DESIGN OF AI-BASED CADET ATTENDANCE DETECTION CAMERA (ARTIFICIAL INTELLIGENCE) WITH THE FISHERFACE METHOD IN THE SURABAYA AVIATION POLYTECHNIC LABORATORY

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ABSTRACT
It is necessary to increase discipline for cadets to avoid indiscipline. Starting from the smallest thing, namely the attendance list of cadets, which requires development in attendance by using face detection as an effort to increase cadet discipline. Using face detection makes it easier for the study program to monitor the attendance of cadets. In addition, face detection ensures from the act of cheating attendance. This research aims to design and build an Artificial Intelligence (AI)-based cadet attendance detection camera system using the Fisherface method. The Fisherface method was chosen because of its ability to recognize faces with high accuracy despite variations in facial expressions, lighting, and distance. The system consists of several main components, namely the camera as a face image capture tool, and software that implements the Fisherface algorithm forface recognition. The result of this research is that the cadet attendance process at the Aviation Polytechnic of Surabaya can be done automatically and in real-time, reducing manual errors and increasing administrative efficiency. This system can be applied in the Surabaya Aviation Polytechnic Laboratory and study program rooms to simplify the attendance process and ensure the attendance of cadets in a more timely manner. The advantage of monitoring the attendance of cadets from previous research is a longer distance of 2 meters at lumen 239 and 2.5 meters at lumen 279. The speed in detecting and sending data to the database is much faster at 1.40 seconds. The accuracy (similarity rate) in detecting is 92.7% of 69 experimental data.
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Keywords: *Attendance Detection, Artificial Intelligence, Fisherface, Face Recognition, Surabaya Aviation Polytechnic*

1. INTRODUCTION

Discipline is a good attitude to follow and follow the rules that apply, for cadets this attitude is an obligation in the institution. The campus should implement a policy to enforce cadet discipline and one way is through attendance. Cadets are required to attend according to the schedule and applicable regulations. Being on time is a form of learning that allows cadets to be disciplined in the agency environment. Of course, training cadets to be disciplined is not an easy thing... The presence of cadets when practicing in the laboratory is very important, to improve the skills that have been learned in the classroom.

Aviation Polytechnic Surabaya is an educational institution that has an important role in shaping prospective professionals in the aviation field. One important aspect of managing the learning environment at the Polytechnic is managing the attendance of cadets effectively and efficiently in laboratories and other areas. However, in practice, managing cadet attendance still often faces several challenges.

Based on the information above, it requires an attendance system that refers to the latest technology to facilitate monitoring of all cadets. The reason the attendance system is needed is also because the current attendance system is still done by manual data collection. An attendance system with the latest technology can also improve cadets' performance in discipline, especially time. This greatly affects cadets because they are required to be fast, responsive, and precise personalities. Along with the rapid development of science and technology, there are solutions to overcome the problems of attendance systems that were originally manual data collection. The solution is to use face detection

attendance as an attendance system and monitoring the attendance of cadets.

Some cases related to student attendance data that currently often occur in the world of education, is the phenomenon of "Titip Absent". In addition, there are also challenges from the lecturers and administrative staff in monitoring the attendance of cadets and validating attendance data due to the large amount of data that must be managed. Therefore, this research proposes a system that aims to reduce the level of fraud in filling out the attendance list and increase the effectiveness of cadet data processing using the AI-base d Face Recognition method with the Fisherface algorithm. In previous research, the face recognition system successfully detected users who had registered, while the eigenface method had difficulty in detecting faces if there were obstacles covering the facial object or if the distance exceeded 50 cm. In the previous method, the use of face recognition with the eigenface method is also relatively slow due to the limited speed in detection caused by the capacity of the SSD or Orange Pi which is not optimal....

To overcome these problems, the authors propose a Final Project with the title Design of an AI (ARTIFICIAL INTELLIGENCE)-BASED FISHERFACE CAMERA AT THE LABORATORY OF SURABAYA AIRPORT POLITEKNIK.

2. METHODS

Research Design

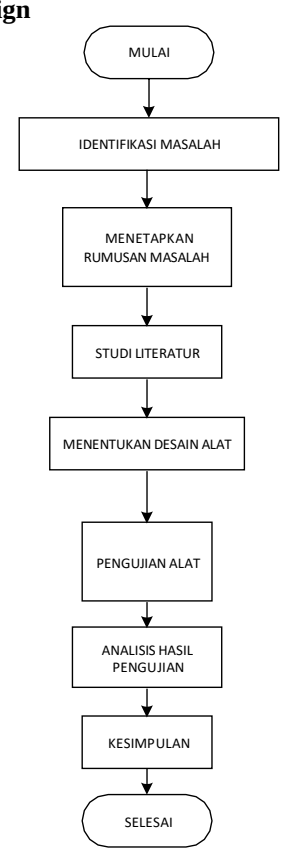

Figure 1 research design

3. DESIGN

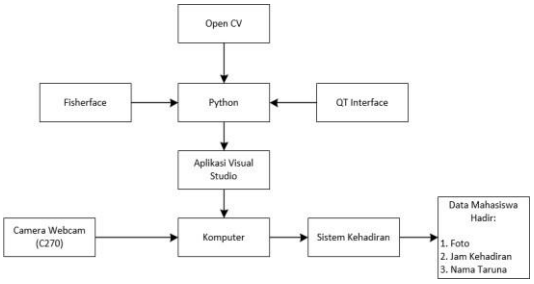

Figure 2 design tool

1. Webcam will be connected to the usb port and plugged into the laptop. The tool will work when cadets take attendance automatically the webcam / camera will record and capture the faces of cadets to be sent to the database that has been created.
2. Computer as a brain that works for the process of detection by the camera and channeling to the database in the study program. In addition, the computer is also used for the process of modifying with coding and applications that have been installed.
3. Inside the computer there is an application that will display the attendance system consisting of photos, hours of attendance, and names of cadets.
4. On the server computer, you must first install the software that manages from taking input, processing, and output, one of which is visual studio c++ which is useful for the programming process.
5. Before python, first install open cv which is useful for libraries that allow face processing, cropping (face detection to face recognition). In the open cv library there is also fisherface.
6. There is an additional library to strengthen the program, namely dlib to support open cv to work more optimally and accurately in running the fisherface program.
7. Before installing dlib, what needs to be downloaded is the visual studio c++ application because the dlib base is in visual studio c++.
8. After that install the python programming language to command the system/laptop so that it has the program we want. In python it is possible to do image processing or data processing.
9. The next step to install pyqt 5 is used to create a display or gui.
10. The last step is to download and install the sublime text application which aims to open, edit and run the code.

4. RESULTS AND DISCUSSION

Research Results

This chapter will discuss system testing that has been made in the previous chapter. The test is carried out to determine the performance of a tool both each component and the whole and to find out whether the system is in

accordance with the plan. In addition, this test ensures that the system can function normally and optimally.

1. *Analysis* Result

In this research, we began by analyzing the potential of the problem, identifying tools and thinking about the tools to be developed. In making this tool, researchers found to improve the discipline of cadets / students, especially in taking attendance. So the emergence of solutions such as AI-based Attendance Detection System.

2. Design

After conducting the analysis stage, the next stage is the planning stage *(Design)* regarding the tools that will be made.

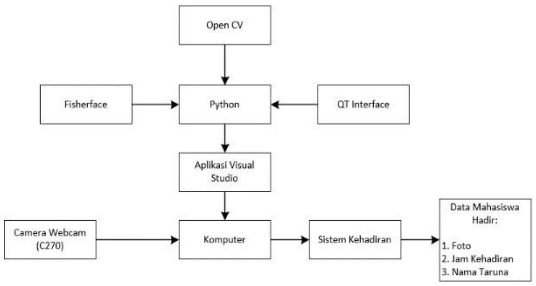

Figure 3 tool design

3. Development

At the *development* stage is the stage where the system design or design that has been made before will be realized to become the desired product. At this *development* stage, what has been designed at the *design* stage will begin to be actualized into a tool that meets expectations.

Discussion of Research Results

Implementation

1. Face Recognition Camera Testing

Camera testing is done connected to the laptop / PC that will be used. Testing will be carried out in 2 stages, namely connected to the camera application that is already available from the default laptop / PC and connected to the *sublime text* application that has been modified for the design of the tool made by the author.

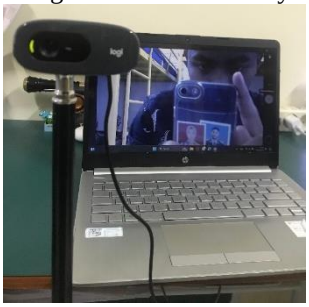

Figure 4 camera testing with apk camera

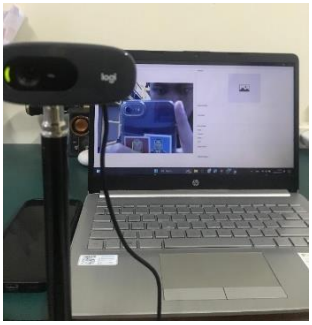

Figure 5 camera testing with the system

In the table below are the results of testing using the built-in camera application and system display using *sublime text* to find out the camera is functioning properly.

Table 1 testing camera

Trial Number	Media	Camera indicator	Description
1	Apk Camera	Normal flame	Connect
2	Apk *Sublime Text*	Normal flame	Connect

After testing the picture above, it can be analyzed that the camera test aims to find out whether the tool can work properly or not as a tool that will later be used as a detector. Figure 4.5 shows that the software synchronization code and the camera are connected.

2. Enroll and sample list testing

The Enroll test process functions as a face detection reader that has been registered into the laptop database folder. The initial process starts from the PC/laptop hardware giving a command to the program to register the cadets' identity in the form of name, class and uploading several photos to be registered. After the identity has been registered, it can start to take the enroll / training process of the face detection model.

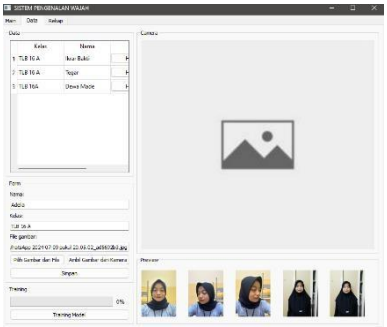

Figure 6 sample registration

Based on the picture above, the test is carried out by enrolling the sample and obtaining data as shown in the table.

3. Working Face Detector Match Testing

The next process is to test/match the face sensor scan with the data previously registered in the program database. The process to validate the actual face in real time with the previously registered one. Face matching testing by matching the faces of cadets who have registered/enrolled/training models into the database that has been created. The sample used is one of the faces of the cadets to test whether the system detects correctly and precisely according to the name, date, time, and confidence that has been made by the program.

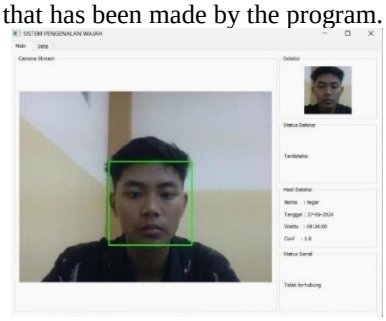

Figure 7 detecting result

Table 2 sample detecting

No.	Sample Name	Percobaan Ke-		
		1	2	3
1	TRI ZAINUDDIN	✓	✓	✓
2	ADELIA MEGA LOURENZA R.	✓	✓	✓
3	AHMAD AKMAL FAHMI	✓	✓	✓
4	AILSA SHAFA NANSHA R.	✓	✓	✓
5	ANGGA ADAM MAULANA	-	✓	✓
6	CHALWAH FARIDA S	✓	✓	✓
7	DEWA MADE BRANDIVA SIDAN	✓	✓	✓
8	DHAVINDA ARGA DHINATA	✓	-	✓
9	FAIZAH HASNA ZAHRA	✓	✓	✓
10	HENDRA OCTAVIANUS SITORUS	✓	✓	✓
11	IKRAR BAKTI BAGGI ALAM	✓	-	✓
12	KHUSNUL CHANDRA RINI	✓	✓	✓
13	MOCH. DANI URDHY S.	✓	✓	✓
14	MOCHAMAD ADI NUGROHO	✓	✓	✓
15	MOCHAMMAD RIZQI R.	✓	✓	✓
16	MUHAMMAD ALIF RAMADHAN	✓	✓	✓
17	MUHAMMAD MAULANA Z.	✓	✓	-
18	MUKHAMMAD KHUSNI M.	✓	✓	✓
19	NASYAFIA AHSANUL AMALA	✓	✓	✓
20	REGITA AMELIA DWI MAHARANI	✓	✓	✓
21	RIZQI MAULA HAMDANI	✓	✓	✓
22	TEGAR KURNIAWAN AL RASYID	✓	✓	✓
23	ULFIANA DYAH PRAMESTI	✓	✓	✓

The measurement results show that the results of the table above testing scan / face detection samples used as many as 23 people with 3 trials. It can be analyzed that 92.7% of the tool has successfully detected various conditions of user skin color against the influence of light. In addition, the system display also displays the name, date, time accurately as shown in the picture.

4. Testing Distance Detection Accuracy and the Effect of Light on Facial Objects

Testing the accuracy of the detection distance to the object is done to assess how well the system or fisherface algorithm can identify/detect and recognize faces at various distances between the camera and the face object. This test can also help determine the optimal distance range where the system provides the most accurate detection results.

The author conducted two test methods to get the difference in results obtained by paying attention to the difference in distance and light. The following is the method used by the author in testing:

1. Distance and lumen range testing in a 239 lux room
2. Distance and lumen range testing in a 279 lux room

Table 3 Distance range testing at lumen 239

No	Face Sample	0,5M	1M	1,5M	2M	2,5M	3M
1	Tegar K.	✓	✓	✓	✓	✓	✓
2	Adelia Mega	✓	✓	✓	✓	✓	✓
3	Dewa Made	✓	✓	✓	✓	-	-
4	Rizki Maula	✓	✓	✓	✓	✓	-
5	Dhavinda Arga	✓	✓	✓	✓	✓	-

Source: author

The results of the analysis in table 4.4 above obtained the maximum distance is 3m, but there are several test objects that are not detected at the optimal distance because there are several factors such as: skin color, light intensity, and makeup. Then the optimal distance is 2m.

Table 4 Distance range testing at lumen 279

No	Face Sample	0,5 M	1M	1,5 M	2M	2,5 M	3 M
1	Tegar K.	✓	✓	✓	✓	✓	✓
2	Adelia Mega	✓	✓	✓	✓	✓	✓
3	Dewa Made	✓	✓	✓	✓	✓	-
4	Rizki Maula	✓	✓	✓	✓	✓	✓
5	Dhavinda Arga	✓	✓	✓	✓	✓	✓

Analyzed results:

After testing the accuracy of distance and the effect of light on face detection, it can be analyzed that the author used a variety of different facial subjects/samples with different facial features, skin colors, and expressions to see how variations would affect the results of the study. The result of testing the most optimal distance for face detection after testing is 2 meters. The light factor also affects face detection. From the experiment testing the effect of different light factors in the table above shows where the optimal distance (the farthest distance that can most often be detected for all face samples) against a light lumen of 239 is 2m and a light lumen of 279 is 2.5m.

5. Testing the time span of face detection and output image capture.

Face detection time span testing is an important step to evaluate the performance of a face detection system. This time span refers to the duration required by the system to detect a face from the time the image is captured until the face is identified. This test not only helps in measuring the efficiency of the face detection algorithm used but is also important in real-time applications where a quick response is required.

The following is to test the speed of taking photos on the face detection system can detect objects with the time range in the table below.

Table 5 Detection speed testing table

No.	Sample Name	Trial Number		
		1	2	3
1	DHAVINDA	01.55s	01.33s	01.33s
2	TEGAR KURNIAWAN	02.01s	01.55s	01.61s
3	RIZKI MAULA	01.75s	01.43s	01.36s
4	ADELIA MEGA	02.37s	02.88s	02.78s
5	DEWA MADE	01.50s	01.77	01.68

Source: author

Analysis results in table 4.6 show to calculate the optimal speed in detecting faces based on the table above.

Dhavinda Arga : Average $= \frac{(01.55s+01.33s+01.33s)}{3} = \frac{4.21}{3}$ = 1.40s

Tegar Kurniawan : Average $= \frac{(02.01+01.55s+01.61s)}{3} = \frac{4.21}{3}$ = 1.72s

Rizki Maula :Average $= \frac{(01.75s+01.43s+01.36s)}{3} = \frac{4.21}{3}$ = 1.51s

Adelia Mega :Average $= \frac{(01.55s+01.33s+01.33s)}{3} = \frac{4.21}{3}$ = 2.68s

Dewa Made :Average $= \frac{(01.50s+01.77s+01.68s)}{3} = \frac{4.95}{3}$ = 1.65s

So, the optimal speed (the smaller the detection time, the faster the detection speed) in detecting faces based on table 4.6 above is 1.40 seconds.

After the author conducts speed testing on the tool made, data on the speed of face detection on the cadet sample above is obtained. It can be analyzed that the speed of detection can be influenced by the number of databases that have been registered. In addition to lighting, the factor of differences in photos entered into the database is also very influential in the speed of

detecting faces. When doing face detection, female samples are slower to be detected by the system than male cadets due to the use of makeup on women.

5 CONCLUSIONS AND RECOMMENDATIONS Conclusion

The conclusions in this test and research are based on the explanation of the previous chapter, so it can be concluded as follows:

1. In the design of this prototype, it can facilitate staff / Prodi in monitoring the attendance of cadets / students who are more effective and efficient in terms of time, especially to improve the discipline of cadets. The development of modern technology today can apply *Artificial Intelligence* systems and be developed with the *Fisherface* method so that in monitoring the attendance of cadets / students this is designed through the Excel application / *sublime text* data output on a PC in the study program room.
2. The face detection system designed using *Artificial Intelligence-based fisherface* algorithm can be implemented in classrooms, study program rooms and electrical labs. This system can display a recap of user face data after taking attendance. The success rate of the attendance system is shown by the sensitivity (quickly receiving stimuli) of 1.40 seconds and accuracy (similarity level) of 92.7%. The success rate of the identification process is indicated by the optimal distance at 239 lumen light, which is 2m. and 279 lumen light, which is 2.5m.

FOLLOW-UP RESEARCH

The author realizes that this tool or device has shortcomings and has not been completely perfect during this manufacturing process. Therefore, the author suggests several things that can be improved to be better and perfect in the future. The suggestions given, namely:

a. grouping data on the output to make it easier tomonitor the attendance system.

b. Update or collaborate IoT and AI systems in managing output data through *web servers*

c. update the most up-to-date methods in processing face detection. The *open face* method is one of the methods that can detect various facial expressions and variations of the user's face simultaneously.

ACKNOWLEDGMENTS

The author would like to thank his beloved father and mother, all lecturers, instructors at the Diploma 3 StudyProgram in Airport Electrical Engineering, as well as colleagues and Adelia Mega who always provide support, advice, and assistance in completing this paper.

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