



THE STATE UNIVERSITY OF ZANZIBAR

**DEPARTMENT OF COMPUTER SCIENCE AND INFORMATION
TECHNOLOGY**

**FINAL YEAR PROJECT SYSTEM DOCUMENTATION FORMAT
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PROJECT TITLE: IMPLEMENTING BIOMETRIC ATTENDANCY FOR UNIVERISITY STUDENTS AND STAFFS.

PROJECT BRAND: BIOTECH ATTENDANCY

DECLARATION

I, **MKOMA, RAMADHAN MOHAMMED** do hereby declare that this is my own work and it has not been submitted for a similar or any other diploma in any other college.

SIGNATURE: 

RAMADHAN MOHAMMED MKOMA

Submitted This.....Day of.....2022

ABSTRACT

The general purpose of this system documentation is to show all the areas that will be performed by student during the time that I will start the implementation phase of my final year system project and shows how the system project imparted the knowledge and self-experience to student.

This system documentation has chapters with chapter one explaining the project background of Biometric Attendance Monitoring System.

Chapter two explains the different methodologies such as the software development approaches, software development lifecycle, architecture of the system and lastly the tools that will be used in developing this software. In chapter three will discuss about the requirement analysis and modeling, while chapter four explains about the system design such as architectural design, database design and UI design.

This system document shows how the system will flow and be able to perform its given tasks and achieve its objectives as needed.

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LIST OF ABBREVIATIONS

BAMS	-	BIOMETRIC ATTENDANCE MONITORING SYSTEM
IOT	-	INTERNET OF THINGS
AI	-	Artificial Intelligence
PWA	-	PROGRESSIVE WEB APPLICATION
JS	-	JAVASCRIPT
CSS	-	CASCADING STYLESHEET
SDK	-	SOFTWARE DEVELOPMENT KIT
OOP	-	OBJECT ORIENTED PROGAMMING
IDE	-	INTEGRATED DEVELOPMENT ENVIRONMENT
CS	-	COMPUTER SCIENCE
OS	-	OPERATING SYSTEM
UI	-	USER INTERFACE

CHAPTER 1

1.1 INTRODUCTION

Introducing the Biometric Attendance Monitoring System (BAMS). **BAMS** is an AI and **IOT** web-mobile based system with **PWA** features that will help to monitor the attendance taking procedure from students and lecturers. The system will eliminate the tradition paper method used to manage the attendance from universities and colleges. The System will provide the Biotechnology (Biometric) fingerprint device that will help to scan the student and lecturer fingerprint and detect the fingerprint recognition by matching the registered fingerprint and the current scanned fingerprint and lastly mark the authorize candidate as attended status.

BAMS will be implemented using the web features but it will have the powerful capability to run on mobile devices such as Android, IOS and Windows phone as a native installed application with standalone app features. It will also have the capability to run as a desktop application on windows, Linux and mac os with standalone features. The system will also provide some services while its offline, so that the system user can be able to view the important features that doesn't require internet to access them.

The intension of this project is help leveraging the attendance taking procedure to students and lecturer (staffs) in order to eliminate the problems of fraudulent signatures, failure to manage attendance schedules properly, lack of attention to study time and many more.

1.2 PROBLEM STATEMENT

The current situation is that the universities and colleges use the traditional name call procedure form attendance system and computerized excel sheets to manage the student's attendance for each single day.

BRIEF PROBLEM STATEMENT

Unsatisfactory attendance from students and lecturers (staff) on the part of universities and colleges such as the problem of copying someone's signature to sign for him or her (fraudulent signatures), failure to manage attendance schedule properly and lack of attention to study time from both instructors and students.

This kind of situation may lead to:

- ✖ Poor performance to students and lecturers
- ✖ Traditional manual paper signature can cause signature forgery (signature fraud)
- ✖ Lack of discipline to students
- ✖ Unsatisfactory storage management
- ✖ Lack of time management

1.3 PROBLEM SOLUTION AND SCOPE

The proposed solution to these kind of problems will be solved using such methodologies:

- ✓ The use of Biometric Fingerprint device to scan and detect (fingerprint recognition) student id and staff (lecturer) id attended to the session.

- ✓ The use of software integrated with biometric fingerprint technology device to manage the students, lecturers and time for each session attended.
- ✓ Implementation of security features for the software and the biometric device to prevent identity frauds.
- ✓ Implementation of secure evaluation report access Human Resource Manager (HR) administration dashboard.

1.4 OBJECTIVES

MAIN OBJECTIVE

The main objective is to automate the attendance taking procedures of an educational universities and colleges using an Intelligent Biometric Fingerprint technology agent in order to eliminate the problems caused by traditional name taking procedure which mostly lead to confusion and conflicts to students and instructors.

SPECIFIC OBJECTIVES

In order to accomplish the big aim of this project the specific objectives will come into play to help achieve the main goal as follows:

- Taking the attendance using biometric devices.
- Managing the attendance using a web-mobile app integrated with the devices.
- Decomposing (Break down) the complexity of managing the attendance for the HR using the intelligent system.
- Solving the problem of frauds and cheating using good security features for both the software and hardware.

1.5 PROJECT BACKGROUND AND MOTIVATION

MOTIVATION

What if I say there is a technology that will help to reduce time and effort while working attendance sheet. Well! The answer is yes, there is a technology. An important Artificial Intelligence technology that can save thousands to millions of students in the universities and other institutes to leverage their performances at schools and outside the industry. This project is important because it solves problems and rises opportunities to the right ones. For me, I think it's enough reason to say why.

BACKGROUND

For the background, many efforts have been donned explicitly to simplify the attendance taking procedure back then until now. We saw the excel sheets now plays a great role to simplify the work, also the google sheet app and web app, but still they weren't design specifically for this kind of tasks, although they're helpful a lot. So now as the world of tech grows, new great technology solution arises, I have seen the biometric fingerprint installed in company and offices and also at school labs, most of the designed specifically for employees to access a specific area and few of them to monitor employee arrival to their jobs. Now I think it's time to use these new technologies to university students and staff in attendance taking and monitoring procedures.

1.6 FEASIBILITY STUDY REPORT

Feasibility study was conducted where requirements were collected at The State University of Zanzibar (SUZA). The Study area of our project is in the department of computing in SUZA where the interview was done through it.

- **Technically:** It is visible because the proposed system will be very easy to interact with its users and control it.
- **Economically & Financially:** The proposed system will be developed using software's that most of them are open sources, such as PostgreSQL database which is used to create database and visual studio code IDE all of them no need of license when used. But for the devices the system will cost some cash to buy the biometric device, Arduino board, sensors and shields.
- **Operational:** To implement this project is possible since most of the HR administration have laptop and smartphone, so they can use the system anytime and anywhere if they have internet and sometimes if not on their mobile devices.

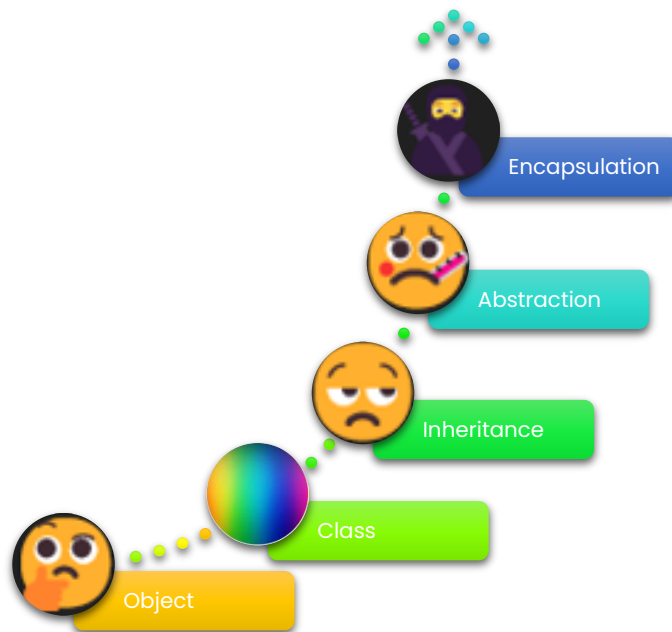
CHAPTER 2

2.0 METHODOLOGY

2.1 SOFTWARE DEVELOPMENT APPROACH

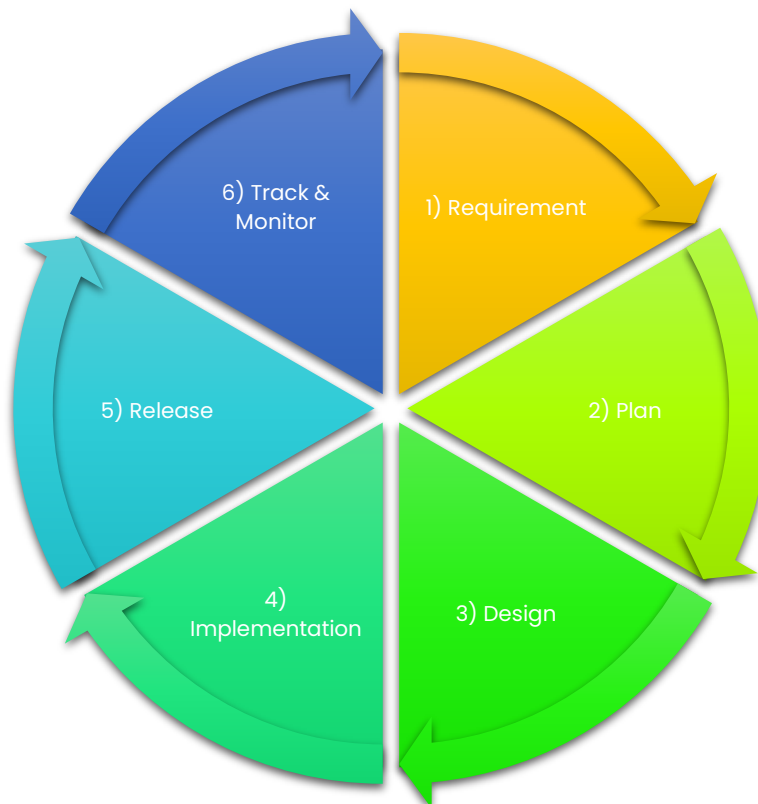
The BAMS project is going to use the Object Oriented software development approach due to some of the good reasons which are as follows:

- OOP reflects the real world behavior which is very good when creating technical project solutions.
- OOP uses the concept of objects in programming, the reason to use OOPs in a code is to increase the reusability and readability of code.
- It allows to break the program into the bit-sized problems that can be solved easily (One object at a time).
- It bundle code into a single unit where you can determine the scope of each piece of data



2.2 SOFTWARE DEVELOPMENT LIFE CYCLE MODEL

The Biometric Attendance Monitoring System (BAMS) will be developed using the Agile Methodology which is the best because the project will never finish. This is true because the system will need some updates for bug fixes, security features and so on. The Agile methodology process is quick enough to adopt changes throughout the development when compared to other methodologies. It also creates unique culture that helps to increase team morale. And lastly, as compared to other methods, the Agile process is quick enough to adjust to changes requested by the clients throughout the development cycle.



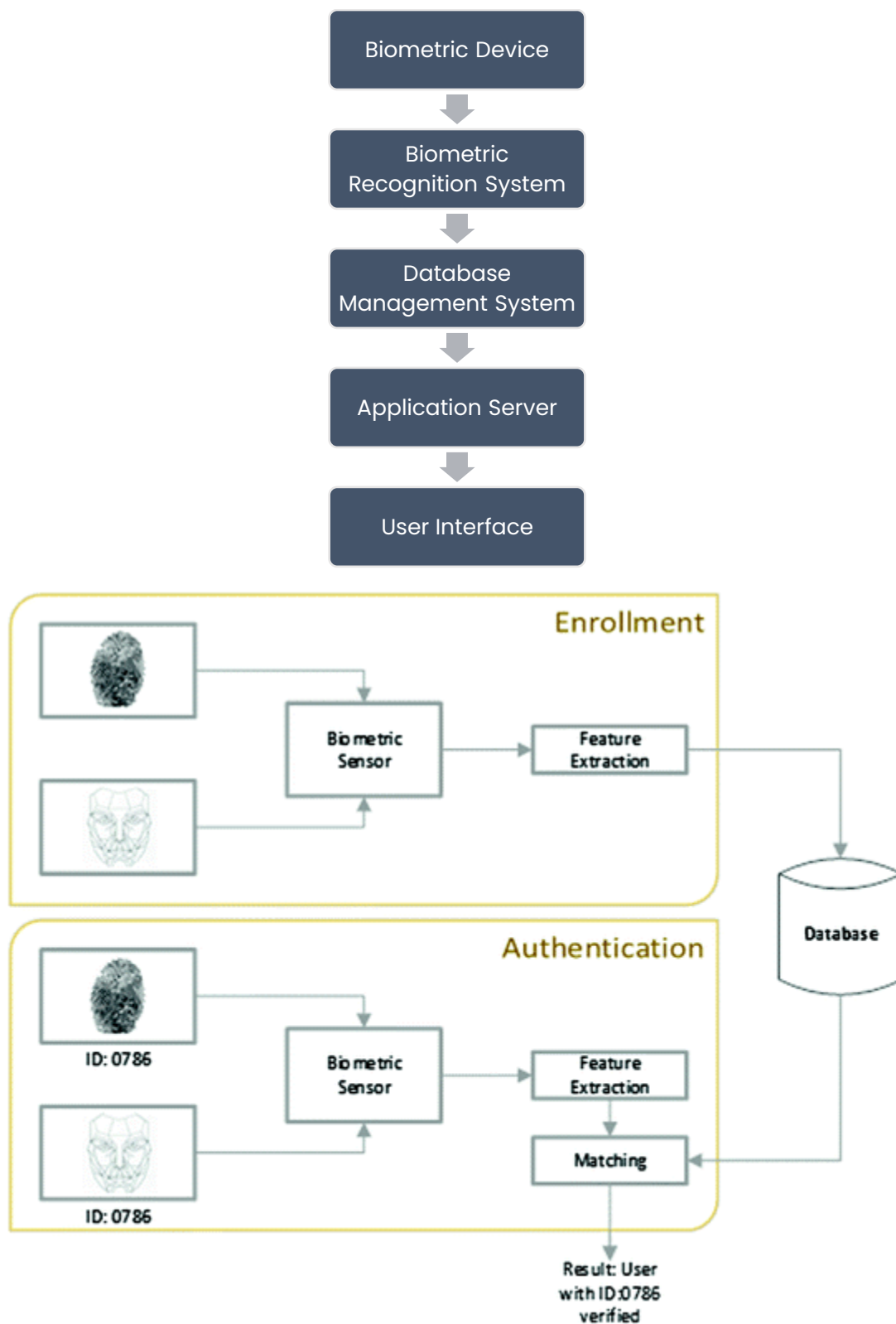
2.3 SYSTEM ARCHITECTURE

The architecture of a biometric attendance management system typically consists of the following components:

1. Biometric sensors: These capture the biometric data of students and staff, such as their fingerprints, facial features, or iris patterns.
2. Data processing and storage: The biometric data is processed and stored securely in a database.
3. Attendance tracking: A software application uses the biometric data to track the attendance of students and staff.
4. User Interface: An Interface is provided for students and staff to input their biometric data and view their attendance records.
5. Integration with other systems: The biometric attendance management system may need to integrate with other systems such as student information system.

It's important to note that the specific architecture and components may vary depending on the requirements and scope of the project.

System architecture diagram for a biometric attendance management system for students and staff:



In this diagram, the biometric device is used to capture the biometric information of the students and staff. The biometric recognition system is responsible for recognizing the biometric data and authenticating the identity of the user. The database management system is used to store the biometric data and attendance records. The application server provides the necessary services for managing the system, while the user interface is used by users to interact with the system.

2.4 SOFTWARE DEVELOPMENT TOOLS

The choice of software development tools for BAMS project may depend on various factors, such as my programming skills, programming languages, and hardware requirements.

Some common software development tools and languages that I'll use for building biometric attendance management systems include:

1. Integrated Development Environments (IDEs) such as Visual Studio, Eclipse, Pycharm, or IntelliJ IDEA.
2. Programming languages such as Python, Java, C#, or C++.
3. Biometric SDKs (Software Development Kits) for integrating biometric sensors and devices with my software application. Some popular biometric SDKs include Neurotechnology, M2SYS, and Innovatrics.
4. Database Management Systems (DBMS) such as MySQL, PostgreSQL, or Microsoft SQL Server for storing attendance management system.
5. Web development frameworks such as Flask, Django, Angular, React or Spring Boot for developing web-based attendance management systems.

CHAPTER 3

3.0 REQUIREMENT ANALYSIS AND MODELING

3.1 REQUIREMENT DETERMINATION

Requirement determination for a biometric attendance management system involve identifying and specifying the needs and expectations of the stakeholders, such as the school administration, students and staff.

3.1.1 INFORMATION GATHERING TECHNIQUES

The information gathering techniques for this biometric attendance management system project includes:

1. **Interviews:** Conducting interviews with stakeholders, such as students, faculty, and administration, to gather information about their requirements and expectations from the system.
2. **Surveys:** Conducting surveys to gather information about the existing attendance management systems, their strengths, weaknesses, and areas of improvement.
3. **Document analysis:** Analyzing existing documents such as attendance registers, attendance policies, and other relevant documents to understand the current system and identify areas for improvement.
4. **Site visits and observation:** Visited the campus or institution and observing the current attendance management system in action to identify any shortcomings and opportunities for improvement.
5. **Brainstorming:** Conducted brainstorming sessions with my supervisor and some of the stakeholders to identify new ideas and requirements for the biometric attendance management system.
6. **Prototype testing:** Building a small prototype or proof-of-concept system and testing it with potential users to gather feedback and identify any additional requirements.

3.1.2 FUNCTIONAL REQUIREMENTS

The functional requirements for a biometric attendance management system may include:

ID	CATEGORY	DESCRIPTION
FR-01	User registration	The system should allow the administrator to register students and staff into the system
FR-02	Biometric data capture	The system should capture the biometric data (fingerprint, face) of registered user.
FR-03	Attendance marking	The system should mark the attendance of users when they scan their biometric data at the designated device.
FR-04	Attendance reporting	The system should generate attendance report for individual users, classes or departments.
FR-05	User management	The system should allow administrator to add, modify or delete users.
FR-06	Device management	The system should allow the administrator to manage the attendance devices, including configuration, software updates, and troubleshooting.
FR-07	Security	The system should be secure and protect the user's biometric data from unauthorized access.
FR-08	User Interface	The system should have a user-friendly interface that allows users to easily scan their biometric data and view their attendance reports.

FR-09	Integration	The system should be able to integrate with other existing systems.
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It's important to note that these specific functional requirements may vary based on the needs and scope of the project.

3.1.2 NON - FUNCTIONAL REQUIREMENTS

Non-functional requirements specify the system's performance, usability, reliability, security, and other quality attributes. For the Biometric attendance management system, the following non-functional requirements are identified:

SN	CATEGORY	DESCRIPTION
01	Performance	The system should respond quickly and efficiently to user requests, and be able to handle a large number of users and transactions at the same time.
02	Usability	The system should be easy to use and understand, with a user-friendly interface that minimizes user error and frustration.
03	Reliability	The system should be dependable and consistent, with high availability and minimal downtime.
04	Security	The system should protect sensitive user data and prevent unauthorized mechanism and audit trails.
05	Scalability	The system should be able to grow and adopt to changing user needs and requirements, without sacrificing performance or reliability.
06	Compatibility	The system should be compatible with variety of hardware and software platforms, as well as different biometric devices and sensors.

07	Maintainability	The system should be easy to maintain and update, with clear documentation and well-organized code.
08	Accessibility	The system should be accessible to users with different abilities, and conform to relevant accessibility standards and guidelines.

3.2 REQUIREMENT STRUCTURING

Requirement structuring is the process of organizing and grouping requirements in a logical manner. It helps to make the requirements more manageable, understandable and traceable.

3.2.1 PROCESS MODELING

The process modeling in Biometric Fingerprint Management system will help to identify the different stages in the system and interactions between them. The main objective of this process modeling is to clearly define the flow of data and activities in the system, in order to identify areas for improvement and optimization.

In the context of biometric attendance management system, the process modeling will involve creating diagram of the steps involved in the attendance process, including capturing biometric data, verifying identity, recording attendance and generating reports. This could be done using various tools.

3.2.1.1 USE CASE DIAGRAM FOR CURRENT SYSTEM

The current system use to take attendance manually, the primary actor is a Lecturer and the goal is to mark attendance for students manually.

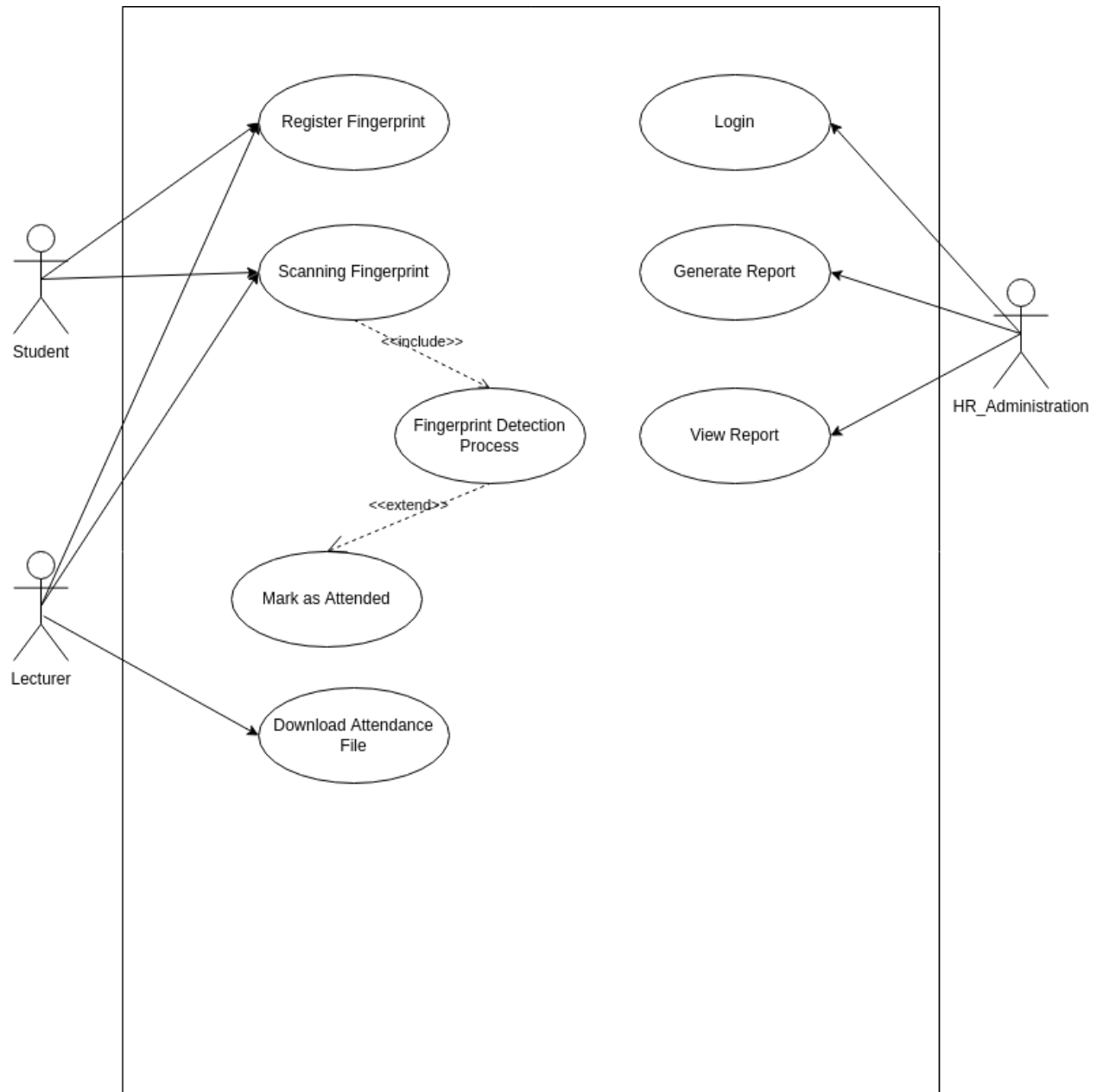
Precondition: The lecturer has access to the attendance sheet.

Postcondition: The attendance record is updated for the day.

The represent the manual process that the system will replace.

3.2.1.2 USE CASE DIAGRAM FOR THE PROPOSED SYSTEM

The use case diagram for the Biometric attendance management system will be used to depict the interaction between the system and its users. It shows various use cases, actors and their relationships. The diagram below defines the biometric fingerprint management system as follows:



This use case diagram helps to visualize the system's functionality and its interactions with different components. It also provides a better understanding of the system's behavior.

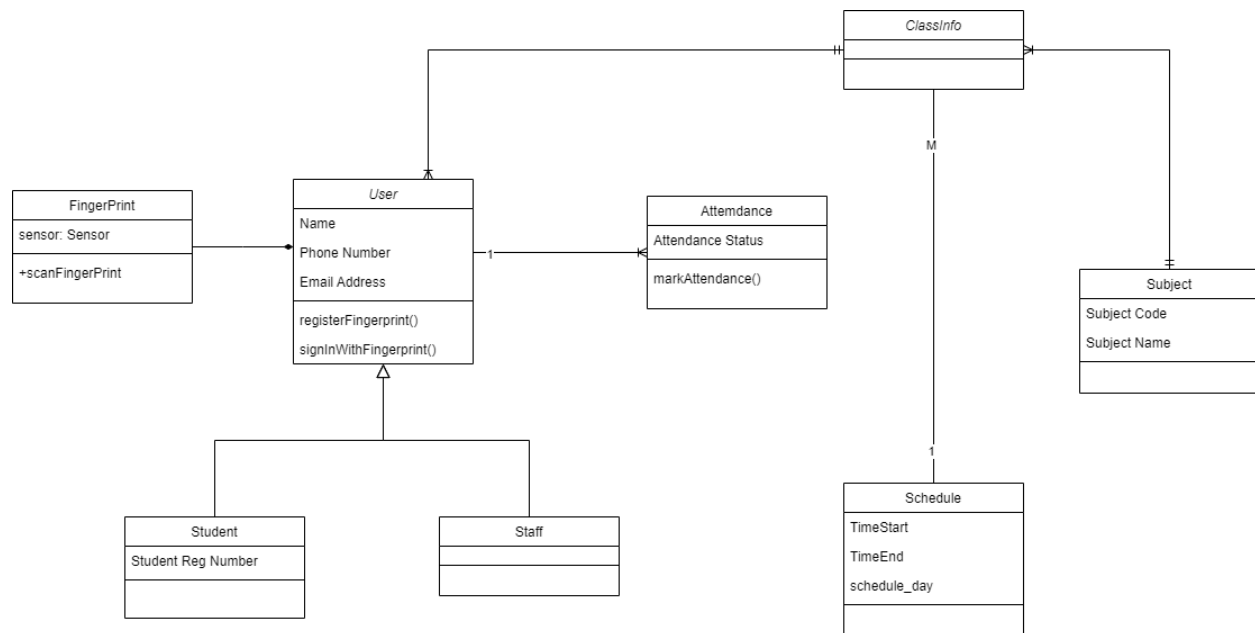
3.2.2 DATA MODELING

The Data modeling involve identifying and defining the various entities involved in the system, as well as their attributes and relationships. Some of the entities in the system include:

1. Student
2. Staff
3. ClassInfo
4. Attendance records
5. Biometric data

3.2.2.1 CLASS DIAGRAM

The class diagram for the biometric attendance system outlines the various classes involved in the system, their attributes, and relationships. The classes include Staff, Student, Attendance, Biometric Device, Administrator, and Report.



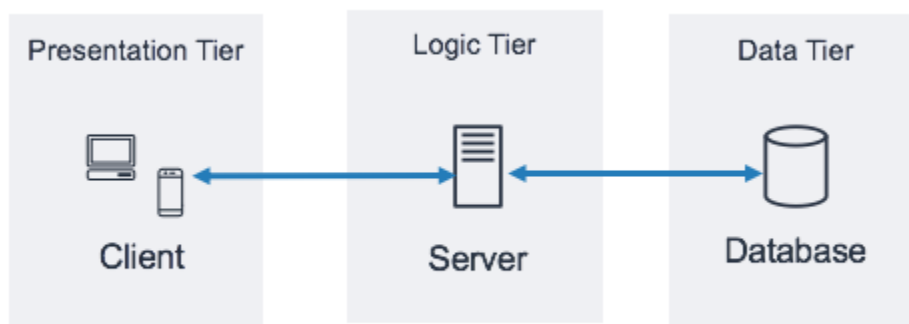
CHAPTER 4

4.0 SYSTEM DESIGN

4.1 ARCHITECTURAL DESIGN

The architectural design of the biometric fingerprint attendance management system will describe the high-level structure and organization of my system. It will provide clear understanding of the components of the system and how they are related to each other. It will also provide details on how the system will be implemented and how the different components will interact with each other.

The biometrics attendance management system consist of three main components: the client, the server, and the database. The client is the device that captures the biometric data of the students and staff, and it consists of a fingerprint scanner and an Arduino board. The server is responsible for processing the biometric data captured by the client and verifying it against the stored biometric data in the database. The server is hosted on a cloud platform and is accessible via an API. The database stores the biometric data of the students and staff, as well as their personal information, such as name and ID number.



The communication between the client and the server is through a wireless network. The client sends the biometric data to the server, which then processes it and sends a response back to the client indicating whether the

biometric data was verified or not. The server communicates with the database to retrieve the stored biometric data and personal information.

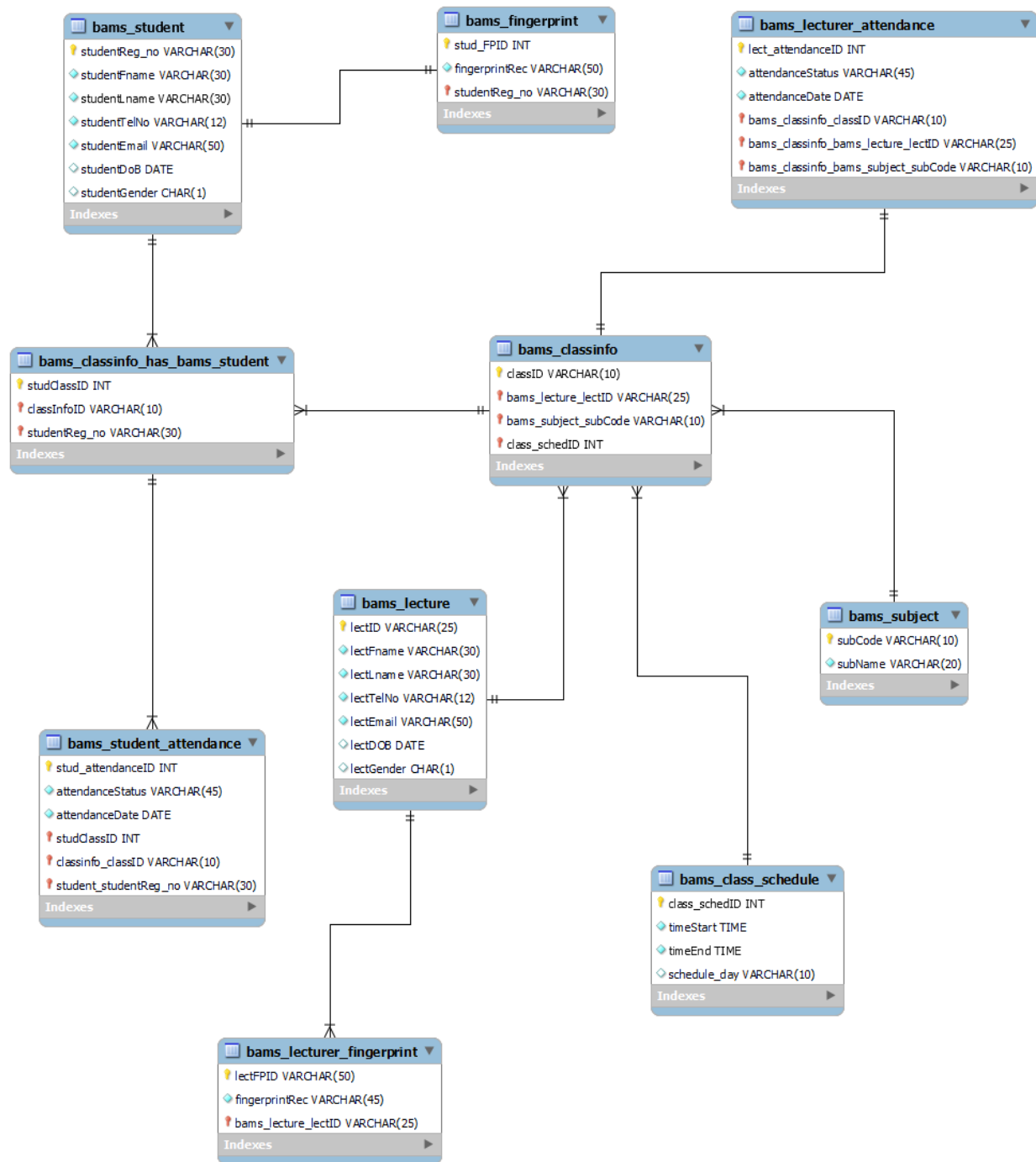
The server is designed using the Model-View-Controller (MVC) architecture. The Model component consists of the data models and the database access layer. The View component consists of the API endpoints that the client communicates with. The Controller component contains the business logic that processes the biometric data and verifies it against the stored biometric data in the database.

Overall, the biometric attendance management system is designed to be secure, reliable, and scalable. The use of biometric data ensures that attendance records are accurate and cannot be falsified. The system can be easily scaled up to accommodate a large number of students and staff, and the cloud-based architecture ensures that the system is available 24/7 from anywhere in the world.

4.2 DATABASE DESIGN

The database design for a biometric attendance management system will be based on the requirements of the system, including the data that needs to be stored and retrieved. The design should ensure that the database is efficient, secure, and easily accessible.

4.2.1 RELATIONAL MODEL



4.2.2 DATA DESCRIPTIONS

This data description includes the necessary data entities and their attributes to support the biometric attendance management system.

1. User Data:

- User ID: unique identifier for each user
- First Name: first name of the user
- Last Name: last name of the user
- Email: email address of the user
- Role: the role of the user (student or staff)

2. Fingerprint Data:

- Biometric ID: unique identifier for each biometric data
- User ID: foreign key to the User table
- Biometric Template: the biometric data template for the user

3. Attendance Data:

- Attendance ID: unique identifier for each attendance record
- User ID: foreign key to the User table
- Biometric ID: foreign key to the Biometric table
- Check In Time: the time the user checked in
- Check Out Time: the time the user checked out

4. ClassInfo:

- ClassInfo ID: unique identifier for each course
- ClassInfo Name: name of the course
- ClassInfo Code: code of the course

5. Enrolment Data:

- Enrolment ID: unique identifier for each enrolment record
- User ID: foreign key to the User table

- Course ID: foreign key to the Course table

4.2.2 DATA DESCRIPTIONS

This data dictionary lists the different fields that will be stored in the database for the biometric attendance system, along with their respective data types, lengths, and descriptions.

Field Name	Data Type	Length	Description
user_id	Integer	10	Unique identifier for each user
name	Varchar	50	Name of the user
department	Varchar	50	Department of the user
designation	Varchar	50	Designation of the user
email	Varchar	100	Email address of the user
password	Varchar	50	Password for user account
fingerprint	Blob	-	Fingerprint data for biometric authentication
date time	Datetime	-	Date and time of attendance record
status	Varchar	10	Status of attendance record (Present/Absent)
device_id	Integer	10	Unique identifier for the biometric device
location	Varchar	100	Location of the biometric device

4.3 USER INTERFACE DESIGN

The user interface (UI) and design are critical components of any software system, including a biometric attendance management system. The UI is the part of the system that the user interacts with directly, and its design should be intuitive and user-friendly to facilitate ease of use and minimize errors.

Some considerations for UI design in a biometric attendance management system include:

1. **Navigation:** The system should be easy to navigate, with clear labels and organized menus to allow users to find the information they need quickly.
2. **Visuals:** The UI should have a clean, modern design that is visually appealing and consistent throughout the system. The use of color coding and icons can also help users to quickly identify information.
3. **User feedback:** The system should provide clear feedback to users when they perform an action, such as submitting attendance or modifying data.
4. **Accessibility:** The UI should be accessible to users with disabilities, including those with visual, auditory, or motor impairments.
5. **Responsiveness:** The UI should be responsive and perform well on a variety of devices, including desktop computers, laptops, tablets, and smartphones.

In addition to UI design, the overall system design should also consider the user experience (UX) to ensure that the system is easy to use and meets the needs of its intended users. This may involve conducting user research and testing to gather feedback and make improvements to the system as needed.

4.2.2 FORM AND REPORTS

In the case of a biometric attendance management system, forms can be used to input data, while reports can be used to display and analyze data.

Forms in the system can include login forms, registration forms, attendance tracking forms, and admin forms. The login form allows users to enter their login credentials, while the registration form allows new users to register for the system. The attendance tracking form will be used to take attendance data and store it in the system, and the admin form will be used by administrators to manage and maintain the system.

4.2.3 INTERFACE DESIGN SAMPLE

The screenshot shows the 'Attendance System' interface. The left sidebar contains a user profile for 'Cletus Igbe' (Online) and a menu with 'Dashboard', 'Employee', 'Attendance List', and 'Attendance Report'. The main content area is titled 'Reports' and features a date range selector (From: yyyy-mm-dd To: yyyy-mm-dd) and a 'View Reports' button. Below this is a table with 10 columns: No., Name, Employee ID., Job Title, Date, Day, Time-In, Time-Out, and Status. The table displays 5 entries for April 2022, all with a status of 'Present'. A search bar is located on the right side of the table. The footer indicates 'Copyright © 2022 Biometric Fingerprint Employee Attendance System | Netcle Technologies' and 'All rights reserved'.

No.	Name	Employee ID.	Job Title	Date	Day	Time-In	Time-Out	Status
1	Joshua Bil	mEQX64	Manager	2022-04-11	Monday	14:49	15:12	Present
2	Ufegan Teh	7xNpYG	Admin Officer	2022-04-11	Monday	16:35	16:41	Present
3	Tomi ilele	JTxwB2	Operation Officer	2022-04-11	Monday	16:37	16:41	Present
4	Akamarisha Ikanobi	782zSt	Program Officer	2022-04-11	Monday	16:37	16:41	Present
5	Student Name 1	7xNpYG	Finance Officer	2022-04-12	Tuesday	15:20	15:22	Present

This screenshot shows the same 'Attendance System' interface, but with a date picker open for the 'From' field. The date picker displays a calendar for May 2022, with the month 'May' selected. The table below the date picker is empty, displaying the message 'No data available in table'. The footer remains the same: 'Copyright © 2022 Biometric Fingerprint Employee Attendance System | Netcle Technologies' and 'All rights reserved'.