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Attendance system based on facial recognition using multi-task convolutional neural network

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Abstract

Some businesses today do not keep track of their employees' attendance. Some of them are still using outdated techniques such as log-based manual inspections. These outdated methods of data collection require excessive paperwork, take time due to laborious recording procedures, and result in inaccurate data collection due to human error and inadequate assessment. The goal of this study is to create an attendance system that can make it simple and accurate for businesses to track their employees' attendance. The aim of this project is to create a system that will make it simple and automatic to record attendance using facial recognition. The result shows that the system is operational and possess a accurate and highly benefits the students and the faculty members.

Keywords: Attendance System; Face Recognition; Multi-Convolutional Neural Network; Machine Learning

1. Introduction

The attendance system is of great significance in enterprises, schools, governments, and other places where personnel management is needed. Attendance through fingerprint recognition requires queuing for identification, which consumes a lot of time. In the case of a finger injury, the accuracy of the fingerprint can also be forged by others. By scanning the ID card for attendance, the identity of the cardholder cannot be verified, which also produces fraudulent attendance behavior. A Face recognition system is also able to recognize a person from a distance without touching or interacting with the person. Moreover, the face recognition system also helps in crime deterrent purposes because the captured image can be stored in a repository and later can be helpful in many ways, like identifying a person.

2. Related literature and studies

Various attendance and monitoring solutions are now in use in the industry. Even though these solutions are primarily automated, they all with flaws. A new deep learning-based facial recognition attendance system is proposed in a research study. The entire process of constructing a face recognition component by integrating cutting-edge methodologies and profound learning improvements is detailed. It is discovered that with fewer face images and the proposed approach of augmentation, great accuracy, 95.02% in total. The investigation of various solutions for identifying faces is one of the undiscovered areas of this research [1].

According to Sawhney et al. [2] the primary goal of their study is to create a smart attendance management system based on facial recognition that will address the issues that exist in current automated systems in use in today's modern world.

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Authenticating an individual in general and attendance is an old procedure that has seen various attempts to improve efficiency and speed. Nonetheless, those advancements fall short of keeping up with the ever-changing, fast-paced lifestyle made possible by ever-expanding technologies. However, progress brings complexities and challenges [3].

3. Methodologies

The research development that the researchers use to ensure the development of the software is the Agile Software Development methodology. Agile methodology has 5 phases which are the requirements, design, develop, test, and deployment. Agile based software development provides an effective solution to the challenges presently being faced by the software industry including ever-increasing software complexity, dynamic user requirements, low budgets, and tight schedules.

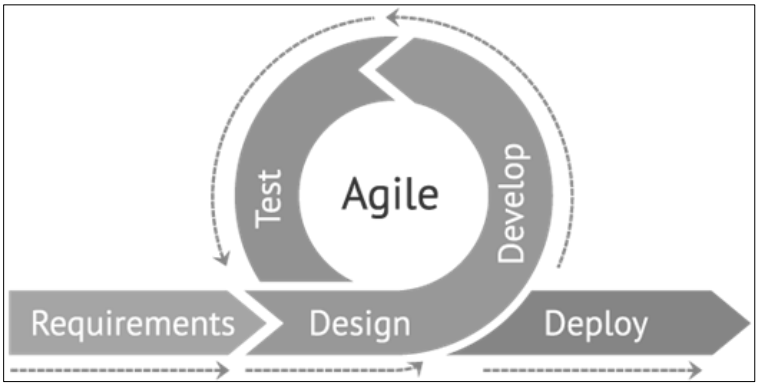

Figure 1 Agile Software Development

3.1. Hardware and Software Components

There is no specific hardware required for the study. The system is developed and tested using AMD Ryzen 5 4500U with Radeon Graphics 2.38 GHz, 16,384 megabytes (MB) or 16.0 gigabytes (GB) random access memory (RAM), and a system type 64-bit operating system, x64-based processor. For this study, the researchers will also use an HD camera for better-quality face detection. The software specification that we will use in developing the system is Windows 10 Operating System and as for our developing equipment we use Visual Studio Code for the web application and PyCharm IDE for creating the Facial Recognition. The researchers will also be using phpMyAdmin as the main database.

3.2. Use Case

The use case diagram below shows the list of actions that define the roles of each user and the interactions that each user can use.

3.3. Evaluation

To evaluate the data gathered in this study, we used a validated and widely accepted evaluation tool, that can determine the accuracy and the quality of the system. We use Confusion Matrix to evaluate and compute the accuracy of the face recognition and ISO 25010:2011 as a base for evaluating the software quality of our system.

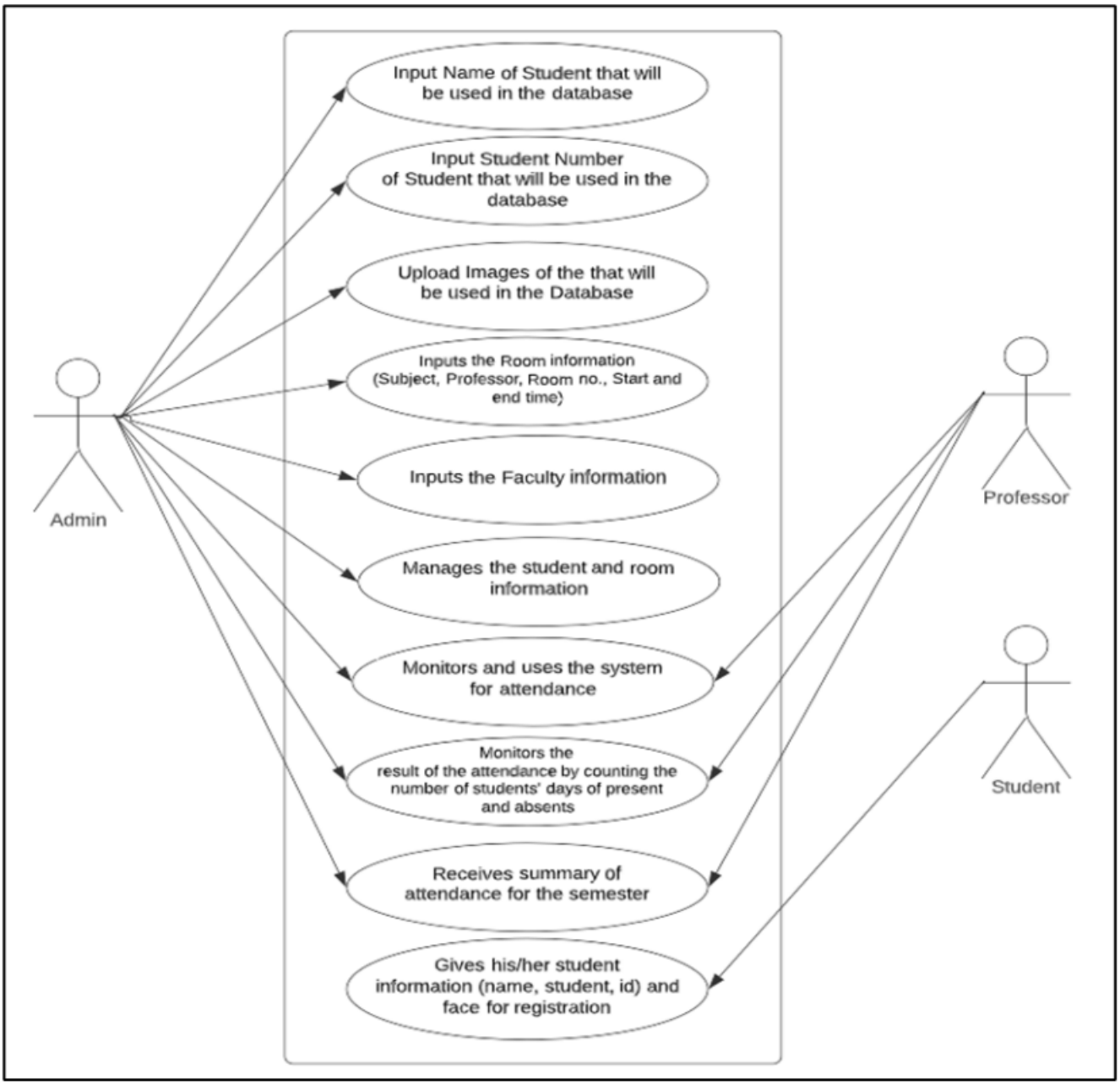

Figure 2 System Use Case Diagram

4. Result and discussion

Based on the test performed by the researchers to assess the quality of the Attendance System by testing the face recognition.

4.1. Confusion Matrix Table Result

Figure 3 shows the confusion matrix table and its result in the system testing using seaborn correlation heatmap. A confusion matrix is a performance measurement technique for Machine learning classification problems. It's a simple table which helps us to know the performance of the classification model on test data for the true values are known. [4]

In our testing, we test 30 students and there are twenty-six (26) students that the face recognition successfully detects which is indicates in the figure the True Positive (TP), next is the True Negative (TN) it has a zero (0) which means the system cannot detecting the students and he/she is not enrolled or recorded in that subject. Followed by the False

Negative (FN) means that there are three (3) students are enrolled or recorded in that subject, but they are not detected by the system, and lastly the False Positive (FP) with the number of one (1) means that the system detects the student, but the credentials displayed is incorrect.

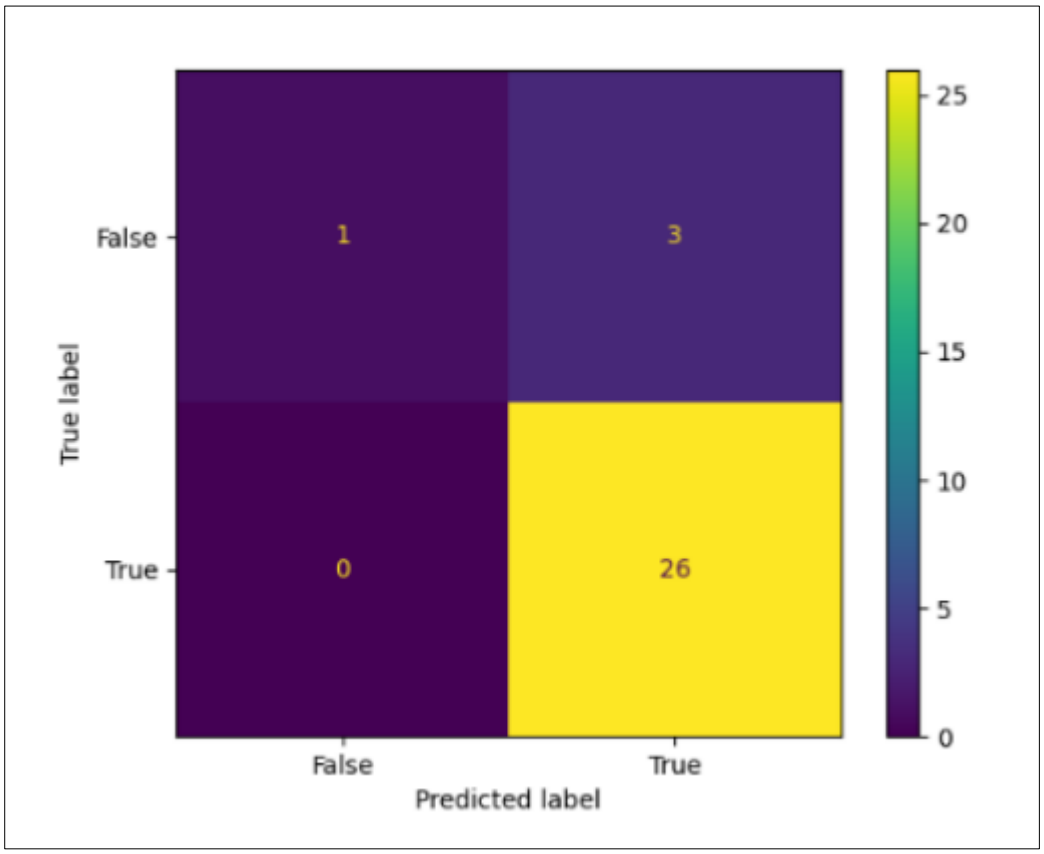

Figure 3 Confusion Matrix

4.2. ISO 25010 Product Quality Characteristics

Table 1 ISO 25010 Product Quality Characteristics in terms of Functional Suitability

No.	Statements	Mean	Interpretation
1	The system has covered all the specified tasks and user objectives	4.9	Fully Observed
2	The proposed system should provide the correct results with the needed degree of precision.	4.6	Fully Observed
3	The proposed system's functions should be able to accomplish specific tasks and objectives	4.4	Fully Observed
TOTAL WEIGHTED MEAN		4.6	Fully Observed

Table 1 shows the Mean of sub-characteristics of Functional Suitability. The total mean score of the first statement is 4.9 equal to "Fully Observed.", the total mean score of the second statement is 4.6 equal to "Fully Observed", lastly, the total mean score of the third statement is 4.4 is equal to "Fully Observed". The total weighted mean is 4.6 means that the respondents concur Functional Suitability is "Fully Observed."

Table 2 ISO 25010 Product Quality Characteristics in terms of Reliability

No.	Statements	Mean	Interpretation
1	The proposed system should be operational and accessible.	4.7	Fully Observed

2	The proposed system should be able to recover data in the event of an interruption or failure.	4.9	Fully Observed
TOTAL WEIGHTED MEAN		4.8	Fully Observed

Table 2 shows the Mean of sub-characteristics of Reliability. The total mean score of the first statement is 4.7 equal to "Fully Observed.", and the total mean score of the second statement is 4.9 equal to "Fully Observed". The total weighted mean is 4.8 means that the respondents concur Reliability is "Fully Observed."

Table 3 ISO 25010 Product Quality Characteristics in terms of Security

No.	**Statements**	**Mean**	**Interpretation**
1	The proposed system should ensure that data are accessible only to those authorized to have access	4.9	Fully Observed
2	The proposed system should prevent unauthorized access to, or modification of, computer programs or data	4.9	Fully Observed
TOTAL WEIGHTED MEAN		4.9	Fully Observed

Table 3 shows the Mean of sub-characteristics of Security. The total mean score of the first statement is 4.9 equal to "Fully Observed.", the total mean score of the second statement is 4.9 equal to "Fully Observed". The total weighted mean is 4.9 means that the respondents concur Security is "Fully Observed.

Table 4 ISO 25010 Product Quality Characteristics in terms of Performance Efficiency

No.	**Statements**	**Mean**	**Interpretation**
1	The proposed system should be able to have a fast response and minimal processing times while it's performing its functions.	4.8	Fully Observed
TOTAL WEIGHTED MEAN		4.8	Fully Observed

Table 4 shows the Mean of sub-characteristics of Performance Efficiency. The total mean score of the first statement is 4.8 equal to "Fully Observed.". The total weighted mean is 4.8 means that the respondents concur Performance Efficiency is "Fully Observed."

Table 5 ISO 25010 Product Quality Characteristics in terms of Usability

No.	**Statements**	**Mean**	**Interpretation**
1	The proposed system should ensure that data are accessible only to those authorized to have access	4.6	Fully Observed
2	The proposed system should prevent unauthorized access to, or modification of, computer programs or data.	4.6	Fully Observed
TOTAL WEIGHTED MEAN		4.6	Fully Observed

Table 5.0 shows the Mean of sub-characteristics of Usability. The total mean score of the first statement is 4.6 equal to "Fully Observed.", the total mean score of the second statement is 4.6 equal to "Fully Observed". The total weighted mean is 4.6 means that the respondents concur Usability is "Fully Observed."

5. Conclusion

The researchers have successfully constructed a website application that is significant towards faculty and students. the functional suitability, reliability performance efficiency and usability product quality. This system will be beneficial to the faculty and students to help them accurately check attendance and automatically.

Recommendation

Following the findings, testing, and evaluation procedures conducted by the researchers, the following recommendations were proposed:

- Improve System's User Interface.
- Use a good quality HD Camera for more accurate face detection.
- Make the web system connect on API for emergency and online use.
- Find more datasets to detect the student more accurately.
- Make the background blur to focus the face detector on students' face.
- Cover the people who have the same facial feature. e.g., identical twins.
- Add more important information in admin and student account.

Compliance with ethical standards

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Disclosure of conflict of interest

The Authors proclaim no conflict of interest.

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