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Face Authentication System for Kindergarten Attendance with Notification (FASKA)

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Abstract

Current methods of attendance tracking in kindergartens are inefficient and unreliable. Traditional methods are prone to human error and do not adequately ensure the safety of young children. Additionally, the administrative burden on educators diverts valuable time and resources away from teaching, forcing them to focus on clerical tasks. This project aims to develop a smart face authentication attendance system with added notification features. The application will provide user information on kindergarten students, such as their name, parent's phone number, and guardian's name. It will track student attendance through facial recognition, recording attendance when a student's face is detected. If a student is absent, a notification will be sent to their parents via WhatsApp. This system streamlines the process and reduces the workload of teachers. The project integrates machine learning technology, utilizing the Android operating system, Firebase, ML Kit, and face recognition. The application development follows the waterfall model approach, starting with requirements, design, implementation, testing, and maintenance phases. Ultimately, the face authentication application for kindergarten attendance enhances workflow and ensures student absence is promptly communicated through notifications.

1. Introduction

The development of the Face Authentication System for Kindergarten Attendance (FASKA) represents a forward-looking initiative designed to leverage facial recognition technology for enhancing security and operational efficiency in educational settings, especially kindergartens. This application will inform the user about the attendance of the student. If the student is absent or late to school, an alert notification system will be given to the number that has been registered to notify that the student is late without any reason why the student has not yet arrived at the intended destination. This application can speed up the attendance by scanning and detecting the faces that have been recognized and stored in the attendance management system. Wearing a mask covers most parts of the face, preventing many facial features from being extracted. This can significantly impact the effectiveness of face detection and recognition [1].

In addition to enhancing operational efficiency, FASKA provides a robust solution for maintaining accurate attendance records, which is crucial for both administrative and safety purposes. The system minimizes the risk of human error and fraudulent attendance entries, which are common in manual systems. Moreover, the use of facial recognition technology reduces the time teachers spend on attendance, allowing them to focus more

on instructional activities. The real-time alert system integrated within FASKA ensures that parents or guardians are immediately aware of their child's attendance status, providing peace of mind and facilitating quick responses if a child is unexpectedly absent or late. This feature is particularly beneficial in ensuring student safety, as it allows for immediate action in case of emergencies.

Furthermore, the implementation of advanced algorithms to handle the challenges posed by face masks is a critical aspect of FASKA. These algorithms must be capable of recognizing faces with partial visibility, ensuring the system remains effective even when students are wearing masks due to health protocols or other reasons [2]. The ongoing development of such technologies will likely lead to improvements in the system's accuracy and reliability under various conditions, including different lighting and angles.

Overall, FASKA not only streamlines the attendance process but also contributes to a safer and more efficient educational environment. As facial recognition technology continues to advance, its application in schools will likely expand, providing even more sophisticated features for attendance management and student safety.

2. Literature Review

A literature review of this attendance system includes an analysis of each component, detailing and comparing existing systems to determine their capabilities. The first review examines voice recognition systems, where employees indicate the start or stop of their shift by speaking to the system. This can be done by calling in, using a mobile app, or speaking through an intercom box. Voice recognition is highly accurate and helps prevent time theft and fraudulent time tracking [3].

The second system reviewed is biometric. Biometric attendance systems use hardware or software to record attendance based on biometric data such as fingerprints, iris scans, hand geometry, and face recognition. These systems, especially those using fingerprint verification, have been widely adopted for various purposes, including employee attendance. The goal is to develop a fast, accurate, and efficient automatic attendance system using biometric verification [4].

The final system reviewed is the manual attendance system, which involves filling out attendance sheets by hand. This traditional method is straightforward, requiring employees to manually record their attendance on physical sheets [5]. The normal method of taking manual attendance is to prepare the sign paper. Next, let people sign their name. Last, check for the person who is in charge to be absent.

In conclusion, this is the importance of attendance management systems (AMS) in organizations and reviews various existing systems, including voice, biometric, and manual based attendance systems. Most of the technology uses of each system are not the same and the way they are used is different. This also can make a difference in the advantages and disadvantages found in each system.

3. Waterfall Methodology

The FASKA project is managed using the Waterfall methodology, which requires the completion of one activity before moving on to the next. This method divides projects into phases based on requirements, design, implementation, testing, and maintenance. Once a phase is finished, the development proceeds to the next stage without revisiting previous stages, as illustrated in Fig. 1. Literature review indicates that the Waterfall model employs a linear approach, making it suitable for sequential or procedural design. This model is particularly beneficial in structured systems development where modifications to the software after coding are strongly discouraged. Additionally, in the Waterfall model, processes and data are usually separated, allowing changes to the data and code independently [6].

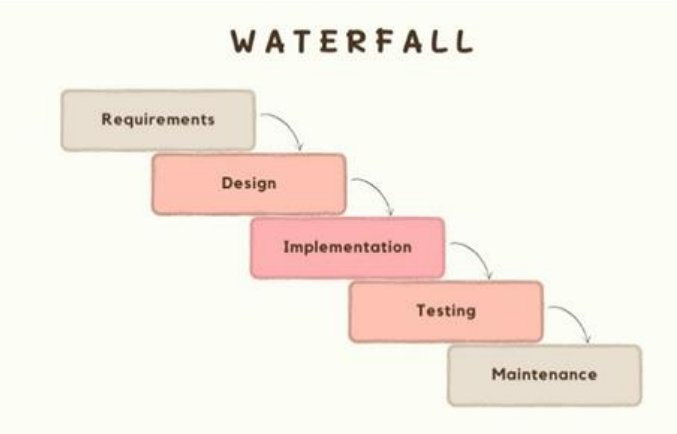

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Fig 1. *Waterfall Methodology*

3.1 Requirements Phase

The initial planning stage involves the team collecting extensive information to ensure the project's success. Due to the sequential nature of the Waterfall method, where each task depends on the completion of previous steps, careful and thorough planning is essential [7]. This phase needs to define user requirements such as email and password of the user to continue into the next phase. The project overview is to define the purpose and scope of the authentication verification system and identify stakeholders involved in the system management. The user requirement of this phase is to specify the features such as user registration, face detection, verification process and control access. It also accesses the user permissions for system management including administration and application user. For the non-functional requirements is to response time for face recognition and backup procedures for data protection. The usability of this project are user-friendly interfaces. For database design schema is for storing user profiles name, date, ID, and time.

3.2 Design Phase

In design phase, we integrate the webcam into the system architecture, update the database schema to store facial images securely, adjust the user interface to display webcam feed, and implement security measures for privacy. The system design shows the overall system architecture, including hardware components (mobile devices and camera) and software components (database and interfaces). For database design schema is for storing user profiles name, date, ID, and time. Then, user interface design for a face authentication verification system for a new user registration including capturing face and verification. In attendance design, it is displaying name, id date and time which has been saved by the user. The Fig. 2 below show the user interface when using the apps.

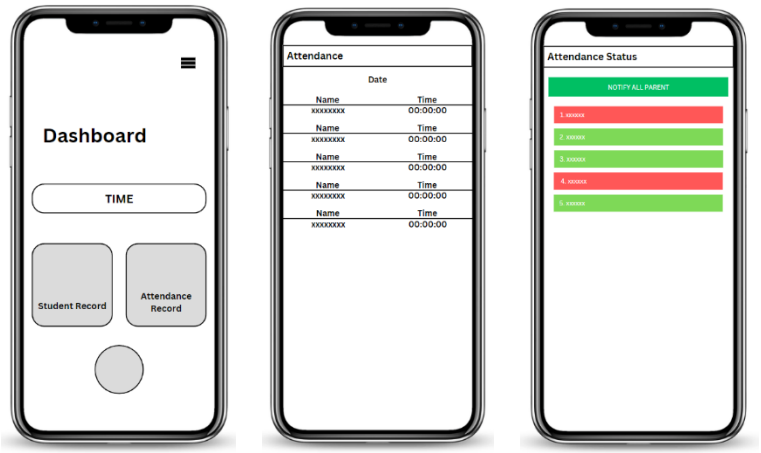
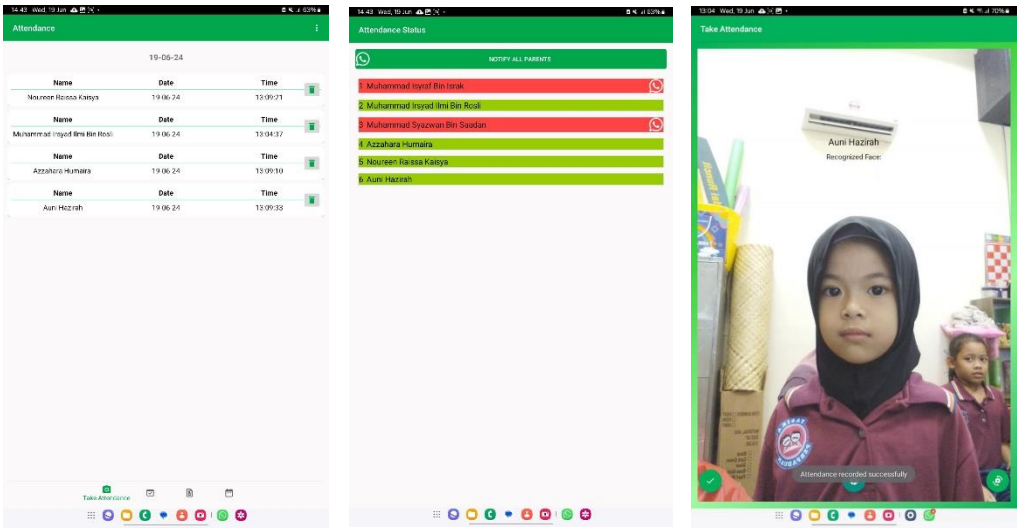


Fig 2. *User Interface design*

3.3 Implementation Phase

Implementation phase is to develop a code to capture a facial image and integrate webcam data with the attendance tracking system, ensuring real-time face scanning, and implementing necessary database modifications. This phase is also carried out to ensure that the project is free from any model of the SDLC processes [6]. The project also developed based on the design made and tested for its own functionality. It can ensure that the project is free from any major malfunctions or problem. In result, correction to the project also can be done from the malfunction detected. After clearly defining and identifying each requirement, the fourth step is to build and develop the software product according to the established standards. In this stage, software organizations begin coding and designing the product. This step involves implementing all the preconditions and postconditions of the project. Fig. 3 below show the function of the application.



(a) (b) (c)

Fig. 3 *Figure description (a) Attendance Record; (b)Attendance status. (c) Face recognition camera*

3.4 Testing Phase

When the project is fully developed, testing is done on this phase. Testing phase is to make the project will be tested to ensure that the project is working according to our expectation and the functionality. If there are any encounter of problem or bug on this FASKA application, it will be fixed as soon as possible and retested until the project is free from any error detected. Also on this step, we outline the testing strategies during the phase where different modules are tested to ensure each one functions according to the standard definitions and the requirements established in the initial phase of the SDLC process. Once the application has been thoroughly tested and confirmed to be error-free, it is ready for release with confidence.

3.5 Maintenance Phase

On the final phase, maintenance will be done on this project to maintain and provide maintenance to the user who used the application if any issue occurred at their environment. This phase focused more on the functionality enhancement of the app with the development of new iteration of the project. Maintenance is done to deliver these changes that we made to improve the system application to the user. These early stages represent the cornerstone of all software development projects agreed upon by software development communities [8].

4. Result and Discussion

This application has undergone testing by 11 users based on Table 1. Users were given an explanation about the background of the application before the testing session was conducted. The explanation about the application for taking student attendance is important to ensure that users understand before viewing and testing the application. After providing the explanation, the completed application was tested by the users, and then they provided feedback and opinions using a prepared 'Google Form'.

Table 1 *Frequency based on Gender*

Gender	Frequency
Male	2
Female	9

Fig. 4 shows that the majority of respondents found the attendance-taking application is very easy to use. This indicates that our application provides convenience to users and is easy to use. No users selected the "difficult" and "very difficult" scale options based on the figure below. It shows that all users were able to use the application easily based on the initial explanation.

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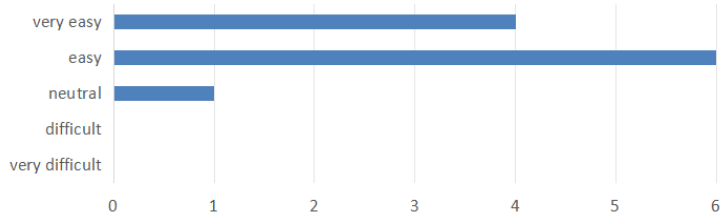

Fig 4. *Respondents find this apps is easy to use*

Fig. 5 shows that most respondents found the attendance-taking application is very accurate for children. This shows that our application provides accurate data to users and there is no missing or inaccurate data recorded. No users chose the "inaccurate" and "very inaccurate" scale options based on the figure below. It shows that all users can use the application very accurately without any doubts.

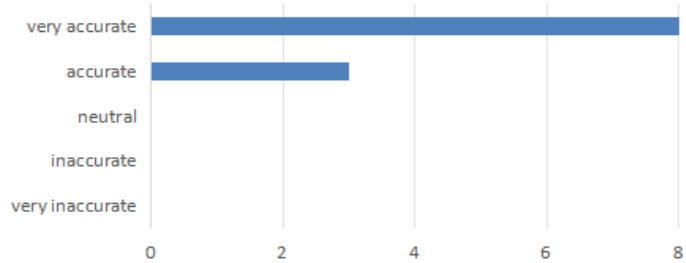

Fig 5. *Respondent found this application is very accurate for children*

Fig. 6 below shows that most respondents tested the application and found the overall on this application is satisfied. This shows that the application we provide to users is satisfied and very satisfied because it is easy and very good to use. No users chose the "dissatisfied" and "very dissatisfied" scale options based on the figure below. It shows that all users are satisfied using our application.

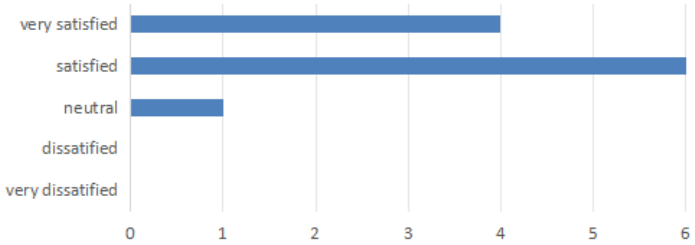

Fig 6. *Respondent found this application is very satisfied*

Fig. 7 below shows that 90.9% of respondents found that there is not any issue found on this application. 9.1% of respondents said yes because there was an issue stated, "still not familiar when using the apps".

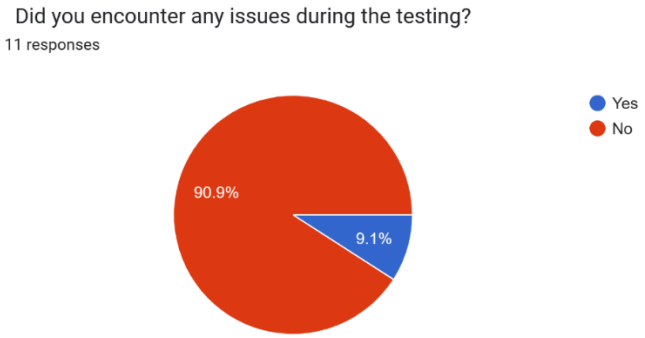

Fig 7. *User feedback about any issue found during testing*

5. Conclusion

In summary, the implementation of FASKA represents a forward-looking approach to attendance management in kindergartens, bringing significant benefits in terms of efficiency, reliability, and child safety. This project highlights the potential of modern technology to transform everyday administrative tasks, ultimately contributing to a safer and more efficient educational environment for young children.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

The author confirm contribution to the paper as follows: ***study conceptual and design:*** *Muhammad Irsyad Ilmi bin Rosli,* ***data collection:*** *Muhammad Irsyad Ilmi bin Rosli, Muhammad Faris Hakimi bin Mohd. Shariff.* ***Analysis and interpretation of result:*** *Muhammad Faris Hakmi bin Mohd. Shariff,* ***draft manuscript preparation:*** *Muhammad Syazwan bin Sa'dan. All authors reviewed the results and approved the final version of the manuscript.*

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