Real-time Class Attendance Monitoring using Smart Face Recognition

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***Abstract*— Student attendance in classroom-based learning usually becomes a pain stake for teachers in terms of monitoring and records keeping. The study provides a solution to this by using the technology of image processing applied in facial recognition. A software was developed to check the student attendance in real-time. The ISO 9126 gauges for functional stability, usability, reliability, portability, efficiency, and maintainability. The functionalities and user acceptance were measured within the bounds of software engineering and measured acceptable to a mean very acceptable rating of 3.74.**

Keywords— Coordinates, Digital Image, Facial Recognition, Image Processing, Image Database

I. INTRODUCTION

The presence inside the school starts the effort, inspiration, procedure, time-overseeing aptitudes, and mentalities on perusing and learning the correct materials. These are the determinants to make students' scholarly progress. The students' participation is a critical variable to develop social abilities, communication from individual students fabricates his belongingness inside the school. Students who build up a feeling of distinguishing proof with the school are probably going to encounter more noteworthy instruction gains, explicitly as an outcome of dynamic investment in the homeroom and school for the most part [1].

Rehearsing a common connection between educator to-student, student-to-student, observing educational plan execution, and solid student synthesis improves the financial experience [2]. The student school introduction for sure supports intellectual advancement in the present moment as appeared from the new research [3] [1]. Long haul carriage of learning and qualities had been assessed the beneficial outcomes in later years. Taking everything into account, taking an interest or introduction at school advances the improvement of the student itself to be conveyed to his development [4].

Participation had turned into one of the most institutionalized evaluating premises to distinguish the student execution too, and it demonstrates the results of the missing companions than the standard student who consistently appears in the class [5]. Non-appearance is a truant way of "pulling back" from school exercises without loaning a real explanation behind not going to classes which adversely changes the presentation of the student. Truancy was classified by two kinds: (1) forgivable unlucky deficiencies, where it was considered from wounds and therapeutic ailments; and (2) unpardonable nonappearances, similar to intentional school withdrawal originating from social, natural, and mental issues [6]. Which turned into the purpose behind low execution, predictable truancy conduct, withdrawal to class exercises, and the direst outcome imaginable were drop-outs.

In all instructive foundation, it comprises of a benchmark for students and instructors concerning participation in a session of study. Which, thinking about the thorough report for students' investment was basic. Customary strategies utilized were normally recognized on paper sheets and another old-styled documenting framework; this suggestion is being utilized for quite a while. It formed into a dilemma for the administration to routinely revise the record and physically measure the extent of classes visited [1].

Most of, utilization of presence information gathering was executed from the paper-based strategy, causing information mistakes, natural deficiencies, and sketchy research discoveries. These are (1) tedious, an interference happens in each student by getting the pivoting register paper bringing about interruption and human mistake that influences the fulfillment at talk hours. (2) indecipherable signatures; and (3) pantomime: students who attempted to outmaneuver the framework by enrolling the missing friends as being in participation, which distinguishing proof from constant non-attendants made progressively troublesome [3].

In the advanced age, innovation has been the ally to simplify work and reduce blunders. Biometrics advances confirm the personality through its attributes, for example, (1) face designs (e.g., the separation and the spans of the facial highlights); (2) palm designs; (3) voice sound; (4) eye designs (iris and retinal examples); (5) unique finger impression designs. The utilization of this physical information from these strategies is obtaining consideration as close to home confirmation methods are more worthwhile than current systems, for example, distinguishing proof cards or a secret key in light of the fact that the information was one of a kind to each individual stays all over one's presence [7]. Developments were made to extemporize day by day needs, why analysts fabricate a programmed participation framework the board, which a PC program made for day by day student participation record in foundations and schools. It streamlines access to the participation of a specific student in a class. This robotized framework will likewise ease in making subtleties and figure the participation capability of the student [8]. Some participation the board framework like a unique finger impression-based framework: finger impression examples were the token for the gadget of an optical unique finger impression sensor to check the participation of the executives for the two students and educators. It was arranged into two procedures: (1) the enlistment; and (2) verification. During the

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time spent enlistment, the unique mark of the client is caught by the sensor and changed over into a progression of bits of information to store in the database to concede the recognizable proof of the client, detailing the procedure of check. During the time spent confirmation, Fingerprint examples were examined once more, the information removed and being contrasted with the put-away information at the database to recognize the match of the unique finger impression. A fruitful match will bring about a sign of participation [9]. Nonetheless, the inconvenience on the sort of computerized framework was the variety in the client's physical or conduct attributes (e.g., slash and wounds on the finger), pivoting conditions (e.g., atmosphere, moistness, sweat-soaked palms, dry hands) [10]. Additionally, a few conditions like Human blunder, in an example, the client neglected to examine his finger that may result as no break recorded, that will consider as invalid to the head to that archived report.

this study is designed to facilitate the exertion of both instructors and students from this kind of deterrent by designing an Automated Student Attendance Monitoring System (ASAMS). Where mechanized student participation is done on enrolling students, and the students go to their particular seats, the framework screens participation in 3 distinctive time interims relying upon the instructors' requests. This examination will reduce the time expended on the association of the student to the gadget with no extra exertion is executed, not normal for the other participation framework.

II. METHODOLOGY

The study is about an automatic attendance monitoring system that identifies and records the presence of the student inside the classroom, which acts as an attendance without the student's interaction. It also includes the equipment model and software application that connects OpenCV digital image processing through the computer application to be used for data manipulation. The study focuses on attendance monitoring features. The frontal view of the student is the only one being detected and recognized. The computer specification affects the performance of the system because of the comprehensive resource management needed to acquire accuracy, smoothness, and performance. The camera specification affects the recognition of the system, depending on the resolution and frame rate. The Student's Attendance Monitoring System using Image Processing is an application designed to track and record the attendance of the students inside the classroom. When operating with the use of camera and detects a face of a student, it sends data and identifies if the student is present or not and sets of a certain amount of time and intervals, if the student remains unstable to the scanning process per interval, the student will mark as absent. Proper seating and posture of the face in the perspective of the camera affects the recognition for they verify the student attendance.

A. Software Process Model

Fig. 1 visualizes how the researches directed the whole study of the system. This method initializes the requirement gathering, in which the researches must come up with proper requirements to acquire the desired output of the system. After requirement gathering the next is the analysis and design; this is how researchers developed the system, by separating the system using the module and designing its specification. The next after analysis and design is the Development phase, where applying and organizing methods for the development of the system. After the development phase, the evaluation phase is the next process in which the system must undergo the evaluation procedure. After on evaluation, lastly the deployment of the system to the desired user. To elaborate more clearly, a step-by-step procedure is provided.

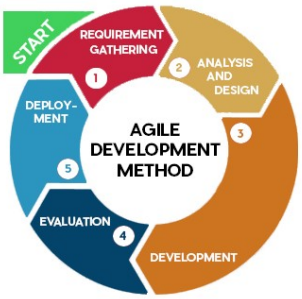

Fig. 1. Agile Development Method

B. Hardware Components

Fig. 2 shows the interconnection of the components for the Student's Attendance Monitoring System using Image Processing. The camera is placed near the front to the point of all students will be seen. To detect a face in a certain position, there must be a gap between of each face so that others will be not covered out to prevent the timer (given time for the student for leaving the scanning process) from activating then it will send the data, and the application will be updated quickly.

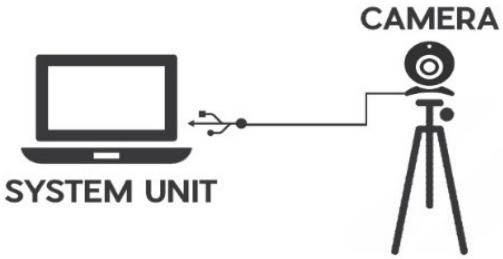

Fig. 2. Hardware Components

C. Conceptual Framework

Fig. 3 visualizes the conceptual framework that contains a process that represents the model used in this study. The illustration shows the major members of the system, the teacher, and the student. The teacher can modify the generated attendance report depending on the demands of the teacher (e.g., Considerations, Medical Excuses). The algorithm used in the system is Haar Cascading and Local Binary Pattern. The system offers services like metadata, editing, saving of the file. The scanned faces from the registration are cropped and converted into machine code, and it will be inserted into the student record. These converted machine codes will be used as a basis for the verification of face detection.

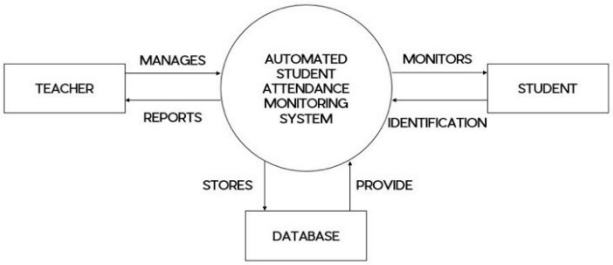

Fig. 3. Conceptual Framework

III. Results

A. Software Components

Fig. 4 visualizes a flowchart that represents how the user will log in to the application. It elaborates that the user is required to insert their credentials, particularly a valid username for them to maximize the features of the application. Similarly, to other system applications, this application is for local account manipulation, which means one account can only be created to the system application in a ratio of one account is to one system unit. However, the username and the password can interchange if needed.

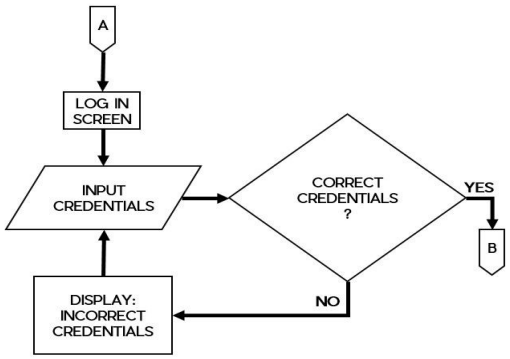

Fig. 4. Flowchart of the Login Screen

Fig. 5 demonstrates the operation of the registration process of the attendance monitoring system. The operation will capture students' faces upon registering process of the application. The captured images will be converted into data to a process provided with its algorithm.

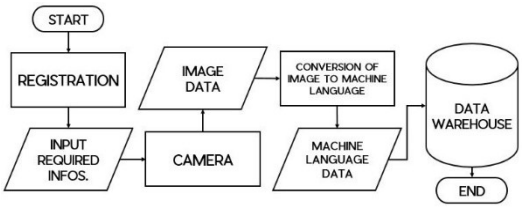

Fig. 5. Flowchart of the Registration Process

The operation of the system is reflected in Fig. 6. After the user successfully logs in, the screen will show to the page wherein the user will have the option to insert, to update, to delete, and to view students' records. After registering students, all registered students must train their images in the system, to help the system to have predictive power on recognizing faces. The main purpose of attendance application is to give the users the details and knowing the attendance status of the students in the classroom automatically, and three intervals are indicated to the record in terms of attendance to tell that the student was not at that time of next monitoring. Also, when the student leaves the classroom, the student will be marked as 'absent' upon the scanning process.

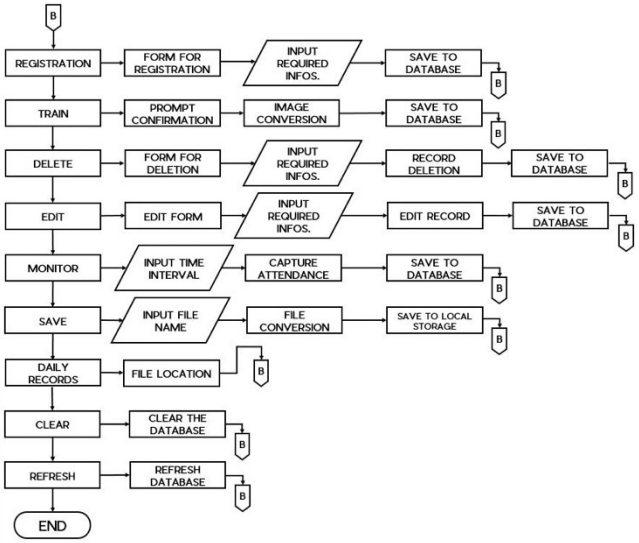

Fig. 6. Flowchart of the System's Front End

B. User Interface Design

The initial log-on screen is reflected in Fig. 7. This module authenticates user credentials who has access to the system.

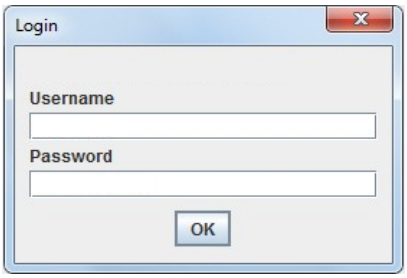

Fig. 7. Graphical User Interface Screen 1- Log-in

The user dashboard provides access to all the functionalities of the system which are: Main page, Class info, Students List with several columns displays the information and status of the student, Date, Add and Delete Student, Help, Create Class List, Action and Help as reflected in Fig. 8.

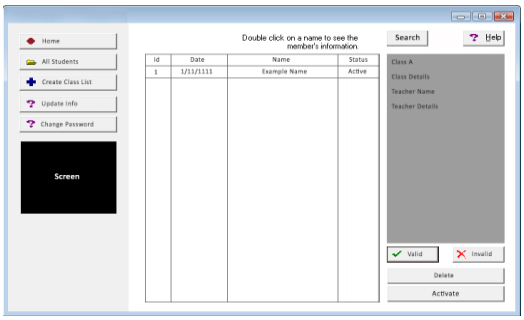

Fig. 8. Graphical User Interface Screen 2-Dashboard

C. Mobile Application

The final design is the ASAMS mobile app installed with a web-camera to be viewed by the teachers with their laptops or computers. It generates reports to monitor student attendance and store the record needed for the recording process. Fig. 9 shows the login screen of the application. The login screen seemed correctly without faults.

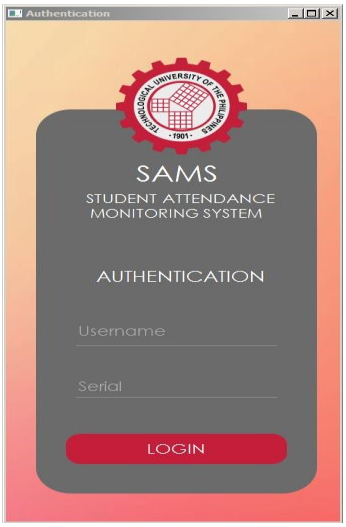

Fig. 9. Working Application of ASAMS

Fig. 10 shows the main user interface of the whole system where all modules are being represented by icons and buttons. This window form shows when the user has logged in successfully. In this window form, the user can register a student, edit student records, delete student records, monitor the attendance, save the generated attendance file, locate the path of generated attendance file, and modify the attendance record.

Fig. 10. Homepage Screen of ASAMS

Fig. 11 shows the windows form when the user clicked the ‘guides' button, which has two guides Figure 13 for tutorials of the step-by-step process, and Figure 14 for the keywords and tips. These forms are the guide in the system to the user a give basic knowledge to the system.

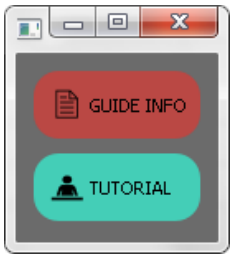

Fig. 11. Windows Form of the Quick Access Guide of the System

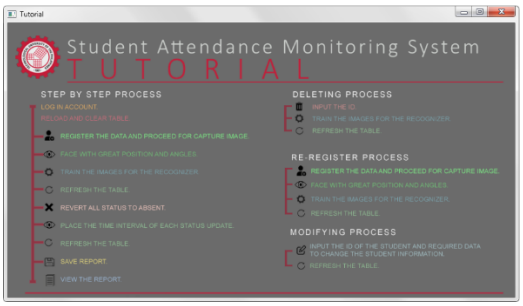

Fig. 12. Windows Form of the Step-by-Step Process Tutorials

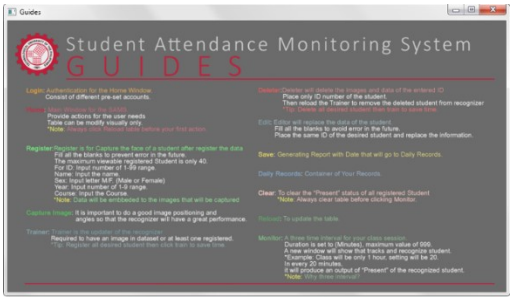

Fig. 13. Windows Form of the Keywords and its Definition with Tips

Fig. 14 shows the interface when the user clicked the button ‘Register’ to the homepage of Application. In this windows form, the user must fill up the information needed to store the information to the database. As the user clicked the button ‘Save and capture image’ the camera will prompt to record the image for the recognition process of monitoring the students’ attendance as shown in Fig. 15.

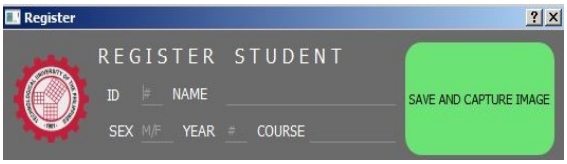

Fig. 14. Registration Prompt

Fig. 15. Recorded Faces of the Students after filling up the Form

Fig. 16 shows the menu where the user must type the ID number and fill up the information required to update the record of the database.

Fig. 16. Edit Records

Fig. 17 shows the windows form when the user clicked the ‘delete’ button from the homepage of the application where

the user must type the ID number of the record to delete the particular record.

Fig. 17. Delete

Fig. 18 shows the windows form when the user clicked the 'train' button from the homepage of the application. In this form, after you successfully register all student information and their faces, you must click the 'train' to convert faces into machine language as the algorithm recognize it.

Fig. 18. Training Recognizer

Fig. 19 shows the windows form when the user clicked the 'save' button from the homepage of the application. In this form, you can save your attendance record by typing the name of the file that is going to be saved.

Fig. 19. Save Attendance Record Windows Form

Fig. 20 shows the windows form when the user clicked the 'daily records' button from the homepage of the application. In this form, you can locate and view your records in an excel format to modify the records depending on the professors' decisions.

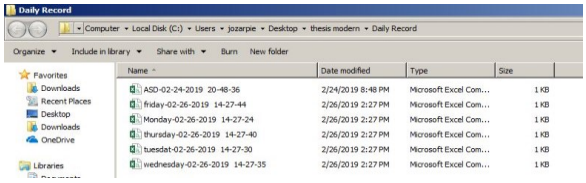

Fig. 20. Save Attendance Record Windows Form

IV. Test Results And Evaluation

The system was tested and assessed by its capability to give monitoring and records student's attendance at three different time intervals depending on the teachers' demands. The test directed depends on ISO 9126 gauges for functional stability, usability, reliability, portability, efficiency, and maintainability. Several test procedures were conducted to assess the acceptance of the user for the screen interfaces of the system. The function works well for all the test procedures conducted otherwise; the function is not working at all.

TABLE I. Average Response Time Of All The Application's Interface Screens

APPLICATION'S INTERFACE SCREENS	AVERAGE RESPONSE TIME
Login Page	0.25 seconds
Guide and Tutorials Page	0.26 seconds
Student's Registration Page	0.26 seconds
Student's Face Scan Page	33 seconds
Edit Student's Information Page	0.25 seconds
Delete Student's Information Page	0.62 seconds
Student's Monitoring Page	1.07 seconds
Saving Student's Attendance Record Page	0.62 seconds
Retrieving Student's Attendance Page	0.30 seconds

Table I displays the results of all the average response time of all the application's interface screens. All screen pages were tested three times to calculate the average response time.

TABLE II. Evaluation Results-Based From ISO 9126 From The Chosen Respondents

CRITERIA	MEAN	QUALITATIVE INTERPRETATION
Functionality Suitability	3.50	Acceptable
Performance Efficiency	3.47	Acceptable
Reliability	3.12	Acceptable
Portability	4.20	Very Acceptable
Usability	4.06	Very Acceptable
Maintainability	4.14	Very Acceptable
Overall Mean	**3.74**	**Very Acceptable**

There were twenty students, two teachers, and one IT staff who are chosen as members of the respondents responsible for the assessment. Assessment methodology relies upon the criteria given to the customer or client of the application. A review with respect to the degree of significance of the criteria was given to the customers to be evaluated. Considering the Likert Scale, the client ought to pick on a numerical rating from 1 to 5, 1 being the least score, poor or not adequate and 5 being the most noteworthy, brilliant or profoundly satisfactory. Rating the degree of significance of the accompanying criteria depends on ISO 9126 gauges. It appears in Table II over that most of the chosen respondents rated the application as acceptable to very acceptable with an overall mean weighted score of 3.74. It demonstrates that the application breezed through all tests directed as a major aspect of the testing and assessment procedures.

V. Conclusion

The ISO 9126 gauges for functional stability, usability, reliability, portability, efficiency, and maintainability. The application developed implementing real-time attendance monitoring using facial recognition produced acceptable results using ISO9126. The functionalities and user acceptance were measured within the bounds of software engineering and measured acceptable to a mean very acceptable rating of 3.74. The application empowers the clients to scan students' face with corresponding information,

train the image (students' faces) as they converted into machine language, and in monitoring attendance, the face data scanned were compared to the data stored from the local database that comes from the post-register, analyze the presence of a student to identify the truant peer students by the given time of interval which is divided into three separate times set by the teacher, serves as an attendance record after the data are verified and generate student records required by the teacher.

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