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FACULTY OF ENGINEERING AND TECHNOLOGY

COMPUTER ENGINEERING DEPARTMENT

CEF 440: INTERNET PROGRAMMING (J2EE) AND MOBILE PROGRAMMING

TASK 2: REQUIREMENTS GATHERING

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Table of Contents

INTRODUCTION	4
What is Requirement Gathering?	4
What is a project initiation document (PID)?	5
What is a project initiation document (PID) template?	5
Why we used a PID template?	6
What's included in a project initiation document template?	6
REQUIREMENT GATHERING PROCESS	7
Project Scope Definition:	7
Identifying Stakeholders and Defining their Roles:	8
Gathering Techniques	9
Paper-Based Questionnaires	9
Conducting User Interviews:	10
Google Form Surveys.	11
Workshops.	13
Shadowing:	15
DOCUMENTED REQUIREMENTS	19
Functional Requirements	19
Non-Functional Requirements	19
Use Cases	20
User stories	20
CONCLUSION	20

INTRODUCTION

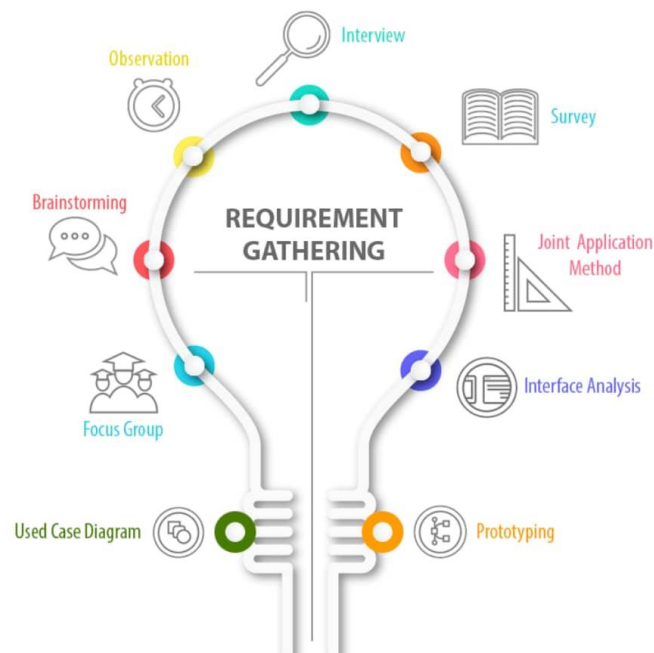
The purpose of this report is to document the requirement gathering process for the development of a Biometric Student's Attendance Mobile Application. The project aims to address the challenges associated with traditional attendance tracking methods in higher educational institutions by leveraging biometric technology, specifically fingerprint recognition, to create a secure and efficient system for recording student attendance.

In order to create an innovative solution, deep understanding of the existing system to ensure the sustainability of proposed solution is needed. This involves comprehensively examining current practices, including their methodologies, frequency attendance recordings, challenges encountered, and the volume of data processed. Moreover, it is imperative to identify the target users and their specific requirements to tailor the solution effectively.

To achieve this understanding, a variety of techniques were employed throughout the requirement gathering process. These techniques include interviews, surveys, shadowing, studying the current system, prototyping, and workshops. By implementing these techniques, we sought to gain insights into stakeholder needs, preferences, and pain points, laying the groundwork for a sustainable and user-centric solution.

What is Requirement Gathering?

Requirement gathering is the process of identifying your project's exact requirements from start to finish. This process occurs during the project initiation phase but you'll continue to manage your project requirements throughout the entire project timeline.



Requirement gathering typically happens during the project briefing or initial kick-off meeting.

Some questions during this briefing include?

- How long will our project schedule be?
- Who will be involved in the project?
- What risks may we face in this project?

The project initiation phase is an important time to establish the foundation of a successful project. Laying out all the key information early ensures that your entire team is in the same page before your work even begins. The best way to do this? Create a project initiation document template.

What is a project initiation document (PID)?

A project initiation document (PID) is a type of document that project managers create before they begin a project. This document compiles key project information such as the project scope, goals, success criteria, business value, and potential project risks. This is also commonly referred to as project charter or a project brief.

What is a project initiation document (PID) template?

A project initiation document (PID) template is a reusable outline of a project initiation document. It's best used when you're creating new projects so you can quickly duplicate the template, and then fill in the relevant project information. This

saves project managers time so they don't have to create a brand new PID every time they start a new project.

Why we used a PID template?

Using a project initiation document template provides your team with a few different benefits. Here's how it can help you:

- **Establishes consistency across all projects:** Using a PID template helps streamline the project creation process, so the project manager can easily follow the same steps every time a new project begins.
- **Allows for customization for specific teams:** PIDs help standardize the project creation process, but one of the major benefits is that you can still customize it to fit the needs of other projects. The template provides the main structure for your project initiation document, but from there you can add and remove different sections based on specific project needs.
- **Quickly provide context for stakeholders:** When stakeholders are managing several different projects at once, it's important for them to get information quickly with as much context as possible. Using a project initiation document template makes it easy for them to find the information they need without having to hunt for it or have unnecessary status meetings.

What's included in a project initiation document template?

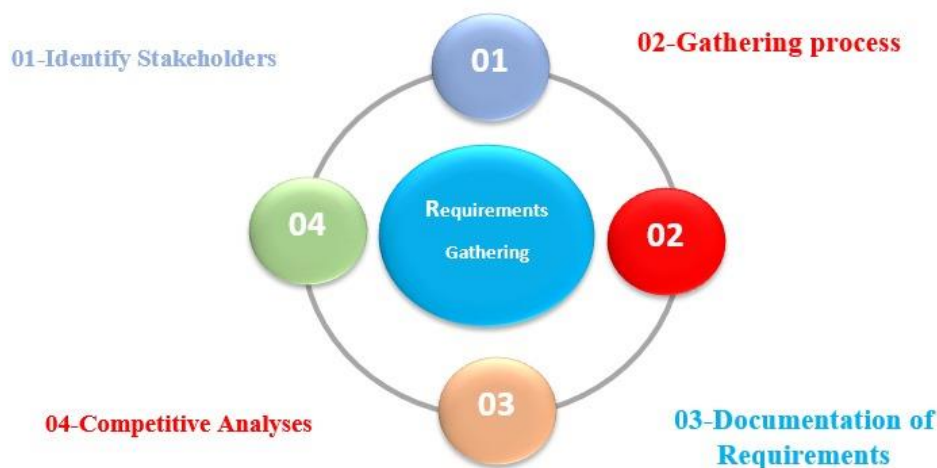
A good project initiation document template will have all of the important project information a stakeholder needs to know in a glance. This template should include:

- **Project goals or objective:** This clearly states what the project intends to achieve and the larger business objectives it connects to.
- **Success metrics:** These are the specific metrics that your team is tracking to monitor whether or not this project is successful.
- **Project scope:** In this instance, a project scope includes the scope of work, the allotted budget, and estimated timeline.
- **Communication plan:** This details information on how your team will communicate throughout the project duration.

- **Resourcing strategy:** Key resource information such as a resource allocation plan or a resource management strategy plan.
- **Key stakeholders:** Important individuals involved in the project from individual contributors to higher management.
- **Project risks:** Information about project risks, such as a RAID log or a risk analysis.

REQUIREMENT GATHERING PROCESS

The requirement gathering process comes to play when we actually intend to start the data collection phase.



Project Scope Definition:

The scope of the project encompasses.

- **Mobile Application Development:**

The design and implementation of a mobile application compatible with popular platforms such as Android or iOS. The application would feature intuitive user interfaces tailored for easy attendance tracking by students

- **Biometric Authentication Integration:**

The application will incorporate biometric authentication functionality to significantly enhance security of attendance record progress by verifying the identities of students using fingerprints.

- **Real-time Attendance Tracking:**

Implementation of real-time attendance tracking capabilities that will allow instructors to access attendance records instantly as students check enabling effective monitoring of student participations. The system will

also ensure recording should not exceed 5 seconds to minimize disruptions during class sessions.

- **Scalability and Customization:**

Designing with scalability and customization would produce a flexible system to meet the needs of educational institutions and accommodate varying class sizes. This ensures seamless integration into diverse academic environments.

- **Automated Attendance Reports:**

Implement functionalities to generate automated attendance reports for instructors and administrators. Reports can provide students' participation rates and attendance trends to streamline administrative tasks and decision-making.

Identifying Stakeholders and Defining their Roles:

Identifying stakeholders is crucial for understanding the diverse perspectives and requirements involved in the development of biometric students' attendance mobile application. The stakeholders identified for the project include; students, teachers, administrators and IT support staff. Each stakeholder group has specific roles, responsibilities and requirements related to the attendance tracking system. Outlined below are their roles.

- ❖ **Administration:**

- **Definition:** Responsible for overall system management and access to attendance data.
- **Role:** Administrators oversee the overall implementation and management of the attendance tracking system.
- **Requirement:** Their requirements include scalability, customization options, integration with existing systems, and compliance with institutional policies.

- ❖ **Teachers:**

- **Definition:** Will use the system to take attendance and monitor student attendance trends.
- **Role:** Instructors are responsible for managing attendance and monitoring student participation.
- **Requirements:** Their requirements include real-time access to attendance data, efficient attendance tracking methods, and tools for managing large class sizes.

- ❖ **Students:**

- **Definition:** Will be enrolled in the system and use their biometric data for attendance verification.
- **Role:** As end-users of the application, students play a vital role in providing input on usability, accessibility, and user experience.
- **Requirement:** Their requirements include ease of use, privacy concerns regarding biometric data, and the ability to access attendance records.

❖ **IT Department:**

- **Definition:** Responsible for system implementation, maintenance, and technical support.
- **Role:** IT support staff are responsible for the technical aspects of implementing and maintaining the application.
- **Requirement:** Their requirements include system reliability, security measures, data backup procedures, and technical support for end-users.

Gathering Techniques

Various techniques were employed to gather requirements, including; interviews and questionnaires, surveys, shadowing, studying current systems, workshops. These techniques allowed for a comprehensive understanding of stakeholder needs, preferences, and pain points related to attendance tracking. This ensures the final application meets the requirements and objectives of the project. The key techniques implemented were;

Paper-Based Questionnaires

Questionnaires are an effective tool for gathering quantitative data from a large sample of stakeholders in a structured manner. They consist of a set of pre-defined questions designed to collect specific information about the use of biometrics for marking the students' attendance. Here's how questionnaires were used and conclusions were drawn from the results obtained.

i. Designing the Questionnaire:

- Identifying the objectives of the questionnaire and defining the research questions to be addressed.
- Developing a clear and concise set of questions that are relevant to the research objectives.
- Using a mix of closed-ended (e.g., multiple-choice, Likert scale) and open-ended questions to gather both quantitative and qualitative data.
- Ensuring that the questionnaire is easy to understand and navigate, with clear instructions for respondents.

ii. Distributing the Questionnaire:

- Choosing the appropriate distribution channels based on the target audience which is the paper-based questionnaire.
- Providing incentives or assurances of confidentiality to encourage participation.
- Monitoring response rates and follow up with reminders to increase participation if needed.

iii. Analyzing the Results:

- We collated and analyzed the responses to identify patterns, trends, and correlations.

- We also calculated descriptive statistics (e.g., mean, median, standard deviation) for quantitative data.
- We conducted thematic analysis and coding of qualitative data to identify recurring themes and insights.
- We compared responses across different demographic groups to assess variations in attitudes and preferences.

Conclusions were drawn regarding the overall satisfaction level with the app's user interface, specific features that are most valued by the stakeholders, and areas for improvement to enhance user experience. These conclusions can then inform iterative improvements to the app and guide future development efforts.....

Conducting User Interviews:

Conducting one-on-one interviews with stakeholders allows for in-depth exploration of their needs, preferences, and challenges. Interviews provide a platform for stakeholders to express their thoughts and ideas freely, leading to rich qualitative data. Interview questions can be tailored to probe specific areas of interest, such as user interface design, authentication methods, and scalability requirements.

Stakeholders interviewed may include students, instructors, administrators, and IT support staff. Questions about their current attendance process, the pain points they face, and their expectations for the mobile app were asked. Here are some sample questions:

- What challenges do you face with the current attendance system (manual or existing app)?
- What features would make the attendance process easier and more efficient for you?
- How would you like to be notified about attendance (lecturers) or view attendance records (students)?

Based on the user interviews conducted with stakeholders, several key conclusions can be drawn regarding their needs, preferences, and challenges with the current attendance tracking systems:

▪ **Challenges with Current Systems:**

Stakeholders, including students, instructors, and administrators, highlighted various challenges with the current attendance systems. These challenges ranged from manual processes, such as roll calls and paper-based attendance sheets, to limitations in existing attendance tracking apps. Common issues included time-consuming processes, inaccuracies in data recording, and difficulties in accessing and managing attendance records.

▪ **Desired Features for Improved Efficiency:**

There was a consensus among stakeholders regarding the need for features that would enhance the efficiency and effectiveness of the attendance tracking process. Key features identified included seamless integration with biometric authentication for enhanced security and accuracy, real-time attendance tracking capabilities to monitor student participation instantly, and intuitive user interfaces that simplify attendance recording for both students and instructors.

▪ **Preferences for Notification and Access:**

Preferences regarding notification and access to attendance records varied among stakeholders. Instructors expressed a desire for streamlined notification mechanisms to alert them of attendance discrepancies or trends, while students emphasized the importance of easily accessible and transparent attendance records through the mobile app. Stakeholders also emphasized the need for customization options to tailor notifications and viewing preferences to their individual needs and preferences.

Overall, the user interviews provided valuable insights into the pain points, expectations, and desired features of stakeholders regarding attendance tracking systems. These insights will inform the development of the Biometric Student's Attendance Mobile Application, ensuring that it addresses real-world needs and delivers a user-friendly and efficient solution.

Google Form Surveys.

Surveys are a method of collecting data to have information, opinions, and feedback from a targeted group of individuals. For a biometric student attendance system, surveys can be conducted among stakeholders such as administrators, teachers, students, and IT personnel to gather requirements, preferences, and concerns related to the system's development and implementation.

Here are the types of requirements that can be gathered through surveys for a biometric student attendance system:

- ❖ Identify specific requirements for biometric modalities such as iris scanning, facial recognition, fingerprint based on usability and user preferences.
- ❖ Come out with the desired features and functionalities of the system such as enrollment, attendance recording.
- ❖ Assess performance expectations and requirements for the biometric attendance system in terms of speed, scalability, and reliability.
- ❖ Gather feedback on acceptable response times for attendance recording and verification, especially during peak hours.

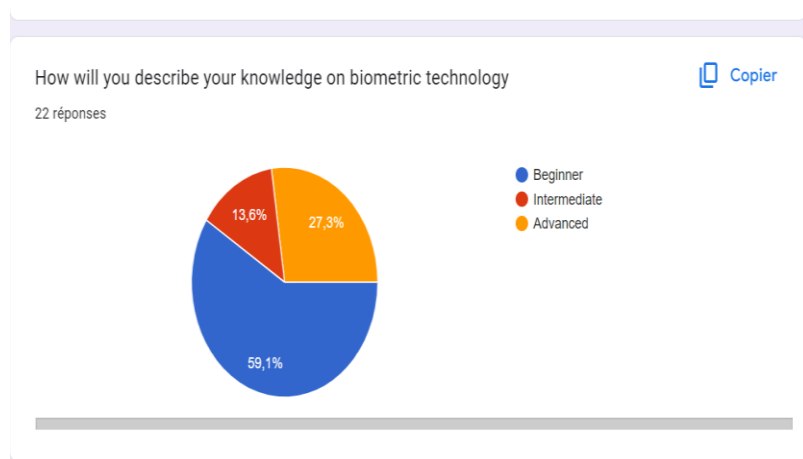
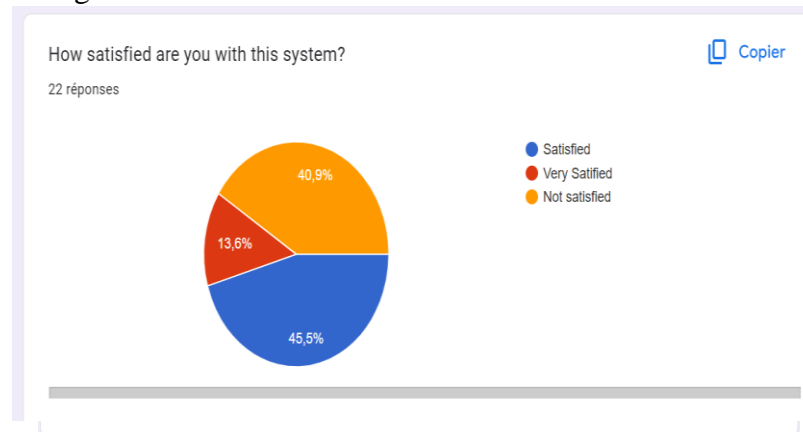
- ❖ Solicit feedback on user interface design, ease of use, and intuitiveness of the biometric attendance system for different user groups (e.g., administrators, teachers, students).
- ❖ Identify requirements for training and support to ensure users can effectively utilize the system.
- ❖ Assess budgetary constraints and resource availability for implementing and maintaining the biometric attendance system.
- ❖ Gather input on cost-effectiveness considerations and priorities for allocating resources effectively.

Based on the surveys conducted among stakeholders for the biometric student attendance system, several conclusions can be drawn regarding requirements, preferences, and concerns related to the system's development and implementation:

- i. **Biometric Modality Preferences:**
Stakeholders expressed varying preferences for biometric modalities, with fingerprint recognition being the most widely accepted due to its familiarity and ease of use. However, there was interest in exploring other modalities such as facial recognition and iris scanning, particularly for their potential to enhance security and convenience.
- ii. **Desired Features and Functionalities:**
The most desired features of the system included enrollment capabilities, real-time attendance recording, and comprehensive reporting functionalities. Stakeholders emphasized the importance of a user-friendly interface and seamless integration with existing systems.
- iii. **Performance Expectations:**
Stakeholders had high expectations for the performance of the biometric attendance system, particularly in terms of speed, scalability, and reliability. There was a consensus that the system should be capable of handling large volumes of attendance data efficiently, especially during peak hours.
- iv. **User Interface Design and Usability:**
Feedback on the user interface design indicated a preference for simplicity, clarity, and intuitiveness. Stakeholders highlighted the importance of easy navigation and minimal training requirements for users of all skill levels.
- v. **Training and Support Requirements:**
Stakeholders identified the need for comprehensive training and ongoing support to ensure effective utilization of the system. This included training sessions for administrators, teachers, and students, as well as access to technical support resources.
- vi. **Budgetary Considerations:**

Budgetary constraints were a significant concern for stakeholders, with many expressing the need for cost-effective solutions that deliver value for money. There was a consensus on the importance of prioritizing resource allocation to maximize the system's benefits within available budgetary limits.

In addition to these conclusions, a photo showing the analysis based on some answered questions can provide visual insights into the survey findings.



Furthermore, providing a link to the Google Form used for the survey allows stakeholders to access the survey results and further engage with the data.

Link to Google Form: [Google form survey.](#)

Workshops.

- Organizing workshops brings together a diverse group of stakeholders in a collaborative setting to brainstorm ideas and discuss requirements.
- Workshops foster creativity and innovation by encouraging participants to generate and refine ideas collectively.

- Structured activities and exercises, such as brainstorming sessions, group discussions, and prioritization exercises, help elicit requirements and identify common themes.
- Workshops provide an opportunity for stakeholders to share insights, build consensus, and align expectations.
- In the Gathering process, organizing one gave a platform for the stakeholders including students and the developers to discuss and refined the requirements. During the workshops, the following discussions were held, focusing on various modules and aspects of the system:



Vector image of stakeholders and developers at workshop

❖ **Enrollment Module:**

- Stakeholders discussed the functionality related to enrolling students into the system by capturing their biometric data, specifically fingerprints.
- Key points included specifying the biometric traits to be captured and ensuring secure storage of biometric templates.

❖ **Attendance Recording Module:**

- Discussions centered around the functionality for recording student attendance using biometric authentication.
- Stakeholders outlined how attendance records would be automatically generated and stored in the system.

❖ **Reporting and Monitoring Module:**

- Stakeholders specified features related to generating attendance reports and monitoring attendance trends.
- Discussions included defining the scope of reports (e.g., individual student, class, time period), accessibility of reports, and customization options for filtering data.

❖ **Security:**

- Security aspects of the system, particularly regarding the protection of biometric data, were thoroughly discussed.
- Requirements for compliance with data protection regulations, encryption of biometric templates, and access control mechanisms were outlined.
- ❖ **Performance:**
 - Stakeholders specified performance expectations of the system, including response times for attendance verification.
 - Discussions focused on the system's ability to handle large volumes of attendance records efficiently, especially during peak hours.
- ❖ **Scalability:**
 - Requirements for the system's scalability to accommodate future growth in the number of students and classes were discussed.
 - Stakeholders explored strategies for scaling the system's infrastructure and functionality to meet increasing demand.
- ❖ **Customization:**
 - The need for customization options to adapt the application to the specific requirements of different educational institutions was emphasized.
 - Discussions included potential features for customization and how they would be implemented to ensure flexibility and adaptability.

Shadowing:

- ❖ Shadowing involves observing stakeholders as they perform their tasks and interact with existing systems.
- ❖ Shadowing allows for firsthand observation of workflows, pain points, and areas for improvement.
- ❖ By shadowing students, instructors, and administrators during the attendance tracking process, valuable insights can be gained into the current practices and challenges faced.
- ❖ Observations from shadowing sessions help inform the design of the mobile application and ensure that it addresses real-world needs effectively.
- ❖ During the shadowing sessions conducted, the following observations were made, highlighting various methods used by teachers and identifying weak points in the traditional attendance tracking process:

Observations Made

- **Variety of Methods:** Different teachers employed various methods for taking attendance, including calling out names, counting students visually, and passing around attendance sheets to write matricules or tick names.

- **Disadvantages:** Several weaknesses were identified in the traditional attendance tracking process. Some teachers tended to skip students' names while calling out attendance, leading to inaccuracies. Additionally, manual counting methods were prone to errors, and passing around attendance sheets often resulted in incomplete data due to time constraints.
- **Advantages:** Despite the drawbacks, certain advantages were noted in the traditional process. For example, the use of pre-printed attendance sheets with student names allowed for quick identification and marking of attendance. Additionally, students sometimes took the initiative to mark attendance for absent classmates, ensuring more accurate records.

Result of Shadowing:

- The shadowing sessions provided valuable insights into the current practices and challenges faced during the attendance tracking process.
- Observations from the shadowing sessions informed the design of the Biometric Student's Attendance Mobile Application, ensuring that it addresses real-world needs effectively.
- Weak points identified during shadowing, such as inaccuracies in manual attendance taking and challenges in distributing attendance sheets, underscored the importance of implementing a more efficient and reliable attendance tracking solution.

ii. Competitive Analysis

A competitive analysis of existing biometric attendance tracking solutions was performed to evaluate features, functionality, user experience, and adoption rates. Strengths and weaknesses of competitors' solutions were identified to inform the development of a competitive offering.

The purpose is to evaluate existing solutions in the market.

i. Methodology:

During research, two international solutions were found and reviewed by reading documentation, exploring demo, and analyzing user reviews. Key factors assessed include

- User Interface (UI) and User Experience (UX)
- Biometric Authentication Features
- Real-Time Attendance Tracking Capabilities
- Reporting and Monitoring Functionality
- Scalability and Customization Options

ii. Findings

a. NCheck

- **Multibiometric Authentication:** Offers robust biometric authentication features, including fingerprint recognition, facial recognition and iris recognition for attendance tracking.
- **Flexibility:** The software works on multiple platforms including desktop, android and android phone, making it adaptable to different work environment.
- **Reporting:** NCheck offers customizable reports that summarize attendance data making it easier for the administrators to analyze student attendance.

Date	First Name	Last Name	Employee Code	Availability	First Checked-in	Early Arrival (Hours)	Late Arrival (Hours)	Last Checked-out	Early Departure (Hours)	Late Departure (Hours)	Event Logs
2021-04-22	Billy	Moss	1	Absent							0
2021-04-22	Billy	Moss	1	Present	2021-04-22 14:27:44 (+ 05:30)		14:27	2021-04-22 19:27:37 (+ 05:30)	7:52		11
2021-04-22	Liam	Cameron	2	Absent							0
2021-04-22	Liam	Cameron	2	Absent							0
2021-04-22	Matt	Devitt	3	Absent							0
2021-04-22	Matt	Devitt	3	Absent							0
2021-04-22	Kamal	Malliga	4	Absent							0
2021-04-22	Kamal	Malliga	4	Absent							0
2021-04-22	Lisa	Harris	5	Absent							0
2021-04-22	Lisa	Harris	5	Absent							0
2021-04-22	Billy	Moss	1	Absent							0
2021-04-22	Billy	Moss	1	Present	2021-04-22 08:04:44 (+ 05:30)		8:04	2021-04-22 08:34:58 (+ 05:30)	19:25		9
2021-04-22	Liam	Cameron	2	Absent							0
2021-04-22	Liam	Cameron	2	Absent							0
2021-04-22	Matt	Devitt	3	Absent							0
2021-04-22	Matt	Devitt	3	Absent							0

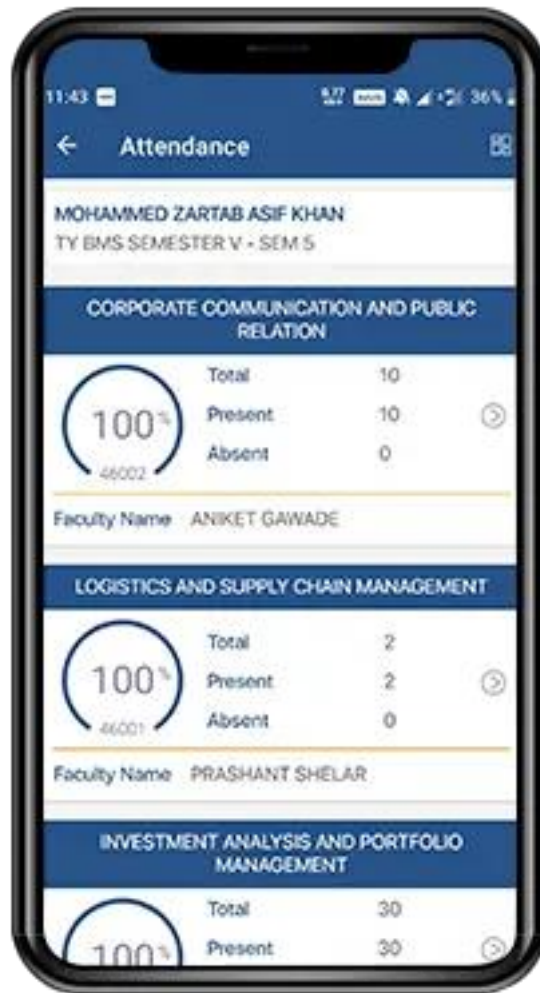
Desktop user interface for NCheck software

b. MasterSoft



- **Attendance Tracking:** Provides real-time attendance tracking with quick verification times, enhancing efficiency in classroom management. It automatically sends SMS alerts to instructors and even parents about students' absenteeism and activities to ensure optimal attendance practices are followed.
- **Reporting:** Comprehensive reporting and monitoring tools allow for detailed analysis of attendance data. Use Figures and charts to display student attendance trends and percentages
- **Secure Cloud Based Platform and Scalability:** Scalable solution suitable for educational institutions of varying sizes, with customization options to meet specific requirements. It is a Cloud based platform, PAAS.

- **UX/UI:** MasterSoft provides an easy-to-navigate platform with a user-friendly interface to quickly access specific staff attendance data and student daily activity records.



User interface of MasterSoft mobile app

iii. Recommendations:

Based on the competitive analysis made, the following recommendations were proposed for the development of the Biometric Student's Attendance Mobile Application.

- UI/UX Design:** Prioritizing intuitive UI/UX design to enhance user experience and promote user adoption.
- Real-Time Attendance Tracking:** Ensuring fast and reliable real-time attendance tracking to streamline the attendance management processes.
- Comprehensive Reporting:** Developing robust reporting and monitoring tools with customizable features to enable detailed analysis of attendance data.

- d. Scalability and Customization:** Designing the application to be scalable and customizable, catering to the diverse needs of educational institutions of varying sizes.

DOCUMENTED REQUIREMENTS

Documenting requirements is a crucial step in the software development process, ensuring that all stakeholders have a clear understanding of what needs to be built and how it will function. This documentation serves as a blueprint for the development team, guiding the design, implementation, and testing phases of the project.

Functional Requirements

- i. Enrollment Module:**
 - Capture biometric data (fingerprints) during student enrollment.
 - Ensure secure storage of biometric templates.
- ii. Attendance Recording Module:**
 - Record student attendance using biometric authentication.
 - Automatically generate and store attendance records in the system.
- iii. Reporting and Monitoring Module:**
 - Generate attendance reports based on individual student, class, and time period.
 - Provide accessibility and customization options for filtering data.

Non-Functional Requirements

- iv. Security:**
 - Comply with data protection regulations for the storage and handling of biometric data.
 - Encrypt biometric templates to ensure confidentiality.
 - Implement access control mechanisms to restrict unauthorized access.
- v. Performance:**
 - Achieve response times for attendance verification within specified limits.
 - Ensure the system can handle large volumes of attendance records efficiently, especially during peak hours.
- vi. Scalability:**
 - Scale the system to accommodate future growth in the number of students and classes.
 - Maintain performance and reliability as the system expands.
- vii. Customization:**

- Provide customization options to adapt the application to the specific requirements of educational institutions.
- Allow for flexibility in configuring features and functionalities based on institutional needs.

Use Cases

- viii. **Enrollment:** As a student, I want to enroll in the system by providing my biometric data (fingerprints) to access attendance tracking.
- ix. **Attendance Recording:** As an instructor, I want to record student attendance using biometric authentication to ensure accuracy and security.
- x. **Reporting:** As an administrator, I want to generate attendance reports based on specific criteria (e.g., individual student, class, time period) for monitoring and analysis.

User stories

- xi. As a student, I want to be able to enroll in the system easily by providing my fingerprints for biometric authentication.
- xii. As an instructor, I want to record student attendance quickly and accurately using biometric technology to streamline the process.
- xiii. As an administrator, I want to access customizable attendance reports to monitor attendance trends and identify patterns.

CONCLUSION

The surveys conducted among stakeholders for the biometric student attendance system have provided valuable insights into the requirements, preferences, and concerns surrounding the development and implementation of the system. Key conclusions drawn from the survey findings include.

b. Biometric Modality Preferences:

Stakeholders exhibit a preference for fingerprint recognition as the primary biometric modality due to its familiarity and ease of use. However, there is interest in exploring additional modalities such as facial recognition and iris scanning for their potential security enhancements.

c. Desired Features and Functionalities:

Stakeholders prioritize features such as enrollment capabilities, real-time attendance recording, and comprehensive reporting functionalities. A user-friendly interface and seamless integration with existing systems are highlighted as essential requirements.

d. Performance Expectations:

There is a consensus among stakeholders regarding the need for the system to deliver high performance in terms of speed, scalability, and reliability.

Efficient handling of large volumes of attendance data, especially during peak hours, is emphasized.

e. User Interface Design and Usability:

Feedback indicates a strong preference for a simple, clear, and intuitive user interface. Easy navigation and minimal training requirements are deemed crucial for users of all skill levels.

f. Training and Support Requirements:

Stakeholders underscore the importance of comprehensive training and ongoing support to ensure effective utilization of the system. This includes training sessions for administrators, teachers, and students, as well as access to technical support resources.

g. Budgetary Considerations:

Budgetary constraints emerge as a significant concern, with stakeholders emphasizing the need for cost-effective solutions that deliver value for money. Prioritizing resource allocation to maximize benefits within available budgetary limits is deemed essential.

In conclusion, the survey findings provide valuable guidance for the development and implementation of the biometric student attendance system, ensuring that the system meets the needs and expectations of all stakeholders while delivering optimal performance and value.