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JomAttendance: Making Facial Business Sense

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Abstract

The attendance system in education currently used in the world are commonly initial on paper is not effective in recording attendance because people can alter and change the data easily. With modern camera technology, the attendance system should use a facial recognition system when recording attendance. Mixed-mode research concluded that university students have agreed that the traditional attendance verification process is a hassle t because of the large class size. Therefore this system plans to solve problems such as reliability, truant and delays when taking attendance. This system uses a facial recognition attendance algorithm. The system demonstrates the benefits of having a facial detection attendance system in a university setting. The facial detection approach is recommended towards a new standard for university attendance because it is faster and more effective to record student attendance.

I. INTRODUCTION

School of all levels has been taking attendance on a piece of paper. The paper states the name and ID of students in columns, and students are required to either sign or tick a box to mark their attendance. An attendance approach aims to record the frequency of students attending class and detect truancy. The second reason for attendance is to ensure every student in a class is accounted for and is not missing. However, the hassle of signing student attendance with pen and paper can be avoided using modern technology[1]. For example, with biometrics technology, the student cannot lie about their attendance with the help of their friends or any other tricks. Every student needs to register their facial structure and biometrics for the system to record their attendance. Before school begins, every student will register their face biometrics to take their attendance before class [2] [3]. Biometrics such as fingerprints and facial images need to be recorded so that the student cannot manipulate the system.

The proposed system will be essential and benefit both the lecturers and the students in terms of time efficiency, accuracy, and automatic attendance. The new attendance system monitors the student's performance by recognising the facial image using a camera that can record every student's face registered into the system [4]. The facial recognition approach is not a new technology and has been utilised in many sectors. For example, law enforcement used face recognition for criminals in their database to identify them in public areas.

The facial recognition mechanism begins with a face detection framework and recognition algorithms that can automatically detect and register students' faces in the classroom. Next, the database will register their attendance in class. If the student is not in a class, it will notify their parents through email or text message and register the absent student [5-12].

The new proposed system can solve problems that the previous attendance system had. By tracking students' attendance in a class, other benefits can be observed, such as the performance of subjects taken by a student, improving the efficiency of the learning process, and boosting the education level and quality of life for the student [6]. Lecturers can also easily manage the attendance data since everything is stored in a database. This paper proposes developing a more efficient, effective, and fool-proof facial recognition system for attendance when using it in real-time [7].

Multiple studies and research have been conducted on facial recognition algorithms, and it is continuously improving. The design of the face detection attendance approach with faster video handling will positively impact the attendance taken in all levels of schools. The modification of the system is to feature facial recognition that can detect a student face in a crowded classroom and automatically mark the student attendance, calculate the student's attendance rate and performance in the class. Using the software application, lecturers can track every student's attendance, show the students' attendance, absences and the percentage of attendance over the total conducted class [8] [9].

From each characteristic provided in the proposed system, there are many benefits in implementing this system in all schools and education institutions. Students and lecturers will no longer experience the trouble of taking attendance from a sheet of paper anymore.

Based on the goal developed, these are hypotheses for

every target as shown in Figure 1 and Table 1.

Table 1
Research Hypothesis

Hypotheses	Descriptions
H1	Data are more viable and reliable to collect and use as a performance benchmark
H2	Students and lecturers will spend less time marking attendance and focus more on studying.
H3	University image improves and is adaptive towards new technology

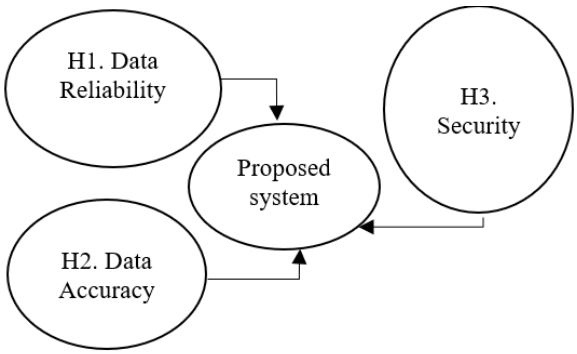

Figure 1: Hypothesis research model

H1: To be able to use the data provided by the proposed system as a form of benchmark of the student performance in all schools.
H2: The processing of marking student attendance can be completed autonomously and instantaneously with the help of modern technology, making teachers and lecturers jobs easier in tracking the students.
H3: With this proposed system implied, the university images improve, and the quality of life for the students and staff also improve due to the new adaptation of this new system.

This system's benefits include making attendance an active process rather than being passive, labour intensive, manual, and unimpressive. The new attendance system can save time when taking attendance and reduce the truancy rate in schools

II. LITERATURE REVIEW

Face recognition is a technology invented back in 1960. Initially, the computer can recognise and detect a human face. The algorithm can identify the gap between the face and the camera and automatically detect whether the face in the camera and the pre-recorded image belongs to the same person, as shown in Figure 2 [10] [11].

Figure 2: Facial recognition

Table 2 reveals the disparity between the existing system of pen and paper for the attendance system and the proposed facial recognition system with all the advantages and disadvantages of both systems [12]. Firstly, the traditional way of marking paper attendance produced multiple faults such as human error, e.g., the person may sign on behalf of their friends who are skipping class. Secondly, completing the attendance process in a large classroom with more than 50 students is time-consuming. The whole process can take more than 15 minutes for all the students to sign [13]. Thirdly, in any system, the provided data need to be reliable. The traditional system in using paper failed to offer data reliability due to chances for students to falsify their attendance. [14]. Fourthly, the data provided by a sheet of paper is inaccurate because the student might sign in the wrong column for the exact date [15] [16]. Lastly, the old system of using paper as a form of attendance is easily manipulated and can be fool [16] [17].

Table 2
Current Attendance System

System	Human error	Time Efficiency	Data Reliability	Data Accuracy	Fool Proof
Pen and paper	/	x	x	x	x
Facial recognition	x	/	/	/	/
Fingerprint	x	/	/	/	/

The proposed system has better features than its predecessors. It eliminates human error when taking attendance, and the implementation of facial recognition is far more time-efficient and provides more accurate data. The system is also fool-proof, meaning students cannot manipulate the system to sign their attendance [20] [21] [22].

Face detection technology has evolved with new and quick algorithms to identify faces in a picture through computing. Sutabri (2019) mentioned a few algorithms, including Viola-Jones, Neural Network, and Eigenface [23]. The paper discusses the high degree of identification for the face of Viola-Jones. The main disadvantage is that these algorithms are longer and less reliable. Eigenface detects faces and distances using a statistical approach known as Principal Component Analysis (PCA). A neural network scans any matrix in an input image to evaluate the presence of a face.

Image processing is becoming increasingly important in today's digital world because of technological advancements. Image detection has many applications these days, including biometric identification, behavioural profiling, video-conferencing, and monitoring. Facial image has developed itself as an essential biometric feature that is readily obtained and does not necessitate any unique or physical contact between the subject and the system. Image recognition is a dynamic and challenging task that involves several parameters such as intensity, orientation, voice, and scale, as can be seen [24]. As a result, the electronic attendance system aids in distinguishing between the faces in the classroom and correctly recognising the faces to mark their attendance. The system's performance is improved by fine-tuning the learning process [24].

A. Facial Recognition Algorithm

In 2D face recognition, raw images are frequently described by geometric structure or by the encoding of their intensity values. A geometric structure representation is produced by altering the raw image into a geometric

primitive, namely curves and points. The structure can be accomplished by identifying distinct face parts like the mouth, eyes, chin, or nose and determining the relative location, distance, and other parameters. The steps of the facial recognition process are as follows.

1) Facial Detection

A photograph of the face is taken then examined. Since it is easier to align a 2D photo with those from the database, primarily facial recognition uses 2D images instead of 3D images. Distinct landmarks or nodal points describe every face. There are 80 nodal points on the human face. The facial recognition system will analyse these nodal points of the face, including the gap across the eyes or the form of cheekbones. Tiny Face Detector was the model implemented in this project. The Tiny Face Detector is a high-performance, real-time face detector that consumes little resources. Since this model is web and mobile-friendly, thus making it is one of the best face detectors for users with limited resources. A customised dataset of 14000 images, including bounding boxes, was used to train the face detector. The model was also developed to predict bounding boxes that fully cover facial feature points.

2) Facial Recognition

The facial analysis is converted into a mathematical model. These features are encoded as a numerical code and are referred to as a faceprint. Every person's faceprint is equivalent to a particular structure of a thumbprint. A ResNet-34-like architecture is applied to calculate a face descriptor (a 128-valued feature vector) from every face image. Face descriptor is being used to define a person's facial characteristics. The model is not restricted to the collection of faces used for training, which mean it can recognise any person's face. It may compare the face descriptors of two given faces to calculate their similarities, for instance, by calculating the Euclidean distance or using another classifier.

3) Image Comparison

After that, the faceprint produced by facial recognition is compared to a database of other faceprints. This database contains images of pre-registered students with the system and can be compared [24]. Faceprints are compared to those stored in a database to determine the matching student's identity.

III. METHODOLOGY

This research applies the integrated approach to collect data and determine how and why queries from the scoping meeting. The survey form and interview questions are posed to the participants. The data are compiled and gathered through the subsequent approach, as shown in Table 3.

The mixed-mode or mixed-method is applied through a random survey and interview as its primary data collection [27-34]. Based on Table 3, the research conducted is explained in the sequential design, including the steps on data collection. To elaborate on the data collection steps, the sequential design is shown in Figure 3.

The survey is done at private universities such as Sunway University, APU University and Monash University, and public universities like University Malaya and UiTM. Then, the fundamental descriptive evaluation is concluded. It will be supported with the statistical information collection, which is the meeting conducted by questioning students who take their attendance by signing a paper. After conducting the interviews, the detailed assessment and reasons behind the statistical analysis are conducted [30-32]. Lastly, the evidence is characterised and established into one summary, as displayed in Table 4. The questionnaires are distributed to gather a general opinion of the universities' students and avoid biases and any other factors that may hinder the data collected [33]. Data collection is a method of mixed-mode where survey and interview questions are taken place to ensure more detailed thoughts and opinions towards the facial recognition attendance system [34-36]. The university will improve its branding and image for the technological advancement made in the attendance system. [37-40].

Table 3
Research Methodology

Research Dimension	Explanatory Sequential Design
Research Methodology	Mixed Mode
Research Methods	Survey & Interview

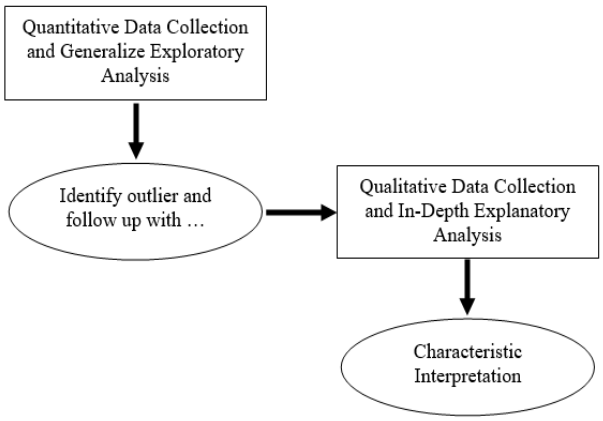

Figure 3. Sequential Design [35-36]

IV. RESULTS AND DISCUSSION

The data collected in this research shows that recipients agreed that the facial recognition in the attendance system would be more cost-saving in university than the traditional method of paper attendance. Figure 4 reveals the survey result for the facial recognition system cost-effectiveness. Figure 4 shows that most participants agree that a facial recognition system is more cost-effective than traditional attendance, with several factors being that less paper will be wasted. 46% of participants agreed that the facial recognition system would be cost-efficient in the long run. Students agreed that current attendance is a hassle and not adequately implemented in the university. There is also less paperwork is required when attendance is automatically done by machine.

Figure 5 shows the data on facial recognition system attendance being time-efficient. 53% of participants agree that the facial recognition system will be time-efficient when recording attendance in a classroom. Respondents stated that because the system is automated, there is no need to write their names on a piece of paper.

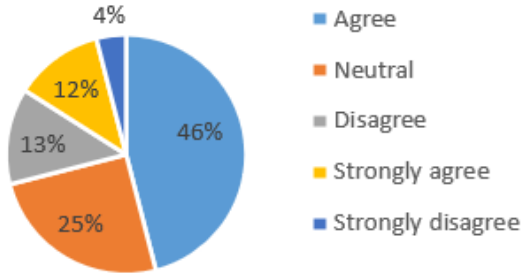

Figure 4: Facial recognition system is cost-effective

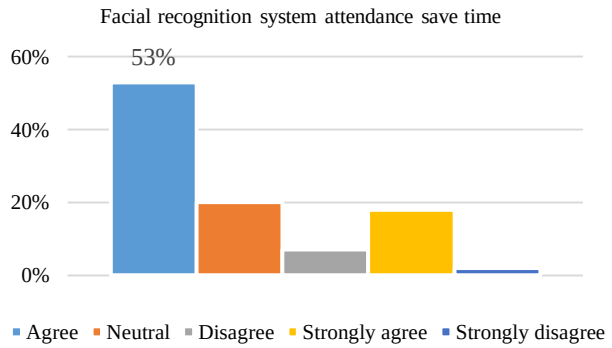

Figure 5: Facial recognition attendance save time

In Figure 6, 66% of the survey participants agree that a university image and brand will be better if seen using modern technology in their university because it shows that the university is progressive and keeps up in modernisation. The student agrees that it provides a conducive study environment.

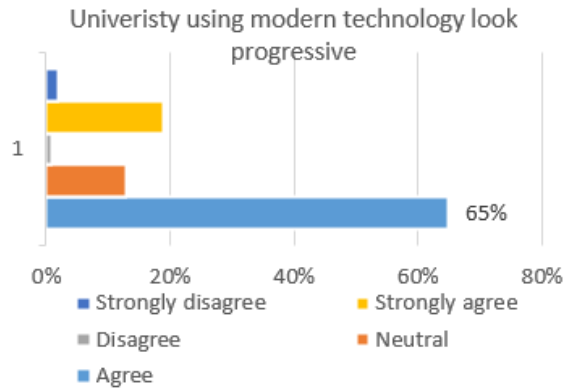

Figure 6: University modern technology look progressive

In Figure 7, the survey collected a substantial percentage of 57% agreed that technology improves the quality of the university because this shows that the university is spending sufficient funding towards modernisation on the facilities. Students also agreed that replacing the current attendance system and implementing a facial recognition system will reduce waiting time drastically and improve the overall process in terms of productivity, therefore, the quality of the university. Students will access and understand their environment surrounded by technology, which will improve their knowledge of technology.

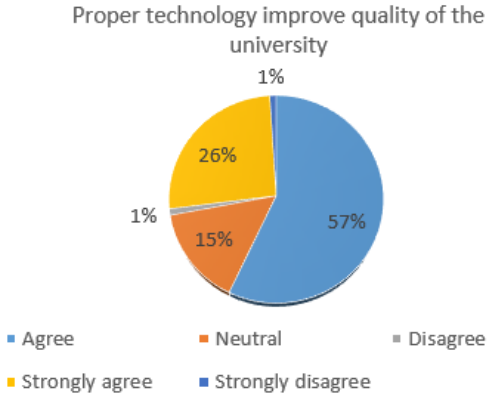

Figure 7: Technology improves university quality

In Figure 8, the facial recognition system attendance consists of 3 buttons. The 'Bar List' button shows the student's bar list on a new page. The 'Attendance' button prompts the application camera to record the attendance. The 'Exit' button closes and shut down the application.

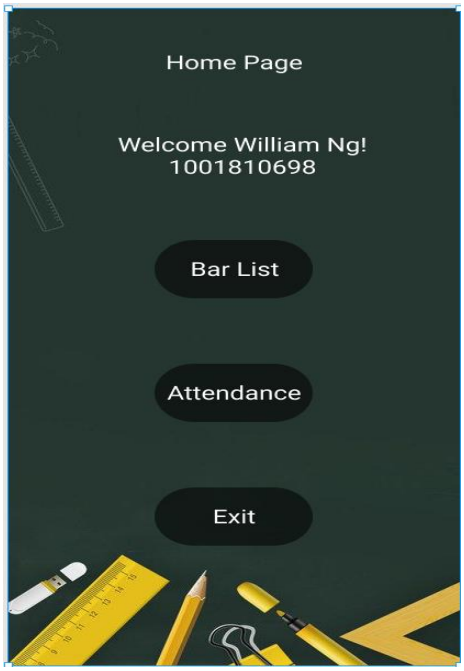

Figure 8: Main page of the application

The facial algorithm is used to detect and mark student attendance. In Figure 9, the attendance page displays a camera app showing the student's face on the screen. After successfully recording the student attendance, it displays the name, class, and the student's attendance. While displaying all this info, two buttons are displayed be at the bottom of the screen. The 'exit' button to shut down the application and the 'home' button to return to the application's main page.

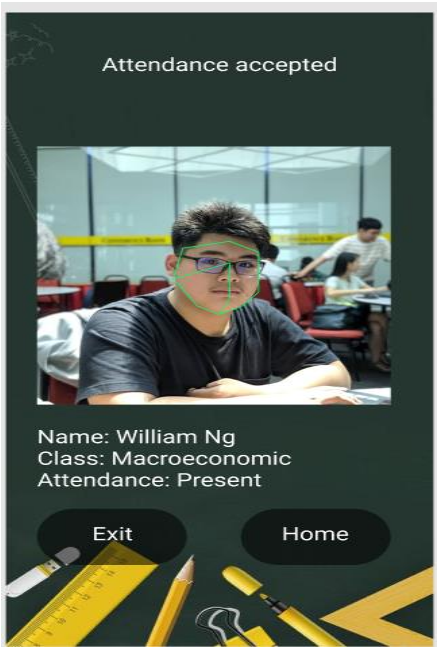

Figure 9: Attendance Page

V. CONCLUSIONS, SHORTCOMINGS, AND FUTURE ENHANCEMENTS

In summary, the facial recognition attendance application aims to provide faster and more reliable attendance data than the current practices. The limitation of the application is that the application is bare-bone and only serve the purpose of only recording attendance with no additional function. Future improvements and upgrades would be towards a better appearance, ensuring the application stays reliable and user-friendly. Secondly, the application may add new features and functions such as a card ID function for users to show their identification, which will benefit the users, whether they are students or lecturers.

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