Face Detection in Digital Image Using Convolutional Neural Network Method for Web-based Class Attendance System

Cicia Melani[1], Ahmaddul Hadi[1], Jusmardi[1], Ade Kurniawan[1]

Department of Electronics Engineering, Universitas Negeri Padang, Padang, Indonesia

***Abstract* – The main problem in this research is the need for a more efficient and accurate class attendance system. Manual attendance is often inefficient and has the potential for error. At Universitas Negeri Padang, especially at the Pesisir Selatan Campus for the informatics study program class of 2023, attendance is carried out through portals, e-learning, and in writing on paper during class, which can cause data mismatches, human error, and the possibility of data manipulation. This research aims to develop a face detection-based automatic attendance system using the Convolutional Neural Network method. This system is proposed to replace the less efficient and error-prone manual attendance method. This research uses the CNN method trained with a face dataset that includes variations in lighting and pose. From 800 face images of 32 students, the results show that the system has a face detection accuracy rate of 90% for face detection using glasses, and 100% accuracy for face detection without glasses. The system enables the attendance process to be faster and more accurate, increasing efficiency. In conclusion, the CNN method is proven to be effective in face detection on digital images and can be well implemented in a class attendance system, thus improving the efficiency and accuracy of the attendance process.**

Keywords— **Face Detection, Digital Image, Convolution Neural Network, Attendance System, Web Based.**

I. INTRODUCTION

The use of computer technology and image processing has also become an important part of the educational process, especially in the area of attendance administration. A consistent attendance process also helps teach students about discipline and responsibility. Recorded class attendance information can be used for academic data management, student administration and assessment. In addition, class attendance is also important for security and monitoring reasons. By recording student attendance, campuses can know who is in class at any given time.

Attendance systems that still use manual methods using paper are still considered a waste of time so that they can affect learning productivity (Prathivi & Kurniawati, 2020). In addition, the manual attendance system also still has disadvantages such as paper that can still be damaged, to falsification of attendance data.

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Corresponding author: Cicia Melani,
Universitas Negeri Padang
Email: ciciamelani26@gmail.com

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So that this still needs further development in order to support learning activities in the classroom (Nugraha Ramdhon & Febrya, 2021). At Padang State University, Pesisir Selatan Campus, especially the informatics study program class of 2023, the attendance uses portals, e-learning, paper in class, and lecturers call students' names one by one so that data synchronization can occur, attendance data is not uniform or incomplete, human errors, and delays in data synchronization which are still considered a waste of time so that it can affect learning productivity. Therefore, it is necessary to develop a system that can automatically perform attendance that cannot be manipulated, and can also perform data calculations.

Using the Convolution Neural Network face detection method for classroom attendance systems has several significant advantages, namely reliable face recognition. CNN is very effective in recognizing facial features with a high level of accuracy, even in various lighting conditions, automatically the attendance process will be more accurate. There is previous research conducted on face detection, Fitrahardi Surya Dharma with the title face recognition in the smart class system for student attendance detection using the Viola Jones and Local Binary Patterns Histogram (LBPH) methods based on Raspberry Pi, the accuracy level produced by these two methods is 82.33%. As for face recognition in the morning 50.83%, 61.11% in the afternoon, 58.89% at night. The difference between this research and previous research lies in the method used and in the implementation of the system, the method used in this research is Convolution Neural Network and the implementation of the system using the web. The selection of the CNN method is expected to produce a better system with high accuracy.

This research aims to design a face detection system for web-based class attendance to improve the efficiency of teaching and learning activities, maintain data security, reduce human error, and monitor class attendance.

II. METHOD

The method used in designing this website is the prototype method. The prototype method is one of the commonly used approaches in software engineering development. The application of the prototype method aims to obtain a clear picture of the application to be developed through a series of stages.

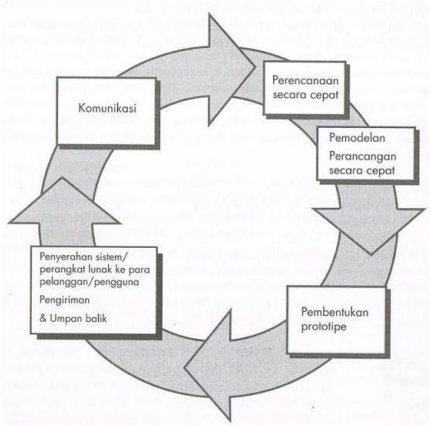


Fig 1. Prototype methode

Communication

At this stage, communication is carried out with parties from the State University of Padang, Pesisir Selatan Campus, especially informatics study program students class of 2023 as users or users of web presence.

Quick Plan

A. Running System Analysisn

The attendance system in the informatics class is still manual with portals, e-learning, paper, and lecturers who call the names of students one by one which results in waste of paper, waste of time, delay in synchronization of attendance data. All activities in manual attendance will be better with the presence of a face detection attendance system using the CNN method.

B. Analysis of the Proposed System

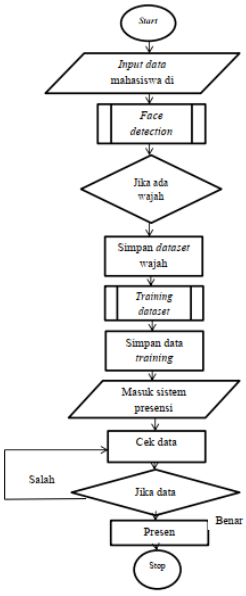


Fig 2. System flowmap

Modelling Quick Design

System Design

A. Use case

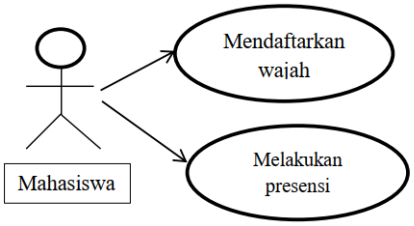


Fig 3. Use case

B. Activity diagram

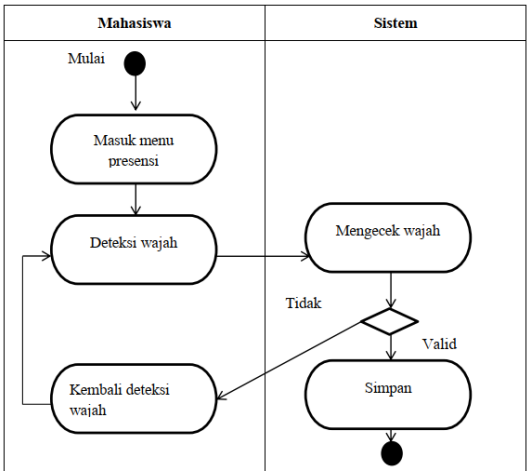


Fig 4. Activity diagram

C. ERD (Entity Relationship Diagram) Design

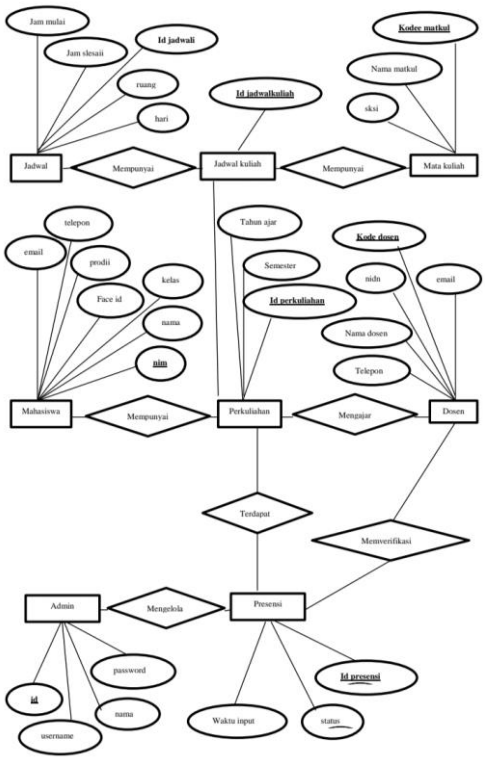


Fig 5. ERD

Construction of Prototype

After the design analysis is complete, prototyping is done through the process of implementing the design in the form of program writing. The system will be built using HTML, JavaScript for the frontend, and the backend using the Python programming language, which has been proven to accelerate web development and provide a solid structure for complex web applications.

Development Delivery and Feedback

The final stage, Development Delivery Feedback, involves sending the prototype version to stakeholders for initial feedback. Prior to delivery, testing is conducted to ensure that the application is performing according to the expected needs and goals. The feedback received is then used to literate and improve the prototype before it is fully launched.

III. RESULTS AND DISCUSSION

A. System Design Results

Fig 6. Face Detection System for Digital Image

Initially the system runs where the face will be detected and the boundingbox comes out along with the name and number, as well as attendance information. Attendance displays the name and number of students who have done face detection in the attendance system.

Fig 7. Face Detection System for More Than One Face in Digital Image

B. Face Detection Test

The face detection test is carried out with the process of matching face detection and face recognition of students according to the existing dataset. This test is done to calculate the accuracy of the face detection system in recognizing faces according to the training data. This test is divided into two parts, namely testing on faces without glasses, which have been entered into the system database and testing on faces that are randomly or randomly obtained from the internet, and faces that use glasses.

TABLE I
FACE DETECTION TEST

No	Face detection test without glasses		
	Dataset	**Results**	**The Truth**
1	 Adira Pratama-23346002		Correct
2	 AISYAH AMALIA PRATIWI-23346003		Correct
3	 Asyaraihan Febsa Yuda-23346004		Correct
4	 CICIA MELANI-20343054		Correct
5	 Daffa Destio Waldy-23346005		Correct
6	 Diah Pita Loka-23346006		Correct
7	 Fajar Aulia Pratama-23346007		Correct

8	 Ilham Sanusi-23346008		Correct
9	 Indah Safitri-23346009		Correct
10	 Intan Sepriyelmi-23346 010		Correct
11	 Muhammad Fauzan-23346012		Correct
12	 Muhammad Gilang Ramadhan-23346 013		Correct
13	 Muhammad Huzaifi-23346014		Correct
14	 Muhammad Rifki Fadillah-2334602 7		Correct
15	 Rafi Geovazi-2334601 5		Correct
16	 Rafid Hilmi-23346016		Correct
17	 Rahmi Fah Riza-23346017		Correct
18	 Rangga Rizky Nugraha-233460 18		Correct
19	 Riska Esa Putri-23346019		Correct
20	 Tiara Utari-23346022		Correct
21	 Wenni Ajijah Hasibuan-233460 23		Correct
22	 Zikry Huda Hermawan-2334 6024		Correct

TABLE III
FACE DETECTION TEST

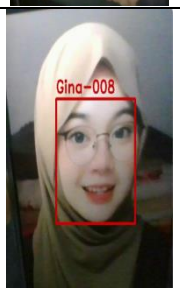
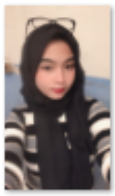
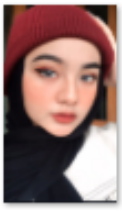
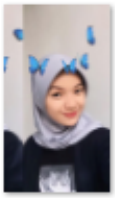
No	Face detection test using glasses		
	Dataset	**Results**	**The Truth**
1	 Ani-001		Correct
2	 Bela-002		Correct
3	 Cuna-003		Wrong
4	 Dela-004		Correct
5	 Ela-005		Correct
6	 Funi-007		Correct
7	 Gina-008		Correct
8	 Hila-009		Correct
9	 Ica-0010		Correct
10	 M. Zidan-23346011		Correct

TABLE IIIII
FACE DETECTION TEST COMPARISON RESULTS

Image data input type	Number of samples(JS)	Number of successful (JB)	Error (E=JS-JB)	Accurate Percentage ($\frac{JS-E}{JS}$ x 100%)
Picture of a student without glasses	22	22	0	100%
Picture of students wearing glasses	10	9	1	90%

Comparison of test result with various conditions was obtained. The accuracy is low when the face is not facing the camera and using attributes such as glasses, lighting, and the accuracy is higher when the face ia facing the face detection camera.

IV. CONCLUSION

This research shows that the application of the Convolution Neural Network (CNN) method to face detection in digital images successfully improves the accuracy and efficiency of web-based class attendance systems. Models trained using a sufficient dataset of various faces showed adequate accuracy, indicating that CNN is an appropriate method for face detection. The resulting model performed well on the test dataset with an accuracy rate of 100% for face detection accuracy without glasses, and 90% for face detection with glasses, indicating that CNN can be relied upon.

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