KANLAYANEESITHAMMARAT SCHOOL

English Program

A FACIAL RECOGNITION SYSTEM FOR ATTENDANCE OF STUDENTS AND TEACHERS

(FAST+)

A Web-Based Platform

A manuscript

submitted to the computer project host and judges

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Preface

In today's fast-paced world, the need for efficient and reliable systems for tracking attendance and time management is more important than ever, particularly in educational institutions and professional settings. Traditional methods of attendance checking, such as manual roll calls or card-based systems, are often time-consuming, prone to human error, and can lead to inefficiencies. As technology evolves, there is an increasing demand for more automated and accurate solutions.

This project presents Fast+: a facial recognition system for attendance of students and teachers, an innovative approach to address these challenges. The Fast+ is used to automate the process of attendance taking, ensuring both accuracy and efficiency. By utilizing advanced algorithms for real-time face detection and identification, the system eliminates the need for manual input and reduces the risk of errors in attendance records.

The primary objective of this project is to explore the feasibility and effectiveness of using facial recognition as a tool for timekeeping and attendance management in academic and professional environments. Throughout this thesis, we will demonstrate how the Fast+ system provides a reliable, secure, and user-friendly solution to these persistent issues, making it an ideal candidate for widespread adoption.

Acknowledgment

The researchers would like to extend sincere appreciation and deepest gratitude to the following individuals, whose constant support, guidance, and invaluable contributions were essential in making this computer project work possible. We are truly grateful for their assistance in bringing this research study to fruition.

Samuel H. Deloso, M.A.E.D, adviser, for his invaluable help, support, and profound expertise throughout the process of completing this project;

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KNEP team for their tireless efforts in designing and coding the system. Your technical expertise, attention to detail, and commitment to excellence have resulted in a highly functional and speedy facial recognition system;

Lastly, we also extend our thanks to the parents and guardians who have shown enthusiasm and support for this project. Your involvement and encouragement have been essential in ensuring the success of this computer project.

Abstract

This project presents Fast+ which utilizes facial recognition technology to automate and modernize the process of attendance tracking in educational and professional environments. It utilizes advanced computer vision and machine learning algorithms to accurately detect and identify individuals based on facial features, ensuring precise and efficient attendance logging.

Fast+ consists of a real-time facial recognition module integrated with a timekeeping platform. The system captures images of individuals as they enter a designated area, such as a classroom or office, and automatically records the time of arrival. It also provides reports on attendance patterns, including late arrivals and early departures, enabling both administrators and users to monitor punctuality with ease. A key feature of the system is its ability to handle multiple users simultaneously, offering scalability for larger environments.

The development of Fast+ involved the use of open-source libraries, such as face.-api.js, and GitHub, to implement the facial recognition process. The system was evaluated for accuracy, speed, and user experience through a series of experimental and pilot tests conducted with teachers and students. Results show that Fast+ significantly reduces the time and effort required for manual attendance recording, offering a high level of accuracy and minimal errors. The system also received positive feedback from users, who appreciated its convenience and ease of use.

This research demonstrates the potential of facial recognition technology to improve timekeeping and attendance management. Future developments could include expanding the system's capabilities to incorporate additional features, such as automatic integration with learning management systems (LMS) or enterprise resource planning (ERP) tools (e.g. smartboard or canvas), and enhancing its performance in different environmental conditions.

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Chapter 1

Introduction

Background of the Study

Have you noticed that Facebook has developed an uncanny ability to recognize your friends in your photographs? In the old days, Facebook used to make you tag your friends in photos by clicking on them and typing in their names. Now, as soon as you upload a photo, Facebook tags everyone for you like magic: This technology is called face recognition. With the rapid development in the field of pattern recognition and its uses in different areas arises the importance of the utilization of this technology in small or large organizations or institutions.

In modern educational institutions and organizations, managing attendance and timekeeping is an essential but often time-consuming task. Traditional methods such as manual roll calls, paper-based systems, and swipe cards are widely used but are prone to inefficiencies, human errors, and security concerns. These conventional methods require significant administrative effort and often lead to delays in reporting, inaccuracies in records, and even fraudulent attendance practices. As technology continues to advance, there is a growing demand for smarter, more reliable systems that can automate these processes, reduce errors, and improve efficiency.

One such promising solution is the integration of facial recognition technology into attendance and timekeeping systems. Facial recognition has seen rapid advancements in recent years due to developments in computer vision, machine learning, and artificial intelligence (AI). This technology offers a non-intrusive, fast, and highly accurate method of identifying individuals based on their facial features, making it an ideal candidate for applications in areas such as security, authentication, and attendance tracking. However, despite its growing potential, facial recognition for attendance has not been widely adopted in many institutions and organizations, particularly in developing regions or smaller institutions, due to concerns over cost, complexity, and privacy issues.

The purpose of this project is to explore the feasibility and practicality of developing a smart attendance and timekeeping system called Fast+, which influences facial recognition technology to automate attendance logging and improve time management. Fast+ aims to provide a solution to the limitations of traditional attendance systems by offering a secure, accurate, and efficient way to track students' presence in real-time. This system can help educational institutions, workplaces, and

other environments reduce administrative burdens, ensure more reliable attendance records, and address issues of tardiness or absenteeism.

The development of Fast+ also addresses the challenges posed by environmental factors such as lighting conditions, facial obstructions, or crowded spaces. As facial recognition technology continues to improve, there is a need to optimize these systems to work effectively in different settings—ensuring that Fast+ remains reliable under various conditions, such as low-light environments or busy classrooms, and adaptable to the diverse needs of users.

In summary, this project aims to develop and evaluate a facial recognition-based system that provides an efficient, secure, and user-friendly alternative to traditional attendance systems. By incorporating advanced computer vision techniques, Fast+ seeks to enhance timekeeping accuracy and operational efficiency in educational and corporate settings. Furthermore, this research will contribute to the growing body of knowledge surrounding the application of facial recognition technology in real-world settings, with potential implications for future integration into a wide variety of organizational and institutional environments.

Objectives of the Study

The main objective of Fast+ is to provide an instant, fast, efficient, user-friendly, and more accurate attendance system. Through our system, school admins and teachers can save valuable instructional time and reduce administrative burdens.

Specific Objectives

Specifically, the study aims to:

a. design and develop the Fast+ that integrates facial recognition technology for automated attendance and timekeeping management in educational and professional settings;

b. provide more reliable and tamper-proof attendance data;

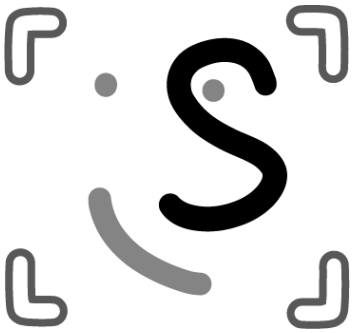
c. evaluate the accuracy and performance of Fast+ for detecting and identifying individuals in various environmental conditions;

d. assess the usability and user experience of Fast+ from the perspective of both administrators and users (e.g., teachers, students, employees)

Statement of Null Hypotheses

The study was geared towards accepting or rejecting the following null hypotheses.

1. Fast+ doesn't significantly improve attendance accuracy;
2. FAST+ doesn't provide reliable or consistent attendance records.



[Figure 1: FAST+ Logo]

Significance of the Study

Teachers. Fast+ offers teachers an efficient way to record and manage attendance, reducing the time and effort typically required for manual roll calls. This automation allows teachers to focus more on delivering lessons, increasing class time and engagement with students.

Administrators. For school administrators, it simplifies attendance management by automatically compiling data into organized records, accessible in real time. This feature reduces the administrative burden associated with manual tracking, reduces errors, and streamlines reporting.

Students. Fast+ benefits students by providing a seamless, non-intrusive attendance system that minimizes disruptions at the start of class.

Scope of the Project

This project focuses on the development, deployment, and evaluation of FAST+, a facial recognition-based attendance management system designed to enhance efficiency in attendance tracking for educational institutions. The system utilizes facial recognition technology to automate attendance recording, allowing users to log their presence by scanning their facial features using designated devices, such as webcams.

The scope includes the design, implementation, and testing phases of FAST+, with an emphasis on its ability to accurately identify and authenticate individuals by comparing captured facial images against pre-registered data in its database. The study evaluates the system's effectiveness in tracking attendance patterns, (e.g. absenteeism), to support informed decision-making and improve attendance management practices.

Definition of Terms

To fully understand the study, the following terms are being defined.

Fast+. It is a facial recognition system specifically designed to track student attendance at Kanlayaneesithammarat School in real-time using facial recognition technology.

Facial recognition. It is a biometric technology that identifies or verifies an individual by analyzing their facial features.

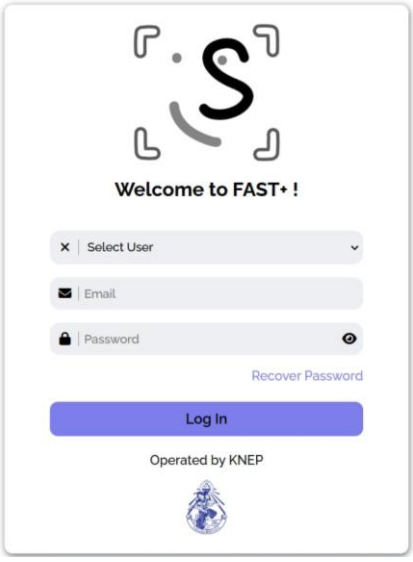
Students. They refer to individuals enrolled in Kanlayaneesithammarat School who are the primary users of the facial recognition attendance system for recording their attendance in classes or other academic-related activities.

Teachers. They refer to the educators employed in Kanlayaneesithammarat School who use the facial recognition attendance system to monitor and manage the attendance of their students efficiently.

Chapter 2

Review of Related Literature

Facial attendance systems have gained significant attention in recent years due to their potential to revolutionize traditional attendance management methods. Numerous studies have focused on evaluating the accuracy and reliability of facial attendance systems. Research by Smith et al. demonstrated high accuracy rates, with facial recognition algorithms achieving recognition rates above 95% in controlled environments. However, factors such as lighting conditions, pose variations, and occlusions can impact accuracy in real-world scenarios (Jiang & DeCoste,). In addition, user acceptance and experience play crucial roles in the successful adoption of facial attendance systems. Studies by Lee et al. and Chen et al., 2016 explored user perceptions and satisfaction, finding that users generally exhibited positive attitudes toward the technology. However, concerns related to privacy, system performance, and ease of use were identified as influencing factors that should be addressed for optimal user acceptance. Privacy and security considerations are paramount in facial attendance systems. Li et al. and Wang et al. have investigated methods to enhance privacy protection by incorporating techniques like encryption, anonymization, and secure data transmission. Additionally, studies have examined the legal and ethical implications of facial attendance, emphasizing the need for compliance with privacy regulations (Mendoza & Kobsa, 2013).

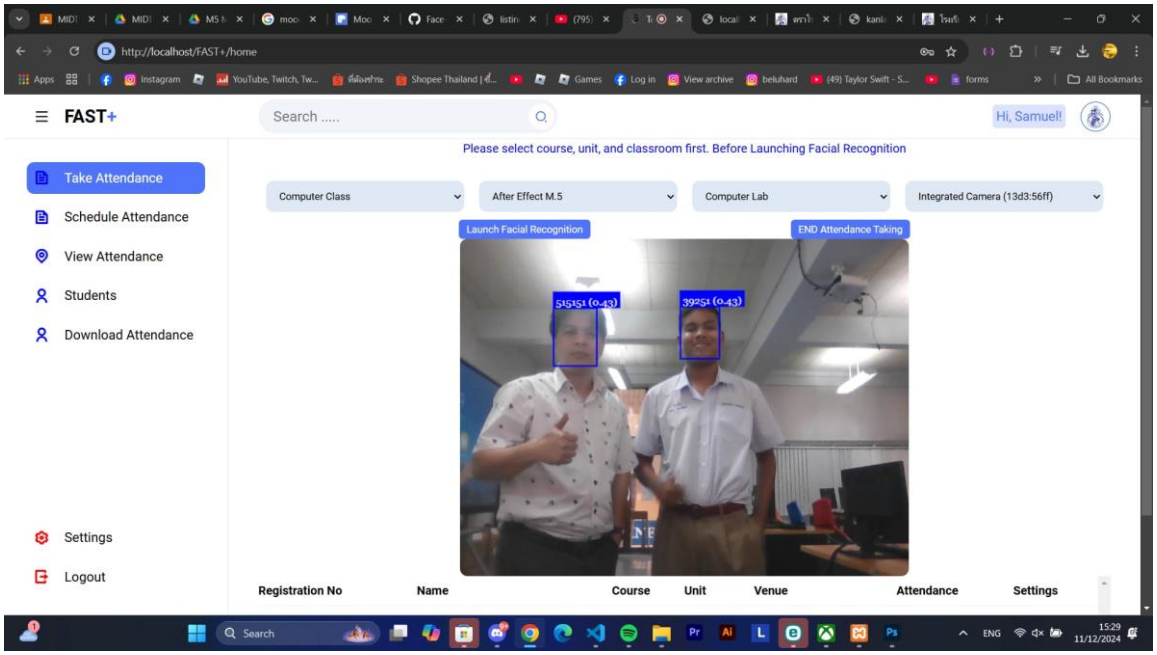


[Figure 2: Graphical User Interface]

Zhang et al. conducted field trials in various settings, such as educational institutions and workplaces, reporting promising results in terms of system functionality and efficiency. Challenges related to scalability, robustness, and environmental factors were identified as areas for further

investigation. Facial attendance systems have been studied in conjunction with other technologies to enhance their functionality and effectiveness. Studies by Liu et al. and Park et al, 2018. explored the integration of facial recognition with biometric modalities such as fingerprint and iris recognition, demonstrating improved identification accuracy and system performance. Several studies have identified challenges and proposed future directions for facial attendance systems. Wu et al. discussed the limitations of current algorithms and highlighted the need for continuous advancements in facial recognition techniques. Additionally, studies have called for further research on the integration of facial attendance with emerging technologies such as artificial intelligence and cloud computing to enhance system capabilities.

Face detection went mainstream in the early 2000s when Paul Viola and Michael Jones invented a way to detect faces that were fast enough to run on cheap cameras. However, much more reliable solutions exist now. The face is the identity of a person. The methods to exploit this physical feature have seen a great change since the advent of image processing techniques. The accurate recognition of a person is the sole aim of a face recognition system and this identification may be used for further processing. Traditional face recognition systems employ methods to identify a face from the given input but the results are not usually as accurate and precise as desired.

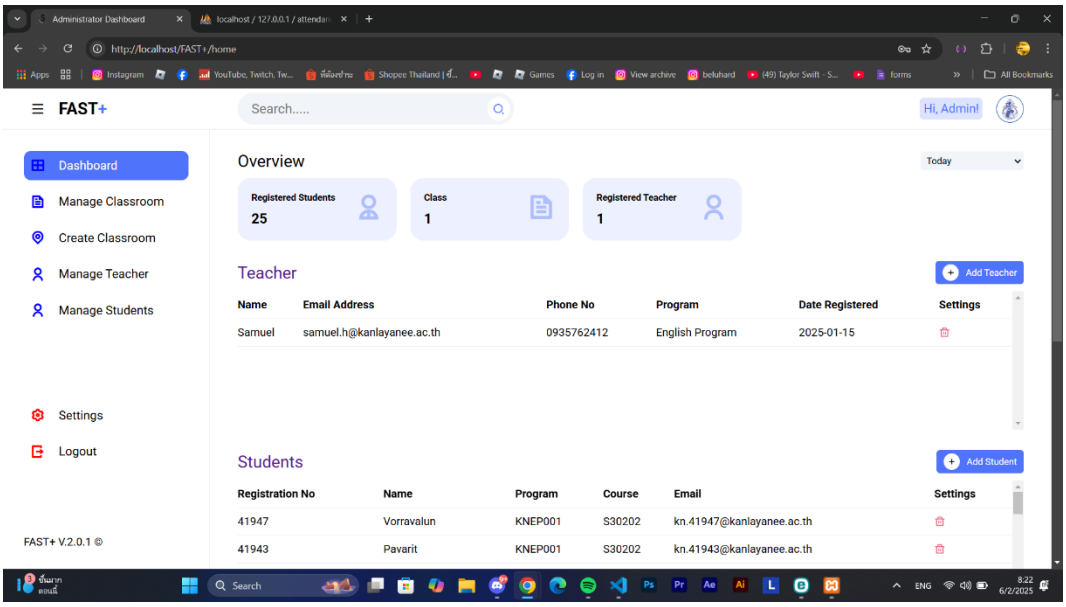


[Figure 3: Teacher's Dashboard]

With the rapid development in the field of pattern recognition and its uses in different areas e.g., signature recognition, and facial recognition, arises the importance of the utilization of this

technology in different areas in large organizations. This is mainly because these applications help the top management make decisions that improve the performance and effectiveness of the organization. On the other hand, for an organization to be effective, it needs accurate and fast means of recording the performance of the people inside this organization.

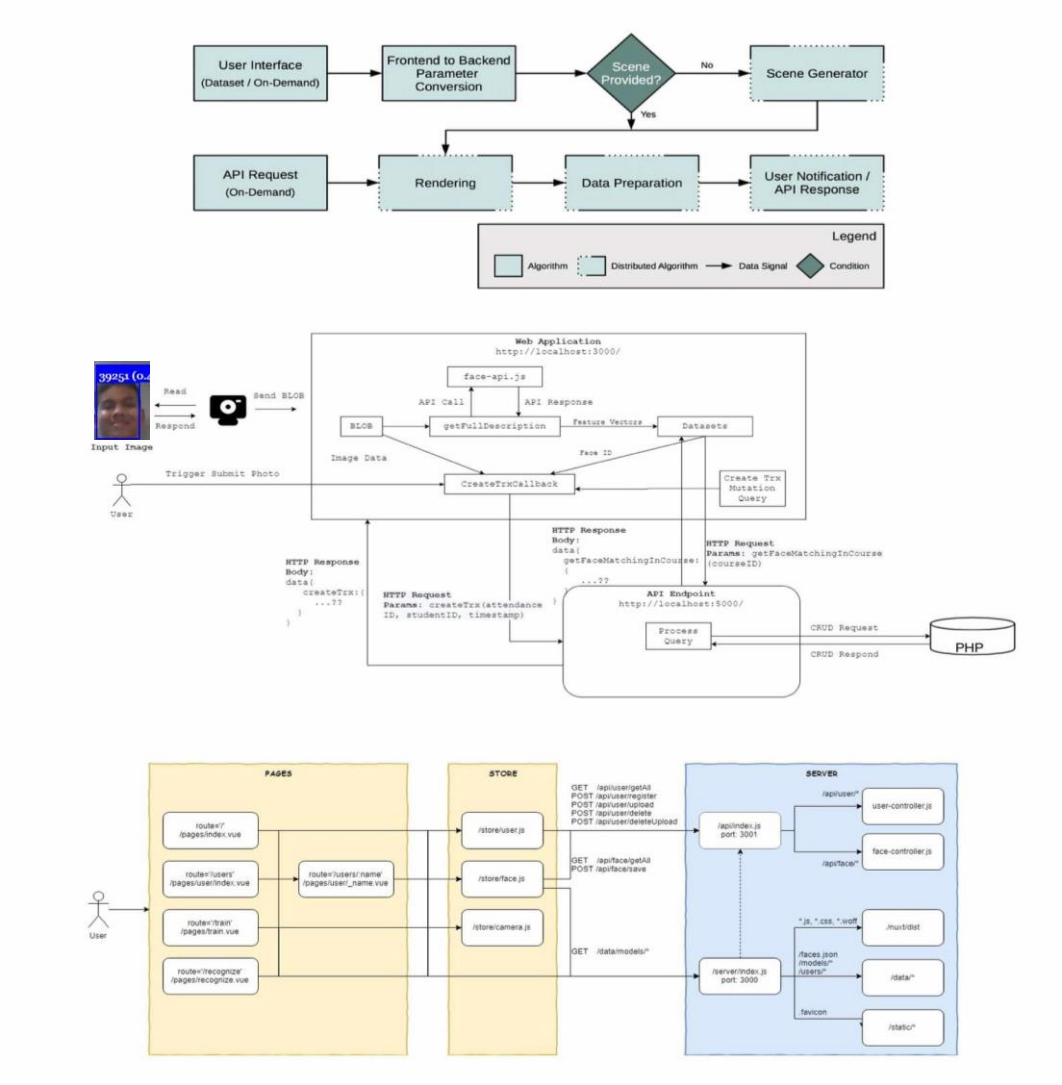
Fast+ presents a user-friendly and efficient interface that simplifies the process of recording attendance using facial recognition technology. Upon accessing the system, school admins and teachers are prompted to register the new students by providing basic details such as ID and name and capturing their faces for identification. These details are saved and stored in a database. To record attendance, the system starts automatically at a specific time when it can capture student's faces simultaneously. The system initiates the facial scan process automatically, guiding users to align their faces within a designated frame on the screen. During the facial scan, the system captures facial landmarks to create a unique biometric template for identification. Once the facial scan is complete, users receive immediate feedback. A green "Attendance Check" appears if the match is successful, indicating a verified attendance record. Users can easily navigate through the system using the top menu bar. Options such as "Attendance Records, and Attendance History" are conveniently accessible providing a smooth experience.



[Figure 4: Administrator's Dashboard]

At the heart of Fast+ is the facial recognition technology. This technology uses advanced algorithms to capture, analyze, and compare facial features of individuals. It converts facial

characteristics into unique facial templates for identification and verification. The facial attendance system includes mechanisms for capturing facial images of individuals. This could involve the use of cameras, webcams, or other imaging devices to capture real-time facial data. In addition, the system relies on a well-structured database to store and manage facial templates and attendance records. The database includes pre-registered facial templates of authorized users, allowing for efficient comparison during the recognition process.



[Figure 5: Facial Attendance Algorithm]

The facial attendance system provides a user-friendly interface for both administrators and users. It allows administrators to manage the system, view attendance data, and generate reports. Users, on the other hand, interact with the system during the attendance capture process. Furthermore, the accuracy and reliability of the facial attendance system depend on the effectiveness of the facial recognition technology, data capture process, and database management. A reliable system ensures minimal false positives and negatives during the matching process.

Chapter 3

Research Methodology

Methodological Approach / Design

The study employed a combination of experimental and survey research methods. Survey research was conducted to collect information about user experiences, perceptions, and satisfaction with facial attendance systems. Researchers designed questionnaires to evaluate user acceptance, perceived benefits, concerns, and suggestions for improvement. This approach provided valuable insights into user perspectives and helped identify areas for system enhancement and policy development. Experimental research was used to evaluate the effectiveness and performance of facial attendance systems. This methodology allows researchers for the systematic collection of data and statistical analysis to draw objective conclusions.

Survey Participants

The survey participants for this study included 25 Mathayom 4/13 students from Kanlayaneesithammarat School, along with 4 selected teachers and 1 admin from the English Program (EP).

Data Collection Tool

The developers administered a survey questionnaire via Google Forms, which included sections such as the introduction, instructions, main research questions, response options, and other relevant details.

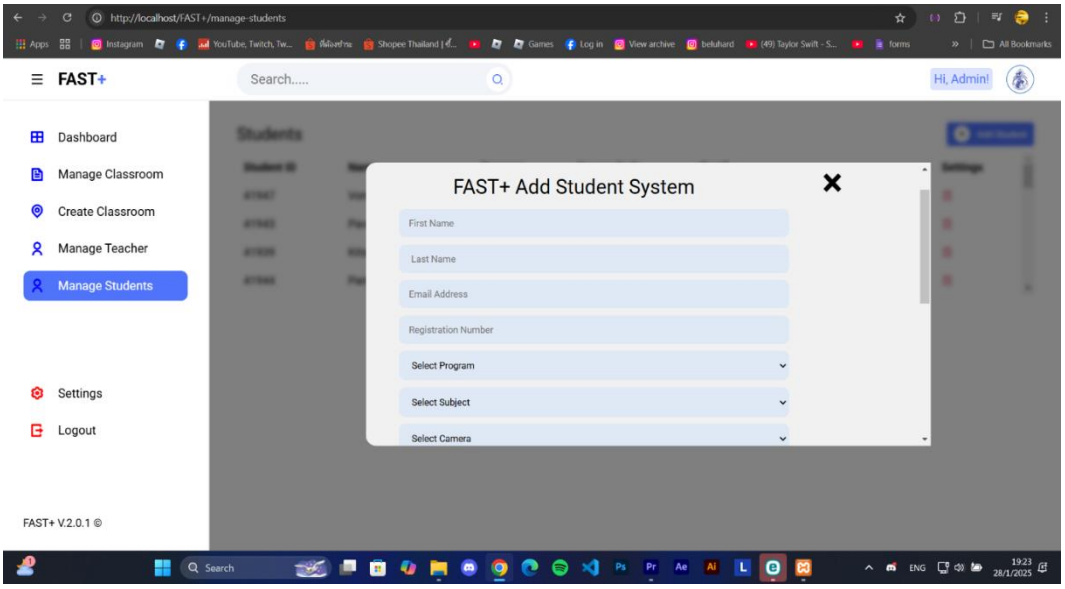
Resources Utilized:

1. Hardware Resources:
    a. Computer System
    b. Cameras
    c. Storage Devices
2. Software Resources:
    a. Technology Stack (e.g. front and back-end technologies, database & hosting)
    b. Visual Studio

3. Networking and Communication

a. Local Area Network (LAN), Wi-Fi & Hotspot

b. Network Security



[Figure 6: Register New Students]

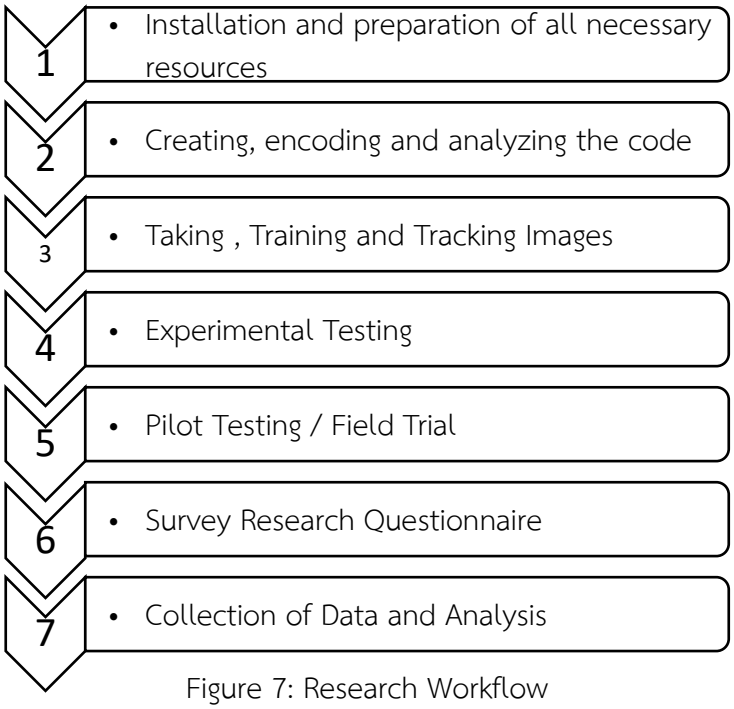


Figure 7: Research Workflow

Chapter 4

Results and Discussion

This chapter presents, analyzes, and interprets the data which comprised the students' and teachers' perception of FAST+, Facial Recognition System.

Table 1

Survey Results of Students and Teachers

N = 30

Students: 25 Teachers: 4 Administrator: 1

ITEM	Strongly Agree (4)			Agree (3)			Disagree (2)			Strongly Disagree (1)			Total	Weighted Mean
	F	%	WM	F	%	WM	F	%	WM	F	%	WM		
1	12	40	1.6	18	60	1.8	0	0	0	0	0	0	3.4	HA
2	10	33.3	1.33	20	66.7	2	0	0	0	0	0	0	3.33	HA
3	19	63	2.53	11	36.7	1.1	0	0	0	0	0	0	3.63	HA
4	19	63	2.53	11	36.7	1.1	0	0	0	0	0	0	3.63	HA
5	22	73.33	2.9	8	26.7	0.8	0	0	0	0	0	0	3.7	HA
6	16	53.33	2.13	14	46.7	1.4	0	0	0	0	0	0	2.43	HA
7	16	53.33	2.13	14	46.7	1.4	0	0	0	0	0	0	3.43	HA
8	12	40	1.6	15	50	1.5	3	10	0.2	0	0	0	3.3	HA
9	29	96.67	3.87	1	3.3	0.1	0	0	0	0	0	0	3.97	HA
10	24	80	3.2	6	20	0.6	0	0	0	0	0	0	3.8	HA
Average Weighted Mean													3.46	HA

Legend:

Rating Scale	**Descriptive Interpretation (DI)**	**Weighted Mean (WM)**
3.25 – 4.00	Strongly Agree (SA)	Highly Accurate (HA)
2.50 – 3.24	Agree (A)	Accurate (A)
1.75 – 2.49	Disagree (D)	Less Accurate (LA)
1.00 – 1.74	Strongly Disagree (SD)	Not Accurate (NA)

Table 1 presents the summary of responses and the corresponding weighted mean obtained from a survey conducted among students, teachers, and an administrator. Based on the responses from a sample of 25 students, 4 teachers, and 1 administrator, the table reveals that most participants reported a positive impact of FAST+ on attendance accuracy and efficiency. This indicates that a significant majority found FAST+ beneficial in improving the process of tracking and recording attendance using facial recognition technology. The survey responses yielded a notable weighted mean score of 3.46 out of 4, reflecting a high level of agreement among participants

regarding the system's accuracy, efficiency, and overall user experience. The weighted mean accounts for the varying significance of each response, emphasizing the importance of the different aspects evaluated in the survey.

These findings suggest that FAST+ has been well-received, garnering positive feedback and a strong consensus on its effectiveness in enhancing attendance management. The favorable weighted mean provides robust evidence of the system's impact in addressing challenges related to reliability and precision. However, while these results are promising, further analysis is recommended to evaluate the system's long-term impact and sustainability. Additionally, incorporating qualitative data, such as insights from in-depth interviews, can complement these quantitative findings and provide a more comprehensive understanding of users' experiences with FAST+.

To evaluate the accuracy of the FAST+, facial recognition system, a one-sample t-test was conducted. The goal was to determine whether the user's perceptions, as measured by the weighted mean, significantly exceeded the neutral benchmark (2.5), indicating agreement with the system's effectiveness.

Table 2

One Sample t- Test Results

Model	Mean	H_o	SD	p-value	t- Stat	Interpretation
Facial Recognition System (FAST+)	3.46	2.5	0.4215	<.001	7.22	Significant

Interpretation:

The t-test result indicates a significant difference between the observed sample mean (3.46) and the hypothesized mean (2.5) at a significance level of 0.05. The p-value is less than 0.001, which is far below the threshold of 0.05, leading to the rejection of the null hypothesis.

This suggests that the participants rated the facial attendance system (FAST+) significantly higher than the hypothesized average, highlighting its perceived effectiveness and accuracy.

Chapter 5

Conclusion and Recommendation

Conclusion

Based on the data analysis and interpretation, the researchers have drawn the following conclusions and recommendations:

The findings reveal that the FAST+ system demonstrates a high level of accuracy and reliability in managing attendance through facial recognition technology. Instances of false positives or false negatives were minimal, showcasing the system’s consistent performance in capturing and identifying facial features. This efficiency has made attendance tracking and recording significantly more manageable and precise. User adoption and acceptance have emerged as critical factors for the system's successful implementation. Feedback from surveys highlighted a positive response from users, who appreciated the system's ease of use and convenience. These insights emphasize the importance of prioritizing user experience while addressing potential concerns to encourage wider acceptance and integration.

In summary, FAST+ has proven to be a reliable and effective tool for modernizing attendance management in schools. Its accurate facial recognition capabilities and positive user reception establish it as a valuable asset. However, to ensure its long-term success and integrity, it is essential to consider ethical implications and proactively address any limitations or challenges the system may face.

Recommendations

Based on the analysis and interpretation of the facial attendance data, the following recommendations are proposed to optimize the functionality, usability, and overall impact of the FAST+ system:

a. Establish a regular protocol for system monitoring, maintenance, and software updates to ensure the system operates at peak performance and adapts to evolving technological needs.

b. Conduct periodic analyses of facial attendance data to uncover trends, enhance accuracy, and identify potential areas for system improvement.

c. Conduct pilot testing in selected departments or areas before a full-scale rollout. Actively gather and analyze feedback from users to identify usability issues, technical limitations, and areas for refinement, ensuring a seamless and user-friendly experience.

d. Provide comprehensive training sessions and materials for users, including students, teachers, and administrators, to ensure they are familiar with the system's functionalities and benefits.

e. Develop and enforce robust policies to safeguard user privacy and data security.

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Appendix A

Survey Questionnaire

Instructions: Please indicate your level of agreement with the following statements by checking (✓) the appropriate response on a scale from 1 to 4, where:

Weight	Descriptive Interpretation (DI)	Weighted Mean (WM)
4	Strongly Agree (SA)	Highly Accurate (HA)
3	Agree (A)	Accurate (A)
2	Disagree (D)	Less Accurate (LA)
1	Strongly Disagree (SD)	Not Accurate (NA)

Questions	SA 4	A 3	D 2	SD 1
1. FAST+ is an easy-to-use system for monitoring attendance.				
2. Using FAST+ improves the accuracy of attendance records compared to traditional methods.				
3. FAST+ saves time in marking attendance compared to manual methods.				
4. I feel comfortable using facial recognition technology for attendance monitoring.				
5. FAST+ effectively reduces errors in timekeeping.				
6. FAST+ is reliable in identifying students accurately.				
7. FAST+ is a significant improvement over the traditional attendance method.				
8. I have minimal concerns about my privacy when using FAST+.				
9. I would recommend FAST+ to others for attendance monitoring.				
10. FAST+ provides valuable features for monitoring attendance.				

Appendix B

Photos