition has often been done for various purposes. Security systems and administrative management through face recognition systems have also started to be used and developed in industry, business, and offices. [6] A face recognition-based attendance system has been carried out and also obtained a high accuracy score of 80%. In this study, the eigenface and haar cascade classifier methods were used for student attendance.[7] The object detection method created by Paul Viola and Michael Jones is the haar cascade algorithm, which is divided into several areas of the face such as the eye area, nose area, mouth area, and others. It depends on the image that has been trained. [8]

Decree of The Health Minister of The Republic of Indonesia Number Hk.01.07/Menkes/382/2020 about Community Health Protocol in Public Places and Facilities for Prevention and Corona Virus Disease Control 2019 (COVID-19) states that there must be a body temperature measurement at the guest entrance and employees. If the temperature is found greater than 37.3 ^{o}C, employee or guest will not allowed enter unless stated negative/ non-reactive COVID-19 after laboratory examination in the form of RT-PCR examination is valid for 7 days or rapid test valid for 3 days, before entering the office. [9] Moreover, Guidelines for the Prevention and Control of Corona Virus Disease 2019 (COVID-19) in Offices and Industries in Supporting Business Continuity in a Pandemic Situation from Minister of Health of the Republic of Indonesia's Decree No. HK.01.07/MENKES/328/2020 states that people with fever (≥38°C) or a history of fever; or symptoms of respiratory system disorders such as runny nose / illness throat/cough and no other cause based on convincing clinical picture and in the last 14 days before the onset of symptoms had a history of travel or living in countries/regions that report local transmission or have history of contact with confirmed cases of COVID-19 classified as Person Under Monitoring. [10].

Based on the decree from Minister of Health of the Republic of Indonesia which has been described, conclude that temperature measurement is one of the important steps to prevent COVID 19 transmission. Therefore, it is necessary to design a device that can

Volume 4, Issue 2, pages 173 - 184
p-ISSN 2655-8564, e-ISSN 2685-9432

measure the body temperature of each employee before entering the office. This is done to prevent the spread of Covid-19. This device also replaces the manual presence that still uses paper. Thus, manipulation of presence data can be avoided. The proposed device is expected to be used in the office.

2 Research Methodology

Methodology used here The working procedure of the tool is depicted using block diagrams. Later on, this block diagram will be utilized as a guide for completing the final project. The system's block diagram is shown in Figure 1.

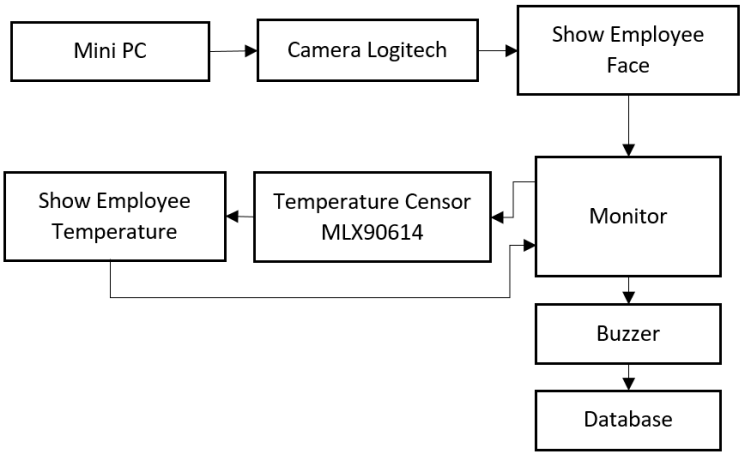


Figure 1 System Block Diagram

The following is an explanation of the block diagram system's function:

1. The Raspberry Pi serves as the system's controller.
2. The temperature sensor is used to determine an employee's body temperature.
3. Monitor functions include keeping track of staff temperature readings.
4. The camera take photographs employees' faces as an indication of their presence.
5. A sound indicator in the form of a buzzer.
6. The database is used to keep track of staff attendance.

International Journal of Applied Sciences and Smart Technologies
Volume 4, Issue 2, pages 173 - 184
p-ISSN 2655-8564, e-ISSN 2685-9432

The system will operate based on the following principle: The camera will work when personnel is objects or faces. It will then appear on the monitor screen. Furthermore, the temperature sensor will work when the thing is in front of the sensor. The results will be presented on the monitor screen and directly recorded into the database. The flowchart is a standard to describe the process. The system design flowchart that is carried out can be seen in Figure 2.

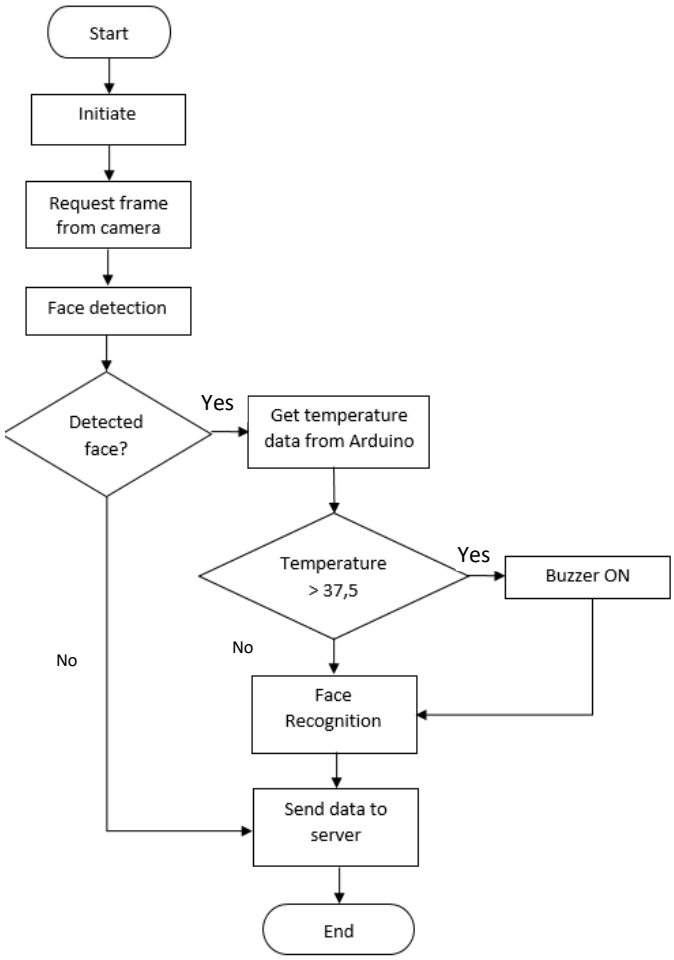


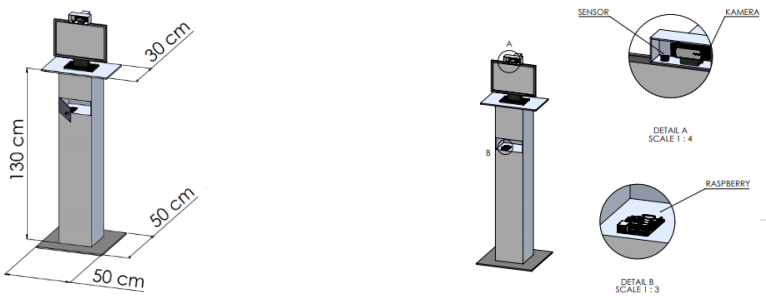
Figure 2 *Flowchart* Design System

When an object is detected, the camera detects the employee's face, and if it fits, the temperature sensor immediately reads the employee's temperature. If the temperature is less than 38°C, the staff have arrived and will enter the room directly. If the employee's

International Journal of Applied Sciences and Smart Technologies
Volume 4, Issue 2, pages 173 - 184
p-ISSN 2655-8564, e-ISSN 2685-9432

temperature rises above 38 degrees Celsius, he will be followed up on his medical history and subjected to health protocols, such as self-isolation at home. Employee data will also be entered into the database.

The design of the tools to be created is referred to as mechanical design. The skeleton section of the gadget is built of a triplet base material. The camera is made up of aluminum in parts. The frame is made of wood since it is easy to develop and arrange out components like Raspberry, Arduino, and monitors. The mechanical design is shown below. Figure 3 (a) shows the front view, and Figure 3 (b) shows the back view of the mechanical design of the tools created.



(a) (b)

Figure 3 Mechanical design from (a) front view and (b)

3 Results and Discussions

This section shows how the system was tested after it was built. Obtain data to determine whether or not the tool designed was successful.

3.1 MLX Sensor Temperature Measurement Testing

The face was brought closer to the MLX temperature sensor with a predetermined distance of 1 meter, and a Non-Contact Infrared Thermometer was used as a comparison. Table 1 shows the results of temperature sensor testing using a non-contact infrared thermometer.

International Journal of Applied Sciences and Smart Technologies

Volume 4, Issue 2, pages 173 - 184

p-ISSN 2655-8564, e-ISSN 2685-9432

Table 1. Temperature Sensor Comparison Test with Non-Contact Infrared Thermometer

No	MLX Temperature Sensor	*Termometer Infrared Non Contact*	Difference Score	*User*
1	35,6°C	36,5°C	0,9°C	1 Dita
2	34,5°C	36,2°C	1,7°C	2 Jahrona
3	34,8°C	35,9°C	1,1°C	3 Della
4	34,6°C	35,5°C	1,1°C	4 Ira
5	35,1°C	35,9°C	0,8°C	5 Vemmi
6	35,8°C	36,4°C	0,6°C	6 Ferahma

According to the findings of the testing, there was a discrepancy between the MLX sensor readings and the Non-Contact Infrared Thermometer, with the lowest contrast distinction of 0.6°C and the highest distinction of 1.7°C. The temperature was shallow while monitoring body temperature because the temperature detection distance is too far from the sensor, causing the temperature sensor to be less accurate when reading body temperature.

3.2 User Identification Testing

The goal of the test is to collect photos of people's faces as data, which will be stored in a folder that will be used as a database to match the system to face detection. Because object detection accuracy in the haar cascade classifier approach depends on the impacts of the training, images were taken as much as feasible to maximize the detection results. Figure 4 shows the identification test results at a distance of one meter. The results of successful and unsuccessful identification are shown in Table 2.

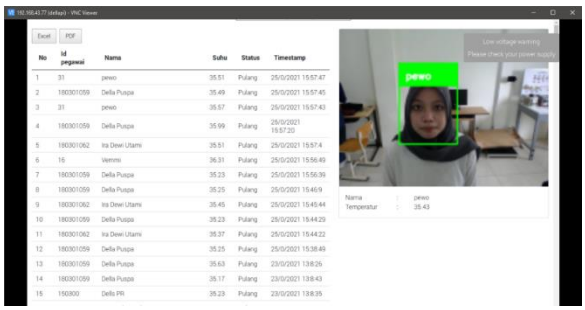


Figure 4 User face identification in 1 meter away

International Journal of Applied Sciences and Smart Technologies
Volume 4, Issue 2, pages 173 - 184
p-ISSN 2655-8564, e-ISSN 2685-9432

Table 2 User's Face Identification

No	*User*	1st Trial	2nd Trial	3rd Trial
1	*User* 1 Dita	Unsuccessful	Successful	Successful
2	*User* 2 Jahrona	Unsuccessful	Successful	Successful
3	*User* 3 Della	Succesfull	Successful	Successful
4	*User* 4 Ira	Unsuccessful	Successful	Successful
5	*User* 5 Vemmi	Unsuccessful	Successful	Successful
6	*User* 6 Ferahma	Unsuccessful	Successful	Successful
7	*User* 7 Ali	Successful	Successful	Successful
8	*User* 8 Azhar	Successful	Successful	Successful

Table 2 shows the result of three times testing. There were several unsuccessful experiments. In the first experiment, several obstacles caused the camera and temperature sensor not to work optimally, such as excessive lighting effects, being too far from the camera position, and the temperature sensor. In the second and third experiments, data obtained that the maximum limit of lighting and distance has been determined. Then, the system were tested in further distance to know how far the system can recognize user. The result shows in Table 3.

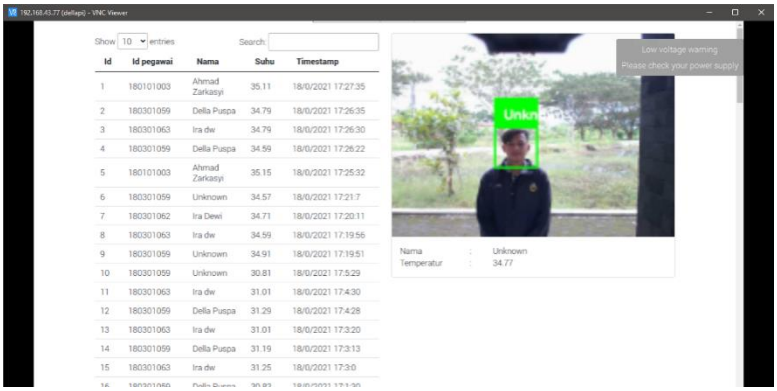


Figure 5 User face identification in 2 meter away

International Journal of Applied Sciences and Smart Technologies
Volume 4, Issue 2, pages 173 - 184
p-ISSN 2655-8564, e-ISSN 2685-9432

Table 3 shows testing system when the user stand in two meters away from camera. System shows status unknown. Whether the user was already registered the system could not recognize the face user. This testing shows that the camera only able to recognize face up to 1.5 meters away.

3.3 Buzzer Testing,

Speaker testing is used to ensure that the speakers can produce a clear sound. The following Table 3 is the result of buzzer testing.

Table 3 *Buzzer Testing*

No	**Temperature**	Categorize	***Speaker***
1	33°C	Normal	*Speaker Off*
2	34°C	Normal	*Speaker Off*
3	35°C	Normal	*Speaker Off*
4	36°C	Normal	*Speaker Off*
5	>37,5°C	High	*Speaker On*

Based on the data in Table 3, if the detected temperature is at an average temperature, the speaker is "OFF" or off. Furthermore, if the detected temperature is above the average temperature or >37.5°C, the speaker is active and gives instructions as a warning.

3.4 Database Testing

In database testing, several experiments were carried out to determine how the database system stores data. The results of the database test can be seen in Figure 5.

International Journal of Applied Sciences and Smart Technologies

Volume 4, Issue 2, pages 173 - 184

p-ISSN 2655-8564, e-ISSN 2685-9432

Excel PDF

No	Username	Time IN	Temperature IN	Time OUT	Temperature OUT
1	Ahmad Zarkasyi	27/0/2021 14:25:39	34.23	27/0/2021 14:26:0	33.85
2	Ali	27/0/2021 14:25:8	34.17	27/0/2021 14:25:17	33.85
3	anggi ap	26/0/2021 14:13:22	31.73	-	-
4	Babas	27/0/2021 13:45:29	35.25	-	-
5	catur	27/0/2021 12:7:0	34.85	-	-

Figure 5. Data Testing Result

In this test, faces that have done training can be saved directly to the database. If people who have not been identified or have been identified but are not suitable in facing the room on faces that previously did data training. The database will store the results of face detection and body temperature of employees who enter and will go home when the employee enters the office and when the employee will go home.

4 Conclusions

The results of testing the tool as a whole show that the tool works according to its function. The camera only able to recognize face up to 1.5 meters away. Buzzer as a sign of a user who has a fever will sound at a body temperature above 37.5°C. From the six sensor tests, there are slight differences between the sensor readings and the MLX and Non-Contact Infrared Thermometer. The temperature measured on the MLX sensor is lower than the temperature on the Infrared Contact Thermometer because the temperature detection distance is too far from the sensor causing the temperature sensor to be less accurate when reading body temperature. Meanwhile, in the first facial identification experiment, there were still 2 failures out of 8 trials. This is because the location where the face was shot makes the camera get too much exposure. After the camera was moved to a more suitable location, the results obtained were successful in the second and third experiments for 8 users.

Volume 4, Issue 2, pages 173 - 184

p-ISSN 2655-8564, e-ISSN 2685-9432

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Volume 4, Issue 2, pages 173 - 184
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