AN ASSESSMENT OF USER ACCEPTANCE OF BIOMETRIC FINGERPRINT ATTENDANCE SYSTEM IN EDUCATIONAL INSTITUTIONS.

BY

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BENIN CITY,

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A PROJECT REPORT SUBMITTED TO THE DEPARTMENT OF COMPUTER SCIENCE, FACULTY OF PHYSICAL SCIENCES, UNIVERSITY OF BENIN, BENIN CITY.IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF A BACHELOR OF SCIENCE (B.Sc.) DEGREE IN COMPUTER SCIENCE.

NOVEMBER, 2025.

CERTIFICATION

This is to certify that this project work was carried out by **OFOMOLA FAITH UFUOMA** with matriculation number **PSC2105368** under my supervision. It is adequate and satisfactory, both in scope and content, for the award of Bachelor of Science (B.Sc) degree in Computer Science of the University of Benin.

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Dr. (Mrs) A. R. USIOBAIFO **DATE**

APPROVAL

This project work is hereby approved in partial fulfilment of the requirements for the award of Bachelor of Science (B.Sc.) Degree in Computer Science from the university of Benin.

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Dr. (Mrs) A. R USIOBAIFO **DATE**
(Project Supervisor)

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Dr. (Mrs) A. R. USIOBAIFO **DATE**

(Head of Department)

DEDICATION

This project is dedicated to God Almighty for giving me the strength and wisdom to see it through to completion, and even throughout my stay in the University of Benin(UNIBEN). It is

also dedicated to my parents; Mr and Mrs Ofomola for their endless love, unwavering support, and guidance throughout my academic journey.

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With a heart overflowing with gratitude, I first and foremost return all glory, honor, and praise to the Almighty God, whose unfailing grace, wisdom, and strength have seen me through every

stage of this academic journey. His love has been my guide, His mercy my anchor, and His faithfulness my constant source of hope. Without Him, this work would not have been possible.

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ABSTRACT

Attendance management is a key part of academic administration, yet many Nigerian universities still rely on manual methods prone to errors and impersonation. This study, titled "An Assessment of User Acceptance of Biometric Fingerprint Attendance Systems in Educational Institutions," examined how students of the University of Benin (UNIBEN) perceive and are willing to adopt biometric fingerprint technology as a modern attendance tool. Using a descriptive survey design, data were gathered from 85 students across different faculties. Guided by the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), the study analyzed factors such as awareness, ease of use, trust, and data security. Results showed high awareness and positive attitudes toward the technology, though concerns about privacy and technical support persisted. The study recommends improved infrastructure, training, and clear data protection measures to enhance user trust and successful adoption of biometric systems in universities.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Technological innovation has become one of the most defining characteristics of the twenty first century. It now influences almost every sphere of human life, ranging from communication and commerce to governance and education. In the modern world, technology serves as the driving force behind efficiency, accuracy, and convenience in everyday operations. Over the past two decades, the rapid advancement of Information and Communication Technology (ICT) has reshaped the global educational landscape, transforming the way institutions manage, teach, and evaluate. Through ICT, universities have been able to digitalize administrative systems, improve data management, modernize teaching methods, and strengthen institutional efficiency and accountability (Aduwo and Olamide, 2022).

Within the context of higher education, one of the most important dimensions of this transformation is the shift from manual to automated systems in managing academic records, particularly student attendance. Attendance is not only an administrative necessity but also a strong indicator of students' participation, discipline, and engagement in learning activities (Eze and Ojo, 2023). In most tertiary institutions, attendance data is used to determine eligibility for examinations, monitor academic progress, assess class participation, and evaluate teaching effectiveness. Therefore, maintaining an accurate and reliable attendance record is essential for ensuring fairness and academic integrity.

Despite its importance, many Nigerian universities still depend on the traditional manual approach to recording attendance. This often involves roll calls, paper registers, or sign in sheets. While these methods have been in use for decades, they are increasingly being criticized for their inefficiency and inaccuracy. Manual attendance processes are time consuming and prone to human error, especially in large classes where lecturers must verify the presence of hundreds of students within a short period (Ogunleye and Bello, 2022). Additionally, the possibility of proxy signing, missing registers, and falsified entries has continued to undermine the credibility of attendance data. Such limitations weaken institutional accountability and hinder the smooth evaluation of student participation.

To overcome these challenges, biometric attendance systems have emerged as a reliable and technology-based solution. Biometric systems work by identifying individuals through their unique physical or behavioral traits such as fingerprints, facial patterns, or iris structures (Zhang and Li, 2019). Among the different biometric options, fingerprint recognition is particularly

preferred in educational institutions because it offers a balance of affordability, accuracy, and ease of deployment (Ahmed and Kumar, 2020). The fingerprint attendance system functions by capturing and storing digital templates of a user's fingerprint, which are later used to verify identity during attendance marking. This eliminates impersonation, ensures precise record keeping, and promotes real time monitoring of attendance data.

The adoption of biometric attendance systems promises significant benefits, including reduced administrative workload, improved punctuality, and enhanced transparency. It ensures that attendance records are tamper proof and automatically stored in secure digital formats, thereby simplifying report generation and data retrieval. Furthermore, it fosters discipline among students by discouraging lateness and absenteeism since only physical presence can be verified through fingerprint scanning.

However, the success of any technological innovation is not determined solely by its technical design but also by the level of acceptance among its intended users. Research in information systems consistently shows that user perception, awareness, and trust play a major role in the acceptance or rejection of new technologies (Venkatesh et al., 2003). Even when a technology performs effectively, users may resist adoption if they lack confidence in its operation, doubt its data security, or perceive it as complex and unnecessary (Nwankwo et al., 2021). Therefore, understanding user acceptance is fundamental to the successful introduction of biometric systems in educational institutions. Factors such as ease of use, perceived usefulness, privacy concerns, and institutional support all shape the level of acceptance and eventual integration.

In the Nigerian context, several universities including the University of Lagos, Covenant University, and Ahmadu Bello University have piloted biometric attendance systems in an attempt to improve accountability and reduce impersonation (Eze and Ojo, 2023). Although these initiatives have achieved partial success, they have also faced notable challenges such as unstable electricity supply, inadequate technical support, maintenance difficulties, and user skepticism about data protection. These challenges have slowed down the rate of adoption and raised concerns about sustainability.

At the University of Benin (UNIBEN), biometric attendance technology has not yet been fully implemented. The institution still relies on conventional manual methods of attendance recording. This dependence on paper-based systems often results in inefficiency, delays, and data inaccuracy. Before such a digital system can be introduced successfully, it is crucial to understand the readiness and perceptions of those who will use it—students, lecturers, and administrative staff. Evaluating their level of awareness, perceived usefulness, and concerns about privacy and data protection provides valuable insights into potential acceptance or resistance.

This study therefore seeks to assess user acceptance of a proposed biometric fingerprint attendance system at the University of Benin. It aims to examine how students perceive the introduction of biometric technology for attendance management, their level of awareness about the system, and their confidence in its privacy and reliability. The research also explores how institutional factors such as communication, training, and infrastructure influence user attitudes and willingness to adopt the technology.

By focusing on these variables, the study contributes to the broader understanding of technology acceptance and digital transformation in Nigerian higher education. It provides a framework for evaluating readiness, trust, and implementation capacity in universities planning to adopt automated systems. Ultimately, the findings from this research are expected to assist policymakers, institutional administrators, and ICT professionals in designing effective strategies for integrating biometric systems that are not only technically sound but also socially and ethically acceptable.

1.2 STATEMENT OF THE PROBLEM

Efficient attendance management is one of the most vital components of academic administration in every higher institution. It plays a crucial role in evaluating students' commitment to learning, helps lecturers monitor class participation, and serves as supporting evidence in the assessment of academic performance. In Nigerian universities, attendance also functions as a key eligibility requirement for participation in examinations and continuous assessment activities. Despite its importance, the reliability and accuracy of attendance data remain questionable because most institutions still rely heavily on traditional manual methods of record keeping.

Manual attendance registers are often vulnerable to forgery, manipulation, and inaccuracy. It is a common practice in many institutions for students to sign the attendance sheet on behalf of friends who are absent, a behavior that undermines the credibility of academic records. In addition, lecturers spend a considerable portion of valuable teaching time calling out names or verifying attendance lists, which disrupts the learning process. Paper-based registers can also be easily misplaced, damaged, or inconsistently maintained across departments and faculties. These weaknesses reduce the accuracy of institutional data and compromise the fairness of assessment processes, particularly when attendance contributes to students' grades or determines eligibility for examinations (Eze and Ojo, 2023).

To address these recurring issues, biometric fingerprint attendance systems have been proposed as a modern solution that ensures accuracy, transparency, and accountability. A biometric system

functions by using unique physiological characteristics such as fingerprints to verify and record the presence of individuals automatically. The use of this system in universities is intended to eliminate impersonation, reduce administrative burden, and promote discipline among students. However, research evidence suggests that the success or failure of technological innovations often depends not only on technical capability but also on the level of user acceptance and readiness (Venkatesh et al., 2003). In many cases, new technologies fail to achieve their intended objectives because prospective users perceive them as complex, intrusive, unreliable, or difficult to operate.

In the Nigerian context, infrastructural challenges also pose a major obstacle to the successful deployment of biometric technologies. Problems such as unstable electricity supply, poor internet connectivity, and limited technical support often hinder the consistent performance of digital systems (Adebayo and Yusuf, 2020). Furthermore, there are growing concerns about the safety and confidentiality of biometric data, as users fear possible misuse, data leaks, or inadequate institutional protection of sensitive information. These fears can create mistrust and resistance even before the system is introduced.

At the University of Benin, the biometric attendance system has not yet been implemented, and this makes the concerns mentioned above particularly relevant. Students and staff may have limited understanding of how such a system operates, or they may harbor doubts about how their personal data will be stored, protected, and used. Others may worry that the fingerprint devices could malfunction, slow down attendance marking, or cause unnecessary delays during lectures. If these uncertainties are not properly addressed, the introduction of a biometric system could face rejection, non-cooperation, or eventual abandonment despite the resources invested.

Therefore, the central problem this study seeks to address is the absence of empirical knowledge about the level of awareness, perception, and readiness of students toward the use of a biometric fingerprint attendance system at the University of Benin. Without a clear understanding of these factors, the institution risks implementing a technology that may not be fully accepted or effectively utilized by its intended users. Such a situation could lead to wasted financial investment, technical inefficiencies, and minimal impact on attendance management.

1.3 AIM AND OBJECTIVES OF STUDY

The primary aim of this study is to assess the level of user acceptance, perception, and readiness toward the adoption of biometric fingerprint attendance systems in educational institutions, with particular focus on understanding the factors that influence users' willingness to embrace the technology for effective attendance management.To achieve this, rhe following specific objextives have been identified:

i. Examine the level of awareness of biometric fingerprint attendance systems among students and staff in educational institutions.
ii. Assess users' perceptions of the usefulness, reliability, and efficiency of biometric fingerprint attendance systems compared to traditional manual attendance methods.
iii. Identify the factors that influence users' acceptance and willingness to adopt biometric fingerprint attendance technology.
iv. Evaluate the challenges and concerns (such as privacy, data security, and technical limitations) associated with the implementation of biometric attendance systems in educational institutions.
v. Provide recommendations for improving user readiness, institutional support, and successful adoption of biometric fingerprint attendance systems.

1.4 RESEARCH QUESTIONS

This study was guided by the following research questions:

i. To what extent are students, lecturers, and other university staff at UNIBEN aware of biometric fingerprint attendance systems?
ii. How do respondents perceive the ease of use, accuracy, and reliability of the biometric attendance systems
iii. What factors are likely to influence users' willingness to accept or resist the proposed system?
iv. What challenges do potential users foresee in the adoption or day-to-day operation of the biometric attendance system?
v. What strategies can be adopted to enhance implementation success, strengthen user confidence, and improve institutional efficiency?

1.5 SCOPE OF THE STUDY

The scope of this study is limited to the University of Benin (UNIBEN) in Edo State, Nigeria. It focuses on three main categories of potential users of a biometric fingerprint attendance system, which are the students, lecturers, and administrative staff.

The study examines participants' awareness, perceptions, and anticipated challenges associated with introducing such a system. Areas of interest include perceived ease of use, usefulness, reliability, and data security. Because UNIBEN has not yet implemented the biometric system, the study does not involve empirical evaluation of system performance or usability tests; rather, it focuses on perceptions and readiness prior to implementation.

The study also excludes other biometric modalities such as facial recognition or iris scanning and does not cover institutions outside UNIBEN. However, its findings may serve as a valuable reference for other Nigerian universities planning similar implementations.

1.6 SIGNIFICANCE OF THE STUDY

This study holds great importance as it explores the level of user acceptance of biometric fingerprint attendance systems in educational institutions, with particular focus on the University of Benin (UNIBEN). The outcome of this research provides both practical and theoretical contributions that can guide decision-making, policy formulation, and technological advancement in higher education.

i. **Improvement of Attendance Accuracy and Accountability:** The study is significant because it highlights how biometric fingerprint systems can eliminate errors, forgery, and impersonation that are common in manual attendance records. Reliable attendance data enhances transparency, ensures fairness in academic evaluation, and strengthens institutional credibility. Through this research, educational institutions can identify effective ways to maintain accurate and verifiable attendance records.

ii. **Guidance for Institutional Policy and Decision-Making:** The findings of this study will assist university management and policymakers in making informed decisions about adopting and implementing biometric systems. It provides evidence-based insights that can be used to plan infrastructure investments, create operational guidelines, and ensure proper maintenance and support for the technology.

iii. **Promotion of User Awareness and Technological Readiness**: Understanding the perceptions and attitudes of students, lecturers, and staff will help the institution design awareness campaigns and training programs to prepare users for the new system. The research will promote a smoother transition from manual to automated attendance methods by identifying factors that influence acceptance and readiness.

iv. **Strengthening Data Privacy and Ethical Management:** One of the major concerns in biometric technology is the security of personal data. This study emphasizes the need for strong privacy policies, secure data handling practices, and compliance with national regulations such as the Nigeria Data Protection Regulation (NDPR). By addressing these concerns, the study helps institutions protect users' rights and build trust in digital systems.

v. **Enhancement of Administrative Efficiency and Time Management**: By automating attendance records, the system reduces the administrative burden on lecturers and staff. This allows them to dedicate more time to teaching, research, and student engagement. The study demonstrates how adopting biometric systems can improve efficiency, reduce paperwork, and promote smoother academic operations.

This research is not only valuable for UNIBEN but also serves as a reference for other Nigerian universities seeking to improve attendance management and embrace digital solutions responsibly. It bridges the gap between technological advancement and user acceptance, ensuring that innovation in education remains practical, ethical, and sustainable

1.7 LIMITATIONS OF THE STUDY

Every research endeavor faces certain constraints. The key limitations of this study include:

i. **Time Constraints:** Data collection was limited to the academic calendar, which restricted the number of respondents and the opportunity for repeated sampling.
ii. **Sampling Method:** Because of logistical and resource limitations, convenience sampling was adopted, which may affect the representativeness of results.
iii. **Response Bias**: Some respondents may have provided socially desirable answers, thereby limiting the authenticity of data.
iv. **Hypothetical Context**: Since the biometric system is not yet implemented at UNIBEN, respondents' opinions are anticipatory rather than experiential.
v. **Infrastructure Limitations**: The study could not empirically assess infrastructural adequacy, such as network reliability or power supply stability, which are external to user perceptions.

Despite these challenges, efforts were made to ensure reliability through careful questionnaire design, anonymity assurances, and cross-verification of responses.

1.8 DEFINITION OF KEY TERMS

i. **Biometrics**: Technologies that use measurable physiological or behavioral characteristics, such as fingerprints or facial features, to identify or verify individuals.
ii. **Fingerprint Recognition**: A biometric process that captures and analyses the unique ridge and valley patterns on a person's fingertip to authenticate identity.
iii. **Attendance Management System**: A digital or manual process used to record, monitor, and manage attendance data within an institution.
iv. **User Acceptance**: The degree to which users are willing to adopt and use a new technology, influenced by perceived usefulness, ease of use, trust, and social factors.
v. **Educational Institution**: An organization, such as a school, college, or university, where formal teaching and learning occur.
vi. **Proxy Attendance**: The act of marking attendance for another person who is not physically present, leading to fraudulent records.
vii. **Technology Acceptance Model (TAM):** A theoretical framework that explains how perceived usefulness and ease of use influence individuals' decisions to adopt new technology (Davis, 1989).
viii. **Unified Theory of Acceptance and Use of Technology (UTAUT)**: A model that integrates several technology acceptance theories and identifies performance expectancy, effort expectancy, social influence, and facilitating conditions as key determinants of user adoption (Venkatesh et al., 2003).

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

The use of biometric fingerprint technology in managing attendance marks a major step forward in the digital transformation of educational institutions. As universities and colleges move towards automation to make administrative tasks more efficient, the process of tracking attendance has become a key area that needs dependable and secure technological solutions. Traditional methods of recording attendance such as handwritten registers or card-based systems often lead to problems such as inefficiency, errors, and dishonest practices like fake attendance or someone signing in for another person (Eze & Ojo, 2023). Because of these issues, biometric fingerprint systems have become popular for their ability to accurately identify individuals, improve the precision of attendance records, and increase transparency and responsibility.

This chapter offers a detailed look at the existing research on biometric fingerprint attendance systems, the technology that supports them, and the elements that influence how users accept and use them. It brings together insights from both global and Nigerian contexts, helping to explain how these systems are created, rolled out, and received by the people who use them. The chapter starts with an explanation of the technical basics of biometric systems, such as their design, how they work, and how they are categorized. It then covers how fingerprint recognition technology functions, how attendance systems have evolved in academic settings, and the theoretical frameworks like the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) that are used to study how people accept new technologies. The chapter also explores past research that highlights the factors affecting user acceptance, such as how easy a system is to use, how useful it is considered to be, and the level of trust, security, privacy concerns, and how ready an institution is to adopt new technologies.

There is special focus on the Nigerian higher education environment, where factors like infrastructure and cultural norms influence how new technologies are accepted, which can be different from what is seen in developed countries. The review ends with a look at existing studies and a summary of key areas that are still not well understood, especially the lack of detailed studies before implementing biometric attendance technologies in Nigerian universities, such as the University of Benin (UNIBEN).

In summary, this chapter provides the theoretical and practical background needed to understand the operation of biometric fingerprint attendance systems and how they are accepted by users.It

ensures that the later analysis is grounded in both international technology standards and the specific conditions found in the local setting.

2.2 OVERVIEW OF BIOMETRIC SYSTEMS

Biometric systems are automatic tools that help recognize or check someone's identity based on their unique physical or behavior traits. These systems are now important in modern ways to confirm who someone is because they use natural traits like fingerprints, face shape, eye patterns, and voice instead of things like ID cards or passwords that can be stolen, shared, or copied (Jain, Ross, & Nandakumar, 2016). These systems are good for personal identification, security, and keeping track of attendance. The main way biometric systems work is through two key steps: enrollment and matching.

During enrollment, the system takes someone's biometric data, like a fingerprint or face, processes it, and saves it as a digital version in a secure place. During matching, the system compares a new biometric sample with the saved data to check if it's the same person (Maltoni et al., 2022). This two-step process helps ensure that the system is reliable and gives consistent results, which is especially important in situations where accuracy and trust are very important, like in school attendance, controlling access to places, and security at borders.

From a working perspective, biometric systems have five main parts (Zhang, 2018):

i. **Sensor or Input Device:** This part captures the raw data like a fingerprint or face image. The quality of this data affects how accurate the rest of the process is.
ii. **Feature Extraction Module**: This part looks at the data and finds the key features, like lines on a fingerprint or patterns in the eye, and turns them into a simple mathematical form.
iii. **Database (Template Storage)**: These features are stored in a secure, encrypted way in a database for later use when comparing new data.
iv. **Matching Module**: This part compares new data with existing stored data to see how similar they are and check if it's the same person.
v. **Decision Module:** Based on how similar the new data is to the stored data, this part decides if the person is who they say they are, allowing or stopping access.

A biometric system can do two kinds of recognition (Maltoni et al., 2022):

i. **Verification (1:1 Matching):** The system checks if the person claiming to be someone is actually that person by matching them to their stored data.
ii. **Identification (1:N Matching)**: The system checks the whole database to find who the person is among all the people that have been registered.

2.2.1 CLASSIFICATION OF BIOMETRIC SYSTEMS

Biometric systems are generally categoried into two main types: physiological and behavioral biometrics (Ratha & Chellappa, 2020).

i. Physiological biometrics are based on physical characteristics like fingerprints, facial shape, the pattern of the iris, hand veins, and DNA.These traits are generally consistent over time and are known for their accuracy when used for verifying someone's identity.
ii. Behavioral biometrics, on the other hand, look at patterns of how people behave, such as the way someone speaks, walks, types on a keyboard, or signs their name.These behaviors can be affected by things like the environment or a person's mood, but they are still helpful for ongoing verification.

Fingerprint recognition is the most commonly used biometric method around the world.This is because it is affordable, easy to use, has well-developed technology, and is highly accurate. Fingerprints are unique to each person, even twins, and the patterns on the fingertips don't change as a person grows older, making them a reliable way to confirm someone's identity in places like schools, government offices, and businesses.

2.2.2 FUNCTIONAL OPERATIONS OF A BIOMETRIC SYSTEM

The way a biometric fingerprint system works usually follows these steps (Abdulhamid et al., 2022):

i. **Capture**: The fingerprint scanner takes a picture of the user's fingertip.
ii. **Preprocessing**: The image is cleaned up using special tools to make it clearer, fix brightness, and find important details like the ends and branches of the ridges.
iii. **Feature Extraction**: Important points on the fingerprint, like the unique patterns of the ridges, are picked out and turned into a set of numbers.
iv. **Template Storage:** These numbers are made secure with encryption and saved in a database.
v. **Matching and Decision**: When someone tries to use their fingerprint, the system compares the new set of numbers with the saved ones. If they match closely enough, the system gives access or confirms the person's presence.

This method makes sure that each check is unique and safe, as even broken or partial fingerprints can still be matched thanks to smart pattern recognition technology.

2.2.3 ADVANTAGES AND CHALLENGES OF BIOMETRIC SYSTEMS.

Using biometric systems has many benefits compared to old ways of identifying people:

i. **Better Security**: Biometric features like fingerprints or faces can't be copied, shared, or stolen easily.
ii. **More Accuracy:** These systems help avoid mistakes made by people and stop someone else from pretending to be another person.
iii. **More Convenience**: People don't need to carry ID cards or remember passwords to be recognized.
iv. **More Efficiency:** These systems make it easier to check attendance or grant access, which saves time for staff.
v. **Easy to Scale**: New systems can handle a large number of users thanks to cloud and other advanced computing methods.

Even though there are many benefits, there are still some problems when using these systems in real life:

i. **Privacy and Security Issues:** If biometric data is accessed without permission, it could be used for wrong purposes or lead to identity theft.
ii. **Sensor Problems**: If the sensors are not good quality, they may not work well in bad weather, dirt, or different lighting conditions.
iii. **People may not like using them**: Some people are worried about being watched, data being misused, or the system being uncomfortable to use.
iv. **Cost and Setup Challenges**: Some places, especially in poorer countries, find it hard to pay for and install biometric systems.

New developments, like machine learning, checking if someone is real, and using edge computing, are helping to fix these problems.These changes make the system more accurate, faster, and better at stopping fake identities (El-Abed & Charrier, 2019).

2.2.4 RELEVANCE OF BIOMETRIC SYSTEMS TO EDUCATIONAL INSTITUTIONS

In schools and universities, biometric systems are becoming more common for tracking how often students attend classes, managing who can enter certain areas, and making administrative tasks more transparent.

For institutions like UNIBEN, using a biometric fingerprint system for attendance can help stop fake attendance records, make data easier to gather, and make the institution more responsible. These systems also provide useful information for planning academic activities and assessing how well students are performing.

Moreover, biometric attendance technologies support Nigeria's larger efforts to modernize through digital solutions, focusing on automation, openness, and new technology in education (Okeke & Igbokwe, 2020).

However, the success of these systems depends on how well people understand them, how reliable the technology is, and how securely data is managed which is the key aspects that this research is based on.

2.3 TYPES OF BIOMETRIC AUTHENTICATION

Biometric authentication can be broadly divided into two main types — physiological and behavioral biometrics. Both types are used to uniquely identify or verify individuals based on their inherent characteristics. The main difference between them is whether the trait being measured is biological or related to behavior (Ratha & Chellappa, 2020). Understanding these two types is important when considering the best biometric methods for managing attendance in educational institutions.

2.3.1 PHYSIOLOGICAL BIOMETRICS

Physiological biometrics involve measuring biological traits that remain relatively consistent throughout a person's life.These include fingerprints, facial features, iris or retinal patterns, palm veins, hand geometry, and DNA sequencing (Jain et al., 2016). These traits are hard to change or fake, which makes them very reliable and unique for authentication purposes.

a. **Fingerprint Recognition:** Fingerprint recognition is the most common form of physiological biometrics used today.It uses a fingerprint sensor to capture the unique ridge patterns and minutiae points on a person's fingertip. The image is then processed with algorithms to extract these patterns and compare them with stored templates (Kaur & Sandhu, 2020). Fingerprint systems are popular for educational attendance applications because they are cost-effective, have mature and reliable algorithms, are easy to set up, and are proven to work well. Their compact sensors can be easily installed in classrooms or faculty offices, making it simple to record attendance automatically.

b. **Facial Recognition:** Facial recognition systems use digital cameras to analyze the geometric relationships between facial features such as the distance between the eyes or the shape of the jawline. These systems are becoming more common in surveillance and smartphone authentication. However, in educational settings, facial recognition can be affected by environmental factors like lighting and camera placement (Zhang, 2018).

c. **Iris and Retinal Scanning:** Iris recognition systems capture the intricate patterns of the iris like the colored part of the eye surrounding the pupil while retinal scanners map the unique blood vessel patterns at the back of the eye.These methods are highly accurate, but they are not widely used in schools due to high costs, user discomfort, and the need for specialized equipment (Maltoni et al., 2022).

d. **Hand Geometry and Vein Recognition:** Hand geometry and vein recognition are two types of biometric technologies. Hand geometry systems measure the physical features of the hand, such as length, width, and thickness of fingers. Vein recognition, on the other hand, uses infrared light to capture the unique patterns of veins beneath the skin. Both are accurate but are better suited for controlled environments like laboratories or high-security areas rather than for everyday classroom attendance.

ADVANTAGES OF PHYSIOLOGICAL BIOMETRICS:

i. They are highly permanent and unique to each individual.
ii. They are difficult to duplicate or share.
iii. They are ideal for one-time enrollment and long-term use.
iv. They offer high accuracy and reliability.

LIMITATIONS:

i. There may be hygiene issues due to physical contact, especially with fingerprint scanners.
ii. They may raise privacy concerns because they store personal physical data.
iii. Some sensors can fail due to environmental or physical changes, such as dirty fingers or poor lighting.

2.3.2 BEHAVIORAL BIOMETRICS

Behavioral biometrics identify individuals based on patterns of behavior that are linked to their identity, such as voice recognition, signature dynamics, keystroke patterns, gait recognition, and mouse movement.Unlike physiological biometrics, behavioral traits can vary due to emotional state, fatigue, or environmental conditions (Ratha & Chellappa, 2020).

a. **Voice Recognition:** Voice recognition identifies people based on the tone, pitch, and rhythm of their voice.While convenient, it can be affected by background noise or changes in voice due to illness or stress, making it less reliable for use in noisy academic settings (Kumar & Ramesh, 2020).

b. **Keystroke Dynamics:** This method tracks the rhythm, pressure, and speed of typing to identify a user.It is commonly used in computer-based settings, such as online exams, rather than for tracking physical attendance (Yu et al., 2023).

c. **Signature Recognition:** This technique captures handwriting characteristics, such as stroke speed, pressure, and direction, using digital tablets.However, its accuracy may decrease over time as handwriting changes naturally, and it cannot prevent impersonation if the signature is forged.

d. **Gait Recognition:** Gait analysis identifies individuals by the way they walk.This method can work unobtrusively through surveillance cameras but requires advanced video processing and can be affected by changes in clothing, footwear, or what a person is carrying.

ADVANTAGES OF BEHAVIORAL BIOMETRICS:

i. They can provide continuous or passive authentication without requiring user interaction.
ii. They are less invasive as they do not involve physical contact.
iii. They are suitable for digital and online environments.

LIMITATIONS:

i. Behavioral traits can change over time or due to emotional states.
ii. Environmental factors can affect the reliability of the system.
iii. They typically offer lower accuracy compared to physiological biometrics.

Table 2.1 compares physiological and behavioral biometric systems according to these parameters.

Table 2.1: Comparison of Physiological and Behavioral Biometrics

Criteria	Physiological Biometrics	Behavioral Biometric
Examples	Fingerprint, iris, facial, hand geometry	Voice, signature, gait, keystroke.
Permanence	High (stable over time)	Moderate (can vary due to behavior or environment)
Accuracy	Very high (low error rate)	Moderate to low
Cost of implementation	Moderate to high	Low to Moderate
User Convenience	Requires user interaction	Can be contactless or passive

Suitable for Education	Highly suitable (e.g fingerprint attendance system)	Less suitable (more effective in digital assessment)

As shown in Table 2.1, physiological biometrics especially fingerprint recognition—offers the best balance between accuracy, cost, scalability, and how willing people are to use it in an educational setting. Fingerprint systems are already widely used, supported by sensors that are easy to find, and have been developed for many years, making them the top choice for managing student attendance in both rich and poor countries (Abdulhamid et al., 2022).

2.3.4 USING MULTIPLE BIOMETRIC METHODS TOGETHER

Newer technologies are now using systems that combine two or more biometric traits, like fingerprints and faces, to make the system more reliable. These systems help deal with problems that come from using just one type of biometric, like blurry images or issues caused by the environment (Maltoni et al., 2022).

However, using multiple methods can be more expensive and harder to set up, which might not work well for places with limited money or technical skills, like many public universities in Nigeria. For tracking attendance, fingerprint biometrics are still the best option because they are simple, accurate, and easy to use.

They are not intrusive and have a strong technical base, which fits well with how schools usually operate. This makes them the main focus of this study on how students at UNIBEN accept this technology.

2.4 FINGERPRINT RECOGNITION TECHNOLOGY (MECHANISMS AND LIMITATIONS)

Fingerprint recognition is one of the most widely used and trusted biometric methods because it is accurate, affordable, and easy to use.

The unique patterns of ridges on a fingerprint stay the same throughout a person's life, which makes it a reliable way to identify individuals (Kaur & Sandhu, 2020). This technology is used in many areas like forensics, banking, mobile devices, and school attendance systems. In places like universities, fingerprint-based attendance systems are especially useful because they help prevent people from pretending to be someone else, make sure everyone is accountable, and make administrative tasks easier.

2.4.1 MECHANISMS OF FINGERPRINT RECOGNITION

The process of fingerprint recognition includes several steps that help ensure the identification is accurate and reliable. These steps can be divided into four main parts: data acquisition, image preprocessing, feature extraction, and matching (Maltoni et al., 2022).

i. **Data Acquisition:** Fingerprint images are captured using special sensors that detect the ridges and valleys on the finger. The quality of the image is very important, as poor quality can lead to errors later on. Factors like how clean the finger is, how much pressure is applied, the lighting conditions, or the condition of the sensor surface can all affect the quality of the image (Abdulhamid et al., 2022).

ii. **Image Preprocessing:** Before the image is analyzed, it goes through a preprocessing step where the contrast is improved and any noise is removed. Techniques like histogram equalization, binarization, and thinning are used to make the ridge patterns more visible and standardize the image size. This helps ensure that even unclear or partial fingerprints can be properly analyzed (Jain et al., 2016).

iii. **Feature Extraction:** In this step, the system looks for special points on the fingerprint called minutiae, which are the ends and branches of ridges. These points help identify the fingerprint uniquely. Algorithms then calculate how these points relate to each other to create a mathematical model of the fingerprint. Some advanced systems also use other characteristics like ridge direction, frequency, and texture to make the identification more accurate (Ratha & Chellappa, 2020).

iv. **Template Creation and Storage:** Once the features are extracted, they are converted into a smaller, encrypted digital template that is saved in the system's database. This template only contains the extracted features, not the actual image, which protects privacy and saves storage space (Zhang, 2018).

v. **Matching and Decision:** When someone tries to log in or verify their identity, a new fingerprint is captured, and its template is compared with stored templates.

The system uses algorithms to calculate how similar the two fingerprints are, based on the alignment of their minutiae points. If the similarity score is above a certain threshold, the system confirms the match. Common matching methods include minutiae-based, correlation-based, and pattern-based approaches (Maltoni et al., 2022).

2.4.2 TYPES OF FINGERPRINT SENSORS

The performance of a fingerprint recognition system is largely determined by the type of sensor used to collect data.

Fingerprint sensors are usually grouped into three main types (Yu et al., 2023):

i. **Optical Sensors:** These sensors work by using light to take pictures of fingerprints. When you place your finger on a glass panel, an internal light source and camera capture the lines (ridges) as dark areas and the spaces (valleys) as light areas. Optical sensors are cheap and often found in time clocks and access systems. However, they can be less effective if the sensor or finger is dirty or has scratches.

ii. **Capacitive Sensors:** These are commonly used in phones and other small devices. They work by sensing changes in electrical charge between the ridges and valleys of a fingerprint. They are small, use little power, and are less affected by dirt. But they may have trouble reading fingerprints that are dry or have thick skin, like those with calluses.

iii. **Ultrasonic Sensors**: These sensors use high-frequency sound waves to create a detailed 3D image of both the top and beneath the surface of a fingerprint. This makes them very resistant to dirt, water, and fake fingerprints. While they are more costly, they offer the best accuracy and reliability (Yu et al., 2023).

Optical sensors are the most commonly used in educational attendance systems because they offer a good balance between cost and accuracy. This makes them a great choice for schools and colleges in places like Nigeria where resources may be limited.

2.4.3 FINGERPRINT RECOGNITION ALGORITHMS

The effectiveness of fingerprint systems relies heavily on the matching algorithms used.

These algorithms take the fingerprint data collected and turn it into a verified identity. There are three main types of these algorithms:

i. **Minutiae-Based Algorithms:** These algorithms focus on matching the tiny details in a fingerprint, such as where the ridges end or split. They are popular because they require less computer power and are efficient (Zhang, 2018).

ii. **Correlation-Based Algorithms:** These compare the overall dark and light patterns of two fingerprint images by placing one on top of the other.
They are quite accurate but need very clear images and use more computer resources.

iii. **Hybrid Algorithms:** These use both minutiae-based and pattern-based methods to improve performance, especially when dealing with unclear or incomplete fingerprints.

Recent studies have started using machine learning and deep learning techniques to improve fingerprint recognition. Neural networks, such as Convolutional Neural Networks (CNNs), can automatically find key features in fingerprints and make the system more resistant to noise. This makes them useful for large-scale attendance systems (Abdulhamid et al., 2022).

2.4.4 PERFORMANCE METRICS AND EVALUATION

The accuracy of a fingerprint recognition system is measured using several key metrics (Jain et al., 2016):

i. **False Acceptance Rate (FAR):** The chance that someone who is not supposed to be recognized is accepted as a match.

ii. **False Rejection Rate (FRR):** The chance that someone who is supposed to be recognized is not accepted.

iii. **Equal Error Rate (EER):** This is the point where FAR and FRR are the same, and it helps to measure overall system reliability.

iv. **Failure to Enroll (FTE):** This happens when the system cannot capture or process a fingerprint during registration.

A lower EER means the system is performing better. However, things like the environment and user behavior can affect these metrics, which is why calibration is important before using the system in real situations.

2.4.5 LIMITATIONS AND CHALLENGES OF FINGERPRINT SYSTEMS

Even though fingerprint systems are widely used, they do face some technical and practical issues:

i. **Environmental Factors:** Dirt, oil, or moisture on the sensor can make the image unclear. Also, poor lighting or inconsistent pressure during capture can affect the accuracy of the system.

ii. **User-Related Issues:** People with worn or damaged fingerprints, such as those working with their hands, may have trouble getting recognized repeatedly.

iii. **Spoofing Threats:** Fake fingerprints made from materials like silicone or 3D printed models can trick some systems. Using liveness detection and adding more security layers can help prevent this (El-Abed & Charrier, 2019).

iv. **Data Privacy and Ethical Concerns**: Storing biometric data, such as fingerprints, can be risky if the database is hacked. It's important for institutions to follow data protection laws and use encryption and anonymization to protect the information (Bisong, 2024).

v. **System Maintenance:** Regular cleaning, calibration, and updating are needed to keep the system working well. If maintenance is not done properly, it can cause more errors and make users unhappy.

2.4.6 NEW IMPROVEMENTS IN FINGERPRINT TECHNOLOGY

Fingerprint systems have improved a lot in terms of how well they work and how easy they are to use:

i. **3D Imaging**: This captures more detailed information by looking at depth, which makes it harder for fake fingerprints to work.
ii. **AI-Driven Feature Extraction**: Using machine learning helps match fingerprints more accurately and handles things like background noise better.
iii. **Cloud Integration**: This allows data to be stored in one place and makes it easier for big organizations to manage large numbers of users.
iv. **Touchless Fingerprint Scanning**: This is good for hygiene, especially after the COVID-19 pandemic, as it allows people to scan without touching the device (Olasupo et al., 2022).

These improvements make fingerprint systems more dependable and better suited for use in large educational institutions where many people need to be checked in quickly and efficiently every day.

Fingerprint recognition is a well-established, reliable, and scalable biometric method. It offers unique, fast, and accurate identification, making it suitable for use in educational attendance systems. However, challenges like fake fingerprints, sensor problems, and privacy issues must be dealt with using strong security, user education, and consistent system upkeep. For places like UNIBEN, using these systems means paying close attention to these practical aspects to build trust, accuracy, and long-term success.

2.5 ATTENDANCE SYSTEMS IN EDUCATIONAL INSTITUTIONS

Keeping track of student attendance is a key part of managing schools and universities. It shows how much students are involved in their studies and helps in assessing how well they are doing. It also helps in planning resources and making sure the institution is meeting its responsibilities (Owolabi, 2021). The quality of an attendance system depends on how well it can be trusted, work smoothly, and be fair. Over time, the way attendance is managed has changed from using paper forms to using digital and biometric tools, each with its own benefits and drawbacks.

2.5.1 WHY ATTENDANCE MANAGEMENT MATTERS IN EDUCATION

Managing attendance has several important roles within schools. For teachers, it helps them notice when students are missing class, improve discipline, and make sure students are being responsible. For school leaders, it helps with reporting to authorities, managing funds, and keeping proper records. Also, in places where attendance affects grades or exam eligibility, a dependable system ensures fairness and stops people from cheating on attendance records (Eze & Ojo, 2023). In Nigerian universities, there is a strong link between how often students attend class and how well they perform academically.

Owolabi (2021) found that students who attend regularly do better in their studies and are more involved. However, the old ways of recording attendance often do not collect this information accurately or quickly enough.

2.5.2 MANUAL ATTENDANCE SYSTEMS

Manual systems are the most traditional way of keeping track of who is present. Usually, teachers call out names or use a physical list to mark attendance during classes. Although they are simple, they have many problems.

Manual methods take a lot of time, especially in big classes, and can result in mistakes when entering or reading data (Enejo & Ibrahim, 2021). They are also open to dishonesty, such as when students sign in for others who are not there, which is a kind of cheating that harms the school's trust. Physical lists can also be lost, damaged, or altered, making it hard to find or check records later.

Many studies have pointed out the difficulties of using manual systems. Eze and Ojo (2023) noted that teachers can spend up to 15 minutes each class on marking attendance, which takes away time from teaching. Because of this, there has been a move towards using more efficient and trustworthy digital systems.

LIMITATIONS OF MANUAL ATTENDANCE SYSTEMS:

Manual attendance systems are often used, but they have several issues.

People may use someone else's name to mark attendance, making it easy to fake. It takes a lot of time to track attendance for large groups or whole institutions. Mistakes can happen because of human error or poor record-keeping. Keeping old records is also hard, and it's difficult to find or use them later. Records can also be lost or damaged, which causes problems.

ADVANTAGES OF MANUAL SYSTEMS

Manual systems are cheap because they don't need special technology. They are easy to start and don't require any special skills. They also work even when there is no electricity or internet, which is useful in some places. Even though these systems have some benefits, they are considered outdated in modern education, especially at places like UNIBEN that are investing in technology.

2.5.3 DIGITAL (NON-BIOMETRIC) ATTENDANCE SYSTEMS

As technology improved, more schools started using digital attendance methods like RFID, barcodes, QR codes, and mobile apps. These tools make data management easier and reduce the need for people to do things by hand.

i. **RFID-Based Systems**: RFID systems use special cards with chips that send signals when scanned. Each student or staff member has a card, and their attendance is recorded automatically when the card is used. This helps stop people from pretending to be someone else, but it still has some risks like cards being shared or lost. Setting up RFID systems needs special equipment and a network, which can be expensive for schools in developing areas.

ii. **QR Code and Barcode Systems:** These systems create unique codes for each student. They scan the code with a phone to mark attendance, and the data is stored in a central place. While efficient, they need a good internet connection and working phones. Also, photos of the codes can be used again, which brings back the problem of impersonation.

iii. **Mobile Attendance Systems:** Mobile apps use phones and location services like GPS to track where people are. These systems are easy to use but depend on phones, battery life, and secure data handling. Not everyone has a smartphone, so some students might be left out.

ADVANTAGES OF DIGITAL SYSTEMS

These systems help reduce the work needed for staff. They record attendance faster than writing it down by hand. They can also connect with other school tools to help with data analysis and reporting.

LIMITATIONS OF DIGITAL SYSTEMS

Digital systems can be affected by lost or copied cards. They may also fail due to technical problems or poor internet. Even with these systems, someone can still pretend to be another person under certain conditions. Setting up and maintaining these systems can be more expensive than manual methods.

In Nigeria, many universities have tried digital attendance systems, but they often don't last because of problems with infrastructure and unreliable power.

2.5.4 BIOMETRIC FINGERPRINT ATTENDANCE SYSTEMS

The shortcomings of manual and digital attendance systems prompted the development of biometric fingerprint attendance systems as a more effective solution.

These systems use fingerprint sensors to confirm a student's identity and log attendance instantly, ensuring real authenticity and responsibility. Since every fingerprint is unique, it is nearly impossible for someone to imitate another person's fingerprint (Abdulhamid et al., 2022).

When properly implemented, biometric attendance systems provide high accuracy, real-time data handling, and compatibility with academic management systems.

Various Nigerian institutions, including the University of Ilorin, Covenant University, and Ahmadu Bello University, have adopted biometric systems for tracking staff and student attendance (Okeke & Igbokwe, 2020). Reports from these implementations indicate a noticeable decrease in tardiness, absenteeism, and the falsification of attendance records.

In educational settings, biometric systems are generally organized around four main processes:

i. **Enrollment:** Collecting and storing each user's fingerprint data in a secure database.
ii. **Verification:** Matching the fingerprint captured during attendance with the stored templates.
iii. **Logging:** Automatically recording attendance data once a successful verification occurs.
iv. **Reporting:** Creating attendance reports for teachers and administrators.

ADVANTAGES OF BIOMETRIC SYSTEMS

i. Eliminates proxy attendance and guarantees the accuracy of data.
ii. Offers immediate verification and automatic record-keeping.
iii. Increases institutional accountability and minimizes fraud.

LIMITATIONS

i. The initial setup costs can be quite high.
ii. Dependence on power and internet connectivity may impact reliability.
iii. Regular maintenance is necessary to avoid false rejections.
iv. Privacy and data security issues may arise if not properly managed.

Despite these challenges, biometric attendance systems are regarded as a transformative tool in educational administration, especially for universities aiming to digitize their administrative procedures.

2.5.5 COMPARATIVE ANALYSIS OF ATTENDANCE SYSTEMS

Table 2.3 provides a comparative overview of manual, digital, and biometric systems based on important factors such as accuracy, efficiency, cost, and data security.

Table 2.3: Comparative Analysis of Attendance Systems

FEATURES	MANUAL SYSTEMS	DIGITAL(NON-BIOMETRIC)	BIOMETRIC SYSTEMS
Accuracy	Low-prone to human error	Moderate-subject to card or code sharing.	High-unique identification via biometrics
Speed	Slow	Fast	Very fast
Cost of setup	Low	Moderate	High
Maintenance	Low	Moderate	Moderate
Data Security	Low	Medium	High
Proxy Attendance	Common	Possible	Eliminated

From Table 2.3, it is clear that biometric attendance systems are better than both manual and digital methods when it comes to accuracy, accountability, and security. But for these systems to work well, they need good infrastructure, proper user training, and rules that are followed.

2.5.6 BIOMETRIC ATTENDANCE IN EDUCATIONAL CONTEXTS

Around the world, universities in India, Malaysia, and South Africa have started using fingerprint-based attendance systems to make students more engaged and reduce absenteeism

(Ahmed et al., 2020). These systems have shown real improvements in how often students attend classes and how efficiently data is managed.

In Nigeria, the use of biometric systems is still in the early stages, but some pilot projects have shown good results. Schools that have introduced biometric systems found that students were more punctual, fake attendance was less common, and data was easier to access (Olasupo et al., 2022).

At the University of Benin (UNIBEN), biometric attendance systems are not yet fully in place. However, the university is moving towards more digital services, like e-learning and online student portals, which shows it is getting closer to using biometric systems. Before rolling out such a system, it's important to check how users feel about it, as this study does, to find out what challenges might come up, like understanding, trust, and whether they see it as useful.

2.5.7 CHALLENGES OF IMPLEMENTING ATTENDANCE TECHNOLOGIES

Using advanced attendance systems, especially in places where things are still developing, can be difficult because of several issues:

i. **Financial problems**: The cost of the devices and setting up the system can be high.
ii. **Power issues**: If there are frequent power cuts, the system won't work properly.
iii. **Internet problems**: The system depends on a good internet connection to send and receive data.
iv. **Maintenance issues**: The devices can get worn out, dusty, or affected by the environment, so they need regular care.
v. **User resistance**: Some people might worry about privacy or not know how to use the system, which can stop them from accepting it.

To deal with these problems, schools need to have a complete plan for setting up the system, including training for users, support for the infrastructure, and clear rules about how data is handled and protected.

The way attendance systems work in schools has changed a lot over time, moving from old, human-based methods to new, tech-based solutions.

Biometric systems, especially those using fingerprints, are special because they are more accurate, secure, and efficient. But to be successful, these systems need the right kind of infrastructure, users who are properly trained, and clear rules about how data is used and kept safe.

For a university like UNIBEN, using a biometric attendance system could improve how the school runs and how accountable students are –provided that problems like power supply, maintenance, and how users feel about the system are handled properly.

2.6 THEORETICAL FRAMEWORKS FOR UNDERSTANDING ACCEPTANCE

Understanding how users accept and use new technologies is important for successfully introducing innovations like biometric fingerprint attendance systems in schools.

Theoretical frameworks help explain and predict how people behave when using technology. Two of the most commonly used models in information systems research are the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003; Davis, 1989). These models form the basis of this study and guide the analysis of how users feel about and intend to use biometric systems in universities.

2.6.1 THE TECHNOLOGY ACCEPTANCE MODEL (TAM)

The Technology Acceptance Model (TAM) was created by Fred Davis (1989) to explain how users accept and use technology.

TAM is based on the Theory of Reasoned Action, which suggests that people's behavior is driven by their intentions, which are shaped by their attitudes and social influences. TAM focuses on two main factors that influence user acceptance: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU).

A. Core Constructs of TAM

i. **Perceived Usefulness (PU):** This refers to how much a user believes that using a system will help them perform their job better or work more efficiently. In the case of biometric attendance, students and staff may find the system useful if it makes recording attendance easier, stops impersonation, and keeps records accurate (Davis, 1989).

ii. **Perceived Ease of Use (PEOU):** This is about how easy users think it is to use the system. If the fingerprint system works smoothly and doesn't require much training, users are more likely to accept it and use it regularly.

iii. **Attitude Toward Use (ATU):** This is the general feeling a person has about using the system, whether positive or negative. A positive attitude makes it more likely that the person will use the system.

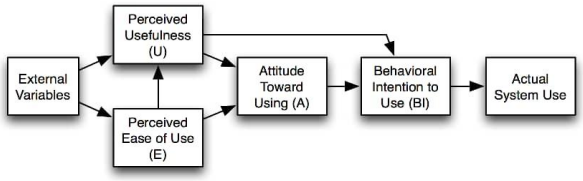
iv. **Behavioral Intention to Use (BI):** This shows how strong a person's intention is to use the system. This intention directly affects how often the system is actually used. Behavioral intention is influenced by perceived usefulness and attitude toward use.

v. **Actual System Use:** This is the real use of the system, which is determined by behavioral intention and other external factors.

B. TAM Structure and Causal Relationships

TAM suggests that how easy a person thinks something is to use (PEOU) affects how useful they think it is (PU). This then affects their attitude toward using it (ATU) and their intention to use it (BI), which together determine if they actually use it (Venkatesh & Davis, 2000).

Other factors like how the system is designed, how much training the user gets, and the environment can also affect how useful someone thinks something is (PU) and how easy they think it is to use (PEOU).



C. Importance of TAM in Biometric Attendance Systems

TAM is important for this study because it shows how people's views on a system's usefulness and how easy it is to use affect whether they accept biometric technologies. For example, students at UNIBEN are more likely to accept fingerprint attendance systems if they think the system is reliable, simple to use, and helps reduce attendance problems.

Studies support this idea: perceived usefulness is the strongest factor in deciding whether people use technology, whether it's biometric or related to online learning (Kumar & Ramesh, 2020).

TAM is simple and accurate in predicting how people accept new technology, especially before it is implemented.

2.6.2 THE UNIFIED THEORY OF ACCEPTANCE AND USE OF TECHNOLOGY (UTAUT)

While TAM is good at explaining how individuals adopt technology, it doesn't take into account the influence of social or organizational factors that can affect how people use a system.

To fix this, Venkatesh et al. (2003) created the Unified Theory of Acceptance and Use of Technology (UTAUT). This model combines ideas from eight earlier theories, including TAM, the Theory of Planned Behavior (TPB), and the Innovation Diffusion Theory (IDT), among others.

MAIN FACTORS IN UTAUT

UTAUT points out four main factors that influence whether users accept and use a system:

i. **Performance Expectancy (PE):** This is how much someone believes using the system will help them do their work better. In attendance situations, people use biometric systems when they think the system makes things more efficient and accurate (Venkatesh et al., 2003).

ii. **Effort Expectancy (EE):** This refers to how easy it is to use the system.A system that is simple and easy to use makes people more positive and more likely to continue using it.

iii. **Social Influence (SI):** This is how much people think important people like lecturers, administrators, or other students believe they should use the new system.In schools, support from authority figures and classmates can greatly affect how quickly a system is adopted.

iv. **Facilitating Conditions (FC):** This is how much people think there are enough resources and support for the system to work. This includes things like electricity, internet, technical help, and school policies that support the system.

INFLUENCING FACTORS:

UTAUT also includes four factors that affect how strong the link is between the main factors and a person's intention to use the system:

i. **Gender**: Men and women might have different views on how useful or easy a system is.
ii. **Age**: Younger people might be more ready to use new technology.
iii. **Experience**: Knowing how similar systems work makes it easier for people to accept them.

iv. **Voluntariness of Use**: People are less likely to use a system if it's forced on them, unless they clearly see the benefits (Venkatesh et al., 2003).

RELATIONSHIP BETWEEN CONSTRUCTS

The UTAUT model says that Performance Expectancy, Effort Expectancy, and Social Influence all directly affect someone's intention to use a system. At the same time, Facilitating Conditions influence whether someone actually uses the system. This model helps explain the many factors that affect how people adopt technology in organizations.

2.6.4 APPLICATION OF THEORETICAL FRAMEWORKS TO THE PRESENT STUDY.

This research employs elements from both the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) to evaluate user acceptance of biometric fingerprint attendance systems. In particular, The study investigates Perceived Usefulness and Ease of Use (derived from TAM) to gauge users' functional perspectives regarding the system.

Additionally, it incorporates Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions (from UTAUT) to consider organizational and contextual elements. By synthesizing these two models, this research provides a holistic understanding of acceptance behavior, harmonizing individual perceptions with situational and infrastructural factors. Such an integrative approach is vital for a pre-implementation analysis at the University of Benin (UNIBEN), where both technological preparedness and user attitudes will influence the effective adoption of the system.

2.7 EMPIRICAL REVIEW

The existing empirical literature offers significant insights into the application, perception, and acceptance of biometric technologies, specifically fingerprint attendance systems, within various educational and organizational settings. Analyzing studies from global, regional, and Nigerian perspectives allows for the identification of common trends, factors influencing acceptance, technological outcomes, and contextual variances that impact successful adoption. This section amalgamates findings from diverse empirical research, providing a holistic understanding of how biometric fingerprint attendance systems have affected institutional processes, data integrity, and user interactions.

GLOBAL EMPIRICAL STUDIES

The implementation of biometric systems in educational settings has surged across different regions worldwide. Research conducted in Asia, Europe, and Africa indicates that although

technical success is frequently achieved, user acceptance and infrastructural support remain essential for long-term viability.

Ahmed et al. (2020) explored the adoption of fingerprint-based attendance systems in Malaysian universities, revealing a notable decrease in impersonation and a reduction in class time lost to roll calls. Faculty and students expressed high levels of satisfaction attributed to the speed and accuracy of the verification process. Nonetheless, challenges such as intermittent sensor malfunctions and limited user awareness were recognized as minor obstacles to consistent usage. The authors concluded that fostering user training and institutional backing was critical for upholding high acceptance rates.

In a similar investigation, Kaur and Sandhu (2020) focused on the deployment of biometrics in Indian higher education institutions, particularly examining the relationship between perceived usefulness and trust. Their findings suggested that acceptance was positively correlated with ease of use and perceived reliability of the system. While students valued the unbiased nature of biometric attendance systems compared to manual signing, they raised concerns over data privacy and the ethical management of biometric information. The authors underscored the necessity for robust data protection policies that align with institutional IT governance frameworks.

A study conducted by Rukhiran et al. (2023) in Sweden assessed the uptake of multi-biometric attendance systems (utilizing both fingerprint and facial recognition). The results indicated a 98% accuracy in attendance monitoring; however, some users exhibited resistance due to concerns about surveillance and privacy. The study highlighted that transparent communication regarding data storage and limitations on data usage played a significant role in enhancing user acceptance, aligning with theoretical models centered around trust in technology adoption.

In South Africa, Abdulhamid et al. (2022) examined biometric attendance systems across four technical universities. Their findings illustrated notable improvements in punctuality and accountability, although challenges stemming from inadequate maintenance, unreliable power supply, and insufficient training persisted. Despite these hurdles, participants largely endorsed the use of biometric systems as a necessary advancement in university administration.

Overall, the global studies assert that biometric systems contribute measurable benefits in efficiency, transparency, and data accuracy; however, their enduring success is heavily reliant on user trust, infrastructure dependability, and robust governance structures.

REGIONAL AND AFRICAN CONTEXT

The implementation of biometric technologies in education across Africa typically reflects international trends but is significantly influenced by economic, infrastructural, and sociocultural factors.

Olasupo et al. (2022) evaluated the implementation of biometric attendance in Nigerian and Ghanaian universities, identifying shared challenges such as erratic power supply, technical maintenance issues, and insufficient funding. Nevertheless, over 80% of respondents agreed that biometric systems enhanced accountability and accuracy in record-keeping. The study concluded that even partial integration of biometric technologies could significantly bolster administrative reliability, contingent on prioritizing maintenance and user training.

In Kenya, Njoroge and Wekesa (2021) studied the efficacy of biometric attendance on staff punctuality in public institutions, revealing a 40% reduction in tardiness following implementation. However, users expressed dissatisfaction due to frequent system downtimes and a lack of technical support. The authors advocated for the establishment of regular maintenance schedules and the provision of backup manual verification methods to ensure performance continuity.

Similarly, Mwangi et al. (2022) examined the university-wide adoption of fingerprint-based attendance systems in East Africa, contending that trust and user awareness emerged as the primary indicators of behavioral intent to utilize such systems. While perceptions of usefulness remained crucial, privacy and ethical considerations significantly affected overall user satisfaction. The study recommended the integration of biometric technologies with training focused on data protection to optimize adoption outcomes.

In Ghana, Mensah and Boateng (2023) performed a comparative analysis of manual versus biometric attendance tracking in tertiary institutions, discovering significant enhancements in data consistency and timeliness facilitated by biometric systems. Nonetheless, the researchers noted that institutional preparedness, particularly regarding infrastructure and training, remained vital for successful adoption.

Across various African contexts, evidence consistently underscores the importance of perceived reliability, technical support, and infrastructural adequacy as critical factors influencing user acceptance of biometric attendance systems, emphasizing the need for universities to strike a balance between technological innovation and local operational realities.

EMPIRICAL STUDIES IN NIGERIA

Nigeria offers a particularly pertinent context for examining the acceptance of biometric attendance systems due to the growing implementation of digital technologies across sectors.

However, significant barriers persist, primarily related to infrastructural challenges and varying degrees of digital literacy.

Okeke and Igbokwe (2020) scrutinized the introduction of biometric fingerprint systems in private Nigerian universities, finding that users acknowledged the efficiency of these systems in curtailing proxy attendance and enhancing attendance logging. However, technical difficulties such as regular power outages and system delays hindered consistent performance. The authors highlighted that institutional dedication to maintenance and sufficient power backup are crucial for ensuring long-term success.

Enejo and Ibrahim (2021) conducted a mixed-methods investigation of biometric attendance adoption in public polytechnics throughout Northern Nigeria. Their quantitative results revealed a high level of acceptance from students and staff who deemed the systems transparent, objective, and fair. However, qualitative feedback pointed to ongoing worries regarding privacy, potential data misuse, and system failures. Participants called for stronger privacy assurances and continuous orientation initiatives to bolster trust.

Bisong (2024) examined data governance and user trust in the utilization of biometric applications within Nigerian educational establishments. The study discovered that user confidence in institutional data management significantly influenced their willingness to provide biometric information. Users specifically demanded transparency concerning data lifespan, storage, and deletion policies. The study concluded that universities must establish formalized data protection frameworks in alignment with Nigeria's Data Protection Regulation (NDPR) to enhance adoption.

Shitta and Okedokun (2024) analyzed the effect of biometric attendance on student performance monitoring in select Nigerian universities. Their findings indicated improved attendance tracking and a positive correlation with academic performance analysis. Nevertheless, the study also noted disruptions caused by inconsistent network coverage and inadequate funding for maintenance, which occasionally hindered data synchronization. The authors proposed hybrid systems incorporating offline verification modes to ensure reliability amid network failures.

Finally, Oluwafemi et al. (2024) assessed user satisfaction with fingerprint attendance systems across five universities. The results demonstrated that perceived ease of use, system accuracy, and institutional support were the strongest determinants of user acceptance. The study advocated for ongoing training and effective technical support teams as essential measures to significantly enhance user trust and sustain system viability.

In summary, empirical investigations in Nigeria converge on the notion that while biometric attendance systems are technically viable and socially advantageous, their success hinges on

technical robustness, institutional preparedness, and ethical data management practices. These insights underscore the rationale for pre-implementation evaluations, such as the current research at the University of Benin (UNIBEN), where understanding user perceptions is pivotal prior to deployment.

2.7.1 SYNTHESIS OF EMPIRICAL FINDINGS

A comparative analysis of findings from global and Nigerian studies reveals several common insights:

i. **Technical Reliability Enhances Trust:** The efficient functioning of biometric systems significantly augments user confidence and satisfaction. Conversely, technical malfunctions rapidly diminish trust and hinder continued utilization (Rukhiran et al., 2023).

ii. **Perceived Usefulness Drives Acceptance:** Users are inclined to adopt biometric systems when they recognize substantial benefits, such as time savings, enhanced accuracy, and reduced instances of impersonation (Kaur & Sandhu, 2020).

iii. **Privacy and Ethical Concerns Persist**: A considerable number of users remain wary regarding the methods of storage and access to biometric data (Bisong, 2024).

iv. **Institutional Support is Critical:** Effective implementation necessitates ongoing technical support, maintenance, and infrastructural reliability (Abdulhamid et al., 2022).

v. **User Awareness Influences Behavioral Intention:** Orientation and sensitization campaigns enhance users' comprehension and acceptance of biometric technologies (Oluwafemi et al., 2024).

These findings affirm that user acceptance is a complex, multi-dimensional phenomenon shaped not only by technical characteristics but also by institutional and human elements. This understanding corresponds with the theoretical frameworks previously discussed, Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT) highlighting the interplay between perceived usefulness, effort expectancy, social influence, and facilitating conditions.

2.8 FACTORS INFLUENCING USER ACCEPTANCE

The effective integration of biometric fingerprint attendance systems in educational settings is contingent not merely on the technological infrastructure but significantly on user acceptance, the degree to which individuals are prepared to adopt, trust, and routinely utilize the technology.

User acceptance is shaped by an interplay of technical, psychological, social, and institutional factors that influence individual outlooks and behaviors (Davis, 1989; Venkatesh et al., 2003).

Building upon the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), along with empirical insights derived from related biometric research, this section delineates the primary variables influencing user acceptance, including perceived usefulness, perceived ease of use, reliability, trust, privacy and data security, social influence, facilitating conditions, awareness, training, and institutional policies.

i. **Perceived Usefulness:** Perceived usefulness pertains to the extent to which an individual is convinced that utilization of a specific technology will enhance efficiency or performance (Davis, 1989). In the realm of biometric fingerprint attendance systems, users are more likely to embrace the technology when they recognize concrete advantages, such as increased accuracy, deterrence of impersonation, and optimized administrative functions.

   Multiple studies affirm that perceived usefulness serves as a critical motivator for behavioral intention. For example, Kaur and Sandhu (2020) reported that students were more favorable towards biometric systems when they perceived their role in promoting fairness and curtailing attendance fraud. Additionally, Okeke and Igbokwe (2020) noted that staff regarded biometric systems as effective tools for assessing punctuality and accountability.
   For an institution like UNIBEN, effectively communicating these benefits and illustrating how the system augments record accuracy and fairness is crucial for enhancing perceived usefulness and consequently, user acceptance.

ii. **Perceived Ease of Use:** Perceived ease of use, referred to as effort expectancy within the UTAUT framework, assesses how uncomplicated and straightforward users find the operation of the system (Venkatesh et al., 2003). An intuitive system that is easy to navigate fosters adoption, whereas one that is prone to failures or necessitates complicated user interactions hinders engagement.
   Research conducted by Oluwafemi et al. (2024) highlighted a correlation between positive user experiences with user-friendly fingerprint systems and heightened acceptance rates among students. Conversely, frequent verification errors or technical delays lead to user frustration and resistance. Improvement in ease of use can be achieved through clear on-screen instructions, high-performing scanners, and user training that alleviates uncertainty during use.

iii. **Reliability and Technical Robustness:** System reliability indicative of the biometric device's consistent operation without errors or interruptions is essential. A dependable fingerprint system minimizes false rejections, false acceptances, and operational downtimes, which collectively enhance user trust in its reliability (Maltoni et al., 2022).

Empirical studies in Nigerian universities reveal that inconsistent performance and inadequate maintenance are primary reasons for dwindling user trust (Abdulhamid et al., 2022). Hence, ensuring high-quality sensors, reliable network connectivity, and regular maintenance checks is imperative. Reliability reinforces both perceived usefulness and perceived ease of use, thus further promoting overall acceptance.

iv. **Trust, Privacy, and Data Security:** Trust embodies the belief that an institution responsibly safeguards users' biometric data. Given that fingerprint systems collect highly sensitive personal information, apprehensions regarding misuse, surveillance, or data breaches can adversely affect acceptance (El-Abed & Charrier, 2019).According to Bisong (2024), more than 60% of students at Nigerian universities expressed concerns regarding biometric data management, underscoring the importance of clear institutional communication regarding data storage and usage. Compliance with the Nigeria Data Protection Regulation (NDPR, 2019) and international data security norms can help mitigate such concerns.

At UNIBEN, the establishment of transparent privacy policies and ensuring students are informed about data encryption and consent protocols are crucial for cultivating trust and adherence to ethical standards.

v. **Social Influence:** Social influence encapsulates the impact of peers, educators, and administrators on an individual's choice to adopt a technology (Venkatesh et al., 2003). In academic contexts, students are more likely to accept new systems when prompted and encouraged by their lecturers/teachers.

Research by Oluwafemi et al. (2024) demonstrated that endorsements from peers and faculty significantly enhanced acceptance rates of biometric systems in Nigerian higher education institutions. Conversely, negative perceptions from peers or unfavorable user experiences can rapidly discourage broader acceptance. Therefore, universities should implement awareness initiatives, faculty demonstrations, and peer ambassador programs to positively harness social influence.

vi. **Facilitating Conditions:** Facilitating conditions refer to the extent to which users believe that the institutional and technical environment supports the use of the system

(Venkatesh et al., 2003). This encompasses access to functional fingerprint scanners, reliable power supply, and prompt technical support.

Research conducted in Nigeria (Olasupo et al., 2022; Shitta & Okedokun, 2024) indicates that infrastructural instability, notably recurrent power failures and insufficient maintenance, significantly undermines the adoption of such systems. For biometric systems to succeed, robust infrastructure is a prerequisite. To bolster user satisfaction and confidence, UNIBEN's implementation strategy should prioritize stable electricity provision, backup systems, and dedicated support teams.

vii. **Awareness and Training:** Awareness and training are pivotal in ensuring that users comprehend how the biometric system operates, its objectives, and its advantages. Many users exhibit resistance to new technologies, often due to a lack of understanding rather than genuine opposition (Rukhiran et al., 2023).

Orientation sessions, demonstrations, and hands-on training can enhance familiarity and alleviate misconceptions regarding privacy and functionality. Mwangi et al. (2022) reported a 30% improvement in user acceptance following well-structured awareness initiatives in universities throughout East Africa. In the case of UNIBEN, similar campaigns can effectively bridge gaps between perception and actuality, fostering confidence and sustained engagement.

viii. **Institutional Policy and Governance:** Institutional policies establish the ethical and procedural frameworks governing system usage. Policies that address data protection, user consent, and disciplinary protocols shape perceptions of fairness and legitimacy (Bisong, 2024). Institutions that implement transparent governance frameworks are more likely to inspire cooperation and reduce skepticism.

Adherence to legal standards, including the NDPR (2019) and ISO/IEC 19792 guidelines for biometric data, underscores institutional accountability. Consequently, UNIBEN's adoption strategy should encompass clearly articulated policies delineating data access, retention durations, and user rights to promote trust and regulatory compliance.

I

2.9 SUMMARY

The reviewed literature highlights the increasing adoption of biometric fingerprint attendance systems as an innovative solution to the shortcomings associated with manual and semi-automated attendance tracking in educational settings. These systems utilize distinct

physiological traits for user verification, providing a level of accuracy, accountability, and efficiency that conventional methods struggle to deliver.

Nonetheless, their successful adoption involves more than just advanced technology; it necessitates an in-depth comprehension of the human, organizational, and infrastructural factors that affect acceptance and long-term viability.

Internationally, studies substantiate that biometric attendance systems boost transparency and administrative reliability by curtailing impersonation, diminishing time loss, and enhancing data management (Ahmed et al., 2020; Kaur & Sandhu, 2020). However, ongoing issues regarding privacy, ethical handling of data, and system reliability remain prevalent, especially in environments where users lack sufficient information about data governance practices (Rukhiran et al., 2023).

Within the African context, particularly in Nigeria, research identifies the transformative potential of biometric systems within higher education while concurrently revealing several persistent challenges: inadequate infrastructure, erratic power supply, lack of funding, and limited technical expertise (Olasupo et al., 2022; Enejo & Ibrahim, 2021). The preparedness of institutions, encompassing management backing, ICT proficiency, and alignment with national data protection regulations, is critical for successful implementation (Bisong, 2024).

The theoretical frameworks such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT)—offer significant insights for interpreting these findings. Both models postulate that perceived usefulness, user-friendliness, supportive conditions, and trust are the primary factors influencing user acceptance.

In the instance of the University of Benin (UNIBEN), where the biometric attendance system has yet to be fully established, these findings underline the importance of conducting a pre-implementation assessment of user acceptance. By investigating users' awareness, perceptions, and expectations, this research provides empirical data that can inform future implementations, ensuring that technological advancements are in harmony with both user requirements and institutional capabilities.

2.10 RELATED WORKS

Previous research has thoroughly investigated the deployment and user acceptance of biometric attendance systems within a range of institutional and national frameworks. A review of these studies reveals insights into the perception of similar technologies, the determinants impacting their adoption, and the obstacles faced during implementation. Additionally, this review highlights gaps in current understanding, especially regarding user acceptance prior to implementation in Nigerian universities, including the University of Benin (UNIBEN).

In their 2020 study, Ahmed et al. analyzed the adoption of biometric attendance systems in Malaysian universities through the lens of the Technology Acceptance Model (TAM). The research concluded that perceived usefulness, ease of use, and institutional support were the primary factors influencing user acceptance. The results indicated that users were more likely to adopt biometric systems when their advantages were clearly presented and when technical support was readily available.

Rukhiran et al. (2023) investigated the acceptance of biometric identification among students in Thailand. While participants recognized the system's convenience and effectiveness, many raised concerns about data privacy and the potential misuse of biometric data by institutions. The authors highlighted the importance of privacy assurances and transparency in data management as vital components in maintaining user trust, a concern also reflected in the current study.

Mwangi et al. (2022) explored the level of awareness and user acceptance of biometric authentication systems in Kenyan universities. Their findings showed that awareness initiatives and training significantly enhanced users' attitudes toward biometric systems, as those who participated in orientation sessions perceived the system as more trustworthy and advantageous. The research recommended that universities incorporate user training as a prerequisite for widespread deployment.

Abdulhamid et al. (2022) focused on the implementation of biometric systems in Nigerian universities, examining aspects of reliability and maintenance. Their findings indicated that frequent system malfunctions, insufficient power supply, and limited technical assistance greatly diminished user satisfaction. They emphasized that infrastructural preparedness is equally significant as user acceptance in determining the overall success of these systems.

Olasupo et al. (2022) assessed the effectiveness of biometric attendance systems in Nigerian higher education. Their research found that the systems decreased impersonation and improved attendance accuracy. However, users' resistance stemmed from inadequate sensitization and a poor comprehension of the systems' benefits. This emphasizes the critical role of pre-implementation awareness, which is a central focus of the present study at UNIBEN.

Okeke and Igbokwe (2020) examined the perceptions of staff and students regarding biometric systems in Nigeria. Their findings demonstrated a general approval of the technology’s transparency and efficiency, yet concerns persisted about privacy and the potential misuse of data. They advocated for stronger institutional frameworks to protect data, thus fostering user confidence.

In 2024, Bisong studied issues of privacy and trust concerning the adoption of biometric systems in Nigerian universities. The study revealed that users’ readiness to utilize biometric systems

depended largely on how effectively institutions communicated their policies on data protection and retention. Adherence to the Nigeria Data Protection Regulation (NDPR) emerged as a critical factor influencing acceptance.

Shitta and Okedokun (2024) assessed the infrastructural and user-related challenges confronting the deployment of biometric attendance systems in Nigerian tertiary institutions. Their findings highlighted issues such as power instability, inadequate maintenance, and insufficient training as significant barriers to acceptance. They recommended that universities enhance their ICT infrastructure and implement backup systems to ensure consistent service.

Lastly, Oluwafemi et al. (2024) used the Unified Theory of Acceptance and Use of Technology (UTAUT) to investigate the factors influencing biometric system acceptance among students in Nigerian universities. Their results indicated that performance expectancy, effort expectancy, and social influence had a significant effect on the intention to use biometric systems. The study concluded that institutional endorsement and peer influence are instrumental in shaping user adoption behaviors.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

To achieve the objectives of this research titled An Assessment of User Acceptance of Biometric Fingerprint Attendance Systems in Educational Institutions, a systematic methodological approach was designed and implemented, using the University of Benin (UNIBEN) as the case study. The research methodology serves as a roadmap that details the processes, techniques, and instruments employed to collect and analyze data in a structured and credible manner. It ensures that the findings generated are valid, reliable, and aligned with the overall objectives of the study.

The choice of methodology was guided by the nature of the research problem, which seeks to evaluate students' perceptions, awareness, and readiness to accept a biometric fingerprint attendance system that has not yet been implemented in the university. Hence, the study adopts a descriptive and survey-based approach to capture the authentic opinions of participants regarding the potential adoption of this system. Rather than examining an existing technology in operation, the study focuses on pre-implementation assessment understanding how users perceive such innovation, what factors may encourage or hinder their acceptance, and how the university can enhance its readiness for deployment.

Attendance monitoring plays a vital role in academic administration, influencing evaluation, discipline, and institutional efficiency. However, in many Nigerian universities, including UNIBEN, attendance management still relies heavily on manual methods such as roll calls and paper registers. These traditional approaches are time-consuming, prone to manipulation, and often inaccurate. Instances of students signing attendance on behalf of absentees (proxy attendance) are common, and lecturers frequently devote valuable instructional time to verifying attendance records. Such inefficiencies compromise accountability and the credibility of attendance as an academic control measure. Consequently, there is a growing call for digital transformation and the adoption of automated systems that can ensure fairness, speed, and reliability in attendance tracking.

A biometric fingerprint attendance system provides a promising alternative to these challenges. By leveraging unique physiological identifiers, such as fingerprints, it minimizes impersonation, prevents duplication, and promotes transparency in academic record-keeping. Beyond improving administrative efficiency, such systems can also strengthen institutional integrity and foster discipline among students and staff. Nonetheless, the success of any technological intervention depends not only on its technical functionality but also on the willingness of users to embrace it.

Therefore, understanding the attitudes, concerns, and expectations of prospective users is crucial before implementation.

The University of Benin offers an ideal context for such an investigation due to its diverse student population and traditional reliance on manual attendance procedures. Exploring students' readiness, perceived ease of use, and trust in biometric technology will provide valuable insights that can guide policy formulation, infrastructural planning, and sensitization initiatives prior to deployment. Moreover, these findings may serve as a reference for other educational institutions seeking to modernize their attendance systems while ensuring user acceptance and compliance with ethical and privacy standards.

Accordingly, this chapter presents the methodological framework adopted for the study. It describes the research design, target population, sampling strategy, data collection instruments, validation processes, and analytical techniques used to interpret the collected data. It also highlights the ethical considerations that guided the study to ensure integrity, confidentiality, and credibility. The approach taken guarantees that the research outcomes are both methodologically sound and contextually relevant, providing a solid foundation for assessing user acceptance of biometric fingerprint attendance systems within educational environments.

3.2 RESEARCH DESIGN

This study adopted a descriptive survey research design because it provides the best means of collecting first-hand opinions from students at the University of Benin (UNIBEN) about their views on the possible introduction of a biometric fingerprint attendance system. Since the system is not yet in use at the university, a descriptive survey was ideal for understanding how people feel, what they know, and what they expect from it before it is implemented.

The survey approach made it possible to gather data from a relatively large group of students within a short period of time. It allowed participants to freely express their opinions and perceptions about the system's usefulness, ease of use, security, and potential challenges. This design also helped to present a clear picture of students' awareness and readiness, which supports the main aim of this research to assess user acceptance of a biometric attendance system.

Several reasons guided the choice of this design:

i. It encourages honest feedback: Students could freely share their thoughts, experiences, and concerns about the proposed biometric system. Their honest responses helped reveal how ready they are to accept or reject the technology.

ii. It combines numbers and opinions: The questionnaire produced both quantitative data (figures and percentages) and qualitative insights (opinions and suggestions). This made the results more meaningful and realistic.

iii. It is practical for a large institution: UNIBEN has many faculties and departments, and using a survey made it possible to reach a wide range of students quickly through both printed and online questionnaires.

iv. It aligns with the research objectives: Since the study focuses on awareness, ease of use, trust, and privacy issues, a survey was appropriate for collecting data on all these aspects effectively.

Using this design, the study provided clear insights into what might support or hinder the successful introduction of a biometric fingerprint attendance system at UNIBEN. The results are expected to help the university plan better by improving infrastructure, organizing user training, and creating supportive policies that will make future adoption smoother and more acceptable to students and lecturers.

3.3 POPULATION OF THE STUDY

The population for this study consists of students and academic staff of the University of Benin (UNIBEN). The university has an estimated student population of about 77,000, covering both undergraduate and postgraduate students across different faculties, including Science, Engineering, Management, Arts, and Social Sciences. Since the biometric fingerprint attendance system has not yet been implemented at UNIBEN, the population represents potential users whose perceptions and readiness are vital for understanding how well the system might be accepted in the future.

The population was chosen because these groups which are students and lecturers are the direct users of any attendance system in the university. Students are the primary participants who are usually required to verify their presence during lectures, while lecturers and instructors are responsible for managing attendance records. Therefore, gathering opinions from both groups was essential for achieving the aim of the study.

To get a balanced view, the study included students from different levels of study and faculties, as well as lecturers who have firsthand experience managing attendance manually. The inclusion of these categories provided a broad and realistic understanding of how the biometric fingerprint system would function in the university environment, especially in terms of user trust, ease of use, and perceived benefits.

The population was relevant for several reasons:

i. **Direct relevance to the study**: Since attendance systems directly affect both teaching and learning activities, selecting these groups provided accurate and practical insights.

ii. **Diverse opinions:** The wide range of students and lecturers offered different perspectives based on their experiences, helping the study to represent the entire university community.

iii. **Future impact**: These respondents are the same individuals who will eventually use the biometric system when it is introduced, making their opinions and readiness crucial for planning and acceptance.

In summary, the population for this study included students and academic staff from selected faculties in UNIBEN. Their contributions provided valuable data on how users perceive the proposed biometric fingerprint attendance system, revealing their awareness, expectations, and willingness to embrace the technology once it is introduced.

3.4 SAMPLE SIZE AND SAMPLING TECHNIQUE

The study's demographic comprised students from various faculties, departments, and educational levels at the University of Benin (UNIBEN), which has a large and heterogeneous student body. Attempting to involve every student in the research would have been infeasible given the time and resource constraints.

Consequently, a sample was selected to adequately represent the overall student population. This methodology facilitated the study's feasibility while still providing valuable insights into the potential reactions of students to a biometric fingerprint attendance system that has yet to be implemented at UNIBEN.

The sample size for this research consisted of 85 students, determined by the number of responses received rather than a predetermined formula, as participation was voluntary and contingent on students' availability and willingness to complete the questionnaire. Distribution included both personal outreach to peers and online platforms such as WhatsApp and email, along with printed questionnaires administered in person. Respondents were allowed to complete the questionnaire at their convenience, reducing pressure and enabling thoughtful, candid responses. Although the biometric fingerprint attendance system remains unutilized at UNIBEN, students were able to articulate their opinions and expectations based on their experiences with existing attendance methods, such as manual records or other electronic systems present in various faculties.

The sampling technique employed in this study was convenience sampling, a non-probability method where participants were selected based on their availability and willingness rather than through random selection. I approached easily accessible students willing to participate, ensuring that involvement was voluntary with no coercion to complete the questionnaires. This method was adopted due to its practical nature, considering the lack of access to a comprehensive student roster and the constraints of time and resources in this research context.

Data collection necessitated a practical approach. I ensured the questionnaire was straightforward, clear, and relevant to students' perceptions regarding a biometric fingerprint attendance system. I shared the questionnaire personally with respondents, clearly explaining the research's purpose and emphasizing the significance of their honest feedback. After distributing the survey, I followed up with individual reminders and clarified any potentially unclear points. Upon completion, I meticulously examined each questionnaire for missing responses or inaccuracies to confirm the data's integrity before analysis.

Throughout the data collection process, several challenges arose. One significant hurdle was students' schedules, filled with lectures and assignments, which delayed their responses. To address this, I offered flexible deadlines and sent courteous reminders without pressure. Furthermore, I reassured participants of the anonymity and exclusive research use of their responses, which fostered increased participation.

Another challenge entailed ensuring the sample represented students across different faculties and levels of study. As the questionnaire was primarily shared with accessible individuals, bias toward a particular faculty or academic year was a concern. To mitigate this, I consciously sought responses from a variety of disciplines and educational tiers, thus enriching the dataset and assuring a broad spectrum of perspectives.

While convenience sampling may not afford equal participation chances for all students, it was pragmatically the most effective approach for this study. Alternative sampling methods such as simple random sampling, stratified sampling, and cluster sampling were considered but discarded as impractical under the present circumstances. Random sampling, for instance, necessitated a complete student list and formal approvals, both unattainable. Stratified sampling would have required grouping by faculty or academic level, demanding coordination and time beyond available resources. Cluster sampling necessitated selection of entire classes or departments, similarly requiring formal administrative consent. Given the constraints on time, resources, and access, convenience sampling was the most feasible option, enabling the collection of sufficient relevant data efficiently while yielding meaningful insights.

The 85-student sample size sufficed for this study, generating valuable information on students' common attitudes, patterns, and acceptance of the biometric fingerprint attendance system. While a larger sample size might enhance precision, the objective was primarily exploratory, involving students' sentiments, readiness to adopt the system, anticipated challenges, and expected benefits. The diverse representation among the 85 respondents ensured the findings remained balanced, meaningful, and reliable for the purpose of this study.

From a student perspective, this approach was relatable; being a UNIBEN student myself afforded me firsthand experience with conventional attendance methods. Reaching out to fellow students felt natural, as we shared common challenges with attendance management. Though the biometric fingerprint system remains unimplemented, many could contemplate its functionality and its potential to address existing grievances. Some discussions surfaced concerns about fingerprint inaccuracies or technical issues, while others highlighted positive aspects such as reducing impersonation, improving efficiency, and streamlining attendance processes. This diversity in viewpoints enriched the responses and added practical depth to the research.

In terms of ethics, I ensured that participation was entirely voluntary and that respondents comprehended the research context. Participants were assured of anonymity, as names were not required on the questionnaire, fostering a comfortable environment conducive to honest feedback. Since the system remains nascent, the study focused on collecting students' opinions and anticipations rather than evaluating the operational system. This approach ensured ethical standards and relevance for future implementation scenarios.

In conclusion, the sampling method and size employed in this study were both pragmatic and effective. The use of convenience sampling facilitated access to willing respondents rapidly, while the sample size of 85 effectively captured various opinions, challenges, and acceptance levels regarding the biometric fingerprint attendance system. My dedicated efforts the personal distribution of the questionnaire, addressing student queries, and ensuring comprehensive responses enhanced data quality, accurately reflecting real student experiences and challenges while upholding ethical norms. The resultant findings offer meaningful insights that may assist the university in anticipating student responses should a biometric fingerprint attendance system be implemented.

3.5 RESEARCH INSTRUMENTATION

The main tool used for this study was a structured questionnaire. This instrument was chosen because it is one of the most effective and convenient ways to collect information from a large number of people within a short period. Since the goal of this research was to understand students' perceptions, awareness, and willingness to accept a biometric fingerprint attendance

system, a questionnaire was ideal for capturing both factual data and personal opinions directly from the target respondents.

The questionnaire was carefully designed to be simple, clear, and easy to understand. This was important because respondents came from different academic backgrounds, and the questions needed to be accessible to everyone. The questionnaire included both closed-ended questions (which required respondents to choose from given options) and open-ended questions (which allowed them to express their thoughts freely).

The structure of the questionnaire reflected the main objectives of the study. The questions were grouped into sections that addressed key aspects such as respondents' demographic information, awareness of biometric systems, perceived ease of use, security and privacy concerns, and overall acceptance of the technology.

The questionnaire provided several advantages for this research:

i. It ensured consistency. Every participant answered the same set of questions, which made comparison and analysis easy.
ii. It was time-efficient. Large numbers of students could participate within a short period.
iii. It encouraged honesty. Respondents could complete the questionnaire privately, which made them more comfortable providing genuine answers.
iv. It supported both physical and digital responses, printed copies were distributed on campus, while Google Forms were shared online for wider participation.

The data collected through this instrument helped the researcher to measure how aware students were of biometric systems, how easy they thought it would be to use, and whether they trusted the technology enough to support its implementation. It also captured their personal concerns about data privacy, system reliability, and institutional readiness.

Overall, the questionnaire served as an effective tool for gathering detailed and reliable data directly from students at the University of Benin (UNIBEN). It made it possible to explore multiple aspects of user acceptance in a structured, measurable, and easy way to analyze.

3.5.1 QUESTIONNAIRE DESIGN

The questionnaire used in this study was carefully structured to collect accurate and relevant information about students' opinions, awareness, and readiness to adopt a biometric fingerprint attendance system at the University of Benin (UNIBEN). Each question was clearly written to avoid confusion and to ensure that respondents could easily understand what was being asked.

The questionnaire was divided into five main sections, each designed to gather information on specific aspects related to the study objectives:

SECTION A: DEMOGRAPHIC INFORMATION

This section gathered background information about the respondents, such as gender, age range, faculty, and academic level. These details helped in understanding the diversity of the participants and how different demographic factors might influence their attitudes toward the proposed biometric system.

SECTION B: AWARENESS AND KNOWLEDGE OF BIOMETRIC ATTENDANCE SYSTEMS

This part focused on measuring students' awareness and familiarity with biometric technologies. It included questions about whether they had heard of or used such systems before, their understanding of how the system works, and whether they believed it already existed in their institution.

SECTION C: EASE OF USE AND USER EXPERIENCE

This section explored students' opinions on how easy or difficult they thought it would be to use a biometric fingerprint attendance system. It examined whether students believed the system would make attendance marking faster, more convenient, and more reliable compared to traditional manual methods.

SECTION D: SECURITY, PRIVACY, AND TRUST

This section addressed students' concerns about the safety of their biometric data. Questions in this part assessed how much they trusted the university to handle and protect their fingerprint information, and whether they were worried about possible misuse or data breaches.

SECTION E: OVERALL ACCEPTANCE AND RECOMMENDATION

The final section measured students' general acceptance of the system. It asked whether they supported the idea of adopting the biometric fingerprint attendance system across faculties, their satisfaction with its perceived performance, and whether they would recommend its continuous use if implemented. It also included an open-ended question where respondents could give additional comments or suggestions about the proposed system.

Each question in Sections B to E was designed using a five-point Likert scale, ranging from Strongly Agree (5) to Strongly Disagree (1). This format allowed for easy measurement of agreement levels and made it possible to analyze responses statistically. Section A included

multiple-choice questions, while the final open-ended question gave respondents the freedom to express personal opinions that could not be captured through fixed responses.

The questionnaire was first drafted and reviewed for clarity before distribution. Feedback from peers and my supervisor was incorporated to ensure the language was simple, objective, and aligned with the study's aims. It was then administered both physically (printed copies) and digitally (via Google Forms), allowing more students to participate easily.

In summary, the questionnaire was a well-structured, practical, and reliable data collection tool that covered every aspect relevant to user acceptance of biometric fingerprint attendance systems. Its design made it suitable for capturing both quantitative data for analysis and qualitative insights for deeper understanding.

3.6 VALIDITY AND RELIABILITY OF INSTRUMENTS

To ensure that the questionnaire used in this study truly measured what it was intended to measure, careful attention was given to both its validity and reliability. Validity refers to how well the questions reflect the research objectives, while reliability refers to how consistent the instrument would be if used repeatedly under similar conditions.

VALIDITY

The content of the questionnaire was designed based on the study's objectives, previous research on biometric systems, and established models such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT). Each question was developed to align with key concepts such as awareness, perceived ease of use, trust, privacy, and overall acceptance of biometric attendance systems.

To improve content validity, the questionnaire was reviewed by my project supervisor and peers, who provided constructive feedback on question clarity and relevance. Their suggestions led to the removal of ambiguous items and the rephrasing of certain questions to make them more straightforward. The goal was to ensure that all items accurately represented what the study intended to explore students' perceptions and willingness to adopt a biometric fingerprint attendance system at UNIBEN.

Additionally, the wording of the questions was kept simple and direct to avoid misunderstanding or misinterpretation. Each section was carefully organized to follow a logical flow, starting from general awareness to specific issues such as ease of use, privacy, and trust. This structure made it easier for respondents to stay engaged and provide thoughtful answers.

RELIABILITY

Although formal statistical reliability tests such as Cronbach's Alpha were not carried out, several steps were taken to ensure the questionnaire was reliable. Every respondent received the same set of questions in the same order and format, whether online or in print. The use of a five-point Likert scale (ranging from Strongly Agree to Strongly Disagree) provided consistent options for responses and allowed for easy comparison across participants.

Furthermore, a pilot review of the questionnaire was conducted informally with a small group of students to confirm that the questions were clear and understandable. Feedback from this pilot helped to identify minor issues, such as the need to simplify certain terms and adjust question sequencing for smoother flow. The revised questionnaire was then finalized and used for the main data collection.

Consistency was also maintained throughout the data collection process. All instructions remained uniform, the same explanation of the research purpose was given to every participant, and similar procedures were followed for both online and paper-based responses. These steps helped to maintain accuracy and reliability across all collected data.

In summary, the questionnaire was developed and refined with great care to ensure both validity and reliability. It accurately reflected the study's focus, provided clear and unbiased questions, and maintained consistency in structure and administration. These measures contributed to gathering dependable data that truly represent students' perceptions and attitudes toward the proposed biometric fingerprint attendance system at UNIBEN.

3.7 DATA COLLECTION PROCEDURE

Data collection for this study was carried out using a structured questionnaire distributed among students of the University of Benin (UNIBEN). Since the biometric fingerprint attendance system has not yet been implemented at the university, the study focused on assessing students' awareness, perception, and readiness toward its possible adoption in the future.

Before beginning data collection, I obtained approval and guidance from my project supervisor to ensure that the process complied with academic and ethical standards. The purpose of the study was clearly explained to all participants. They were informed that their responses would be used solely for academic purposes, participation was voluntary, and their identities would remain anonymous. This transparency encouraged honesty and made participants more comfortable sharing their views.

To ensure wider coverage, I adopted a dual approach for data collection by using both physical distribution and online administration:

PHYSICAL DISTRIBUTION:

Printed copies of the questionnaire were hand-delivered to students on campus, particularly within the Faculty of Science, Engineering, Education, and Management Sciences. I personally approached students before or after lectures to explain the purpose of the research and invite their participation. Those who agreed filled out the questionnaire on the spot or returned it later within the same week.

ONLINE DISTRIBUTION:

A digital version of the questionnaire was created using Google Forms to reach students who were not physically available or who preferred responding electronically. The online link was shared through class WhatsApp groups, Telegram channels, and emails. This approach made participation more flexible and helped to gather responses quickly from students in different faculties and levels.

Through these combined methods, a total of 85 valid responses were obtained from students across various faculties and academic levels. Efforts were made to ensure that the participants represented a mix of departments and study levels from 100 to 500 levels and postgraduate students in order to capture diverse opinions.

After collecting the responses, I carefully reviewed each completed questionnaire to ensure that all necessary questions were answered and that there were no inconsistencies or missing data. The verified responses were then compiled and entered into Microsoft Excel for organization and initial coding. The data were later imported into the Statistical Package for the Social Sciences (SPSS) for proper statistical analysis, including computation of frequencies, percentages, and graphical summaries.

During the data collection process, I faced some practical challenges. Many students were initially reluctant to respond, mainly due to their tight academic schedules or a lack of familiarity with biometric systems. To address this, I provided short explanations on how biometric attendance systems work and emphasized that their honest opinions would contribute meaningfully to improving attendance systems in the university. This reassurance increased participation.

Another challenge was ensuring balanced representation across faculties. To minimize bias, I intentionally shared the questionnaire in multiple faculties and online platforms that cut across different student groups. This ensured a fair representation of perspectives from various academic disciplines.

Overall, the data collection process was carried out smoothly, ethically, and systematically. The combined use of physical and online methods helped achieve an adequate number of responses

within the available timeframe. The approach provided reliable data that accurately reflected students' perceptions, awareness, and attitudes toward the possible implementation of a biometric fingerprint attendance system at the University of Benin.

3.8 METHOD OF DATA ANALYSIS

After all the completed questionnaires and responses were collected, the responses were carefully examined to ensure that each was complete, clear, and usable for analysis. Incomplete or ambiguous responses were excluded to maintain the accuracy and quality of the data. The data obtained were primarily quantitative, as most of the questions used a five-point Likert scale, allowing for easy measurement of students' levels of agreement or disagreement with different statements.

The analysis process involved several stages to ensure that the findings were meaningful and accurately represented the respondents' views.

First, all responses were coded to convert qualitative choices into numerical values that could be analyzed statistically. For instance, "Strongly Agree" was coded as 5, "Agree" as 4, "Neutral" as 3, "Disagree" as 2, and "Strongly Disagree" as 1. This coding system made it possible to calculate averages and identify trends in opinions across all sections of the questionnaire.

Once the coding was complete, the data were entered into Microsoft Excel for initial organization and verification. This helped to detect any possible errors or missing entries before conducting the final analysis. After this step, the cleaned dataset was imported into the Statistical Package for the Social Sciences (SPSS) Version 25, which was used for detailed statistical analysis. SPSS was chosen because it offers accurate statistical computation and produces results in clear tabular and graphical formats, suitable for interpretation and presentation in research reports.

3.8.1 DESCRIPTIVE ANALYSIS

Since the aim of this study was to assess students' awareness, perception, and acceptance of a proposed biometric fingerprint attendance system, the analysis relied mainly on descriptive statistics. Descriptive analysis summarizes the characteristics of the data in a simple and understandable way, showing how respondents answered each question and revealing overall patterns or trends.

The following descriptive tools were used:

i. **Frequencies and Percentages**: To show how often particular responses occurred, especially in the demographic section (e.g., gender, age, and faculty).

ii. **Means and Standard Deviations**: To determine the general tendency of responses and how varied they were across participants.
iii. **Tables and Charts**: To visually represent findings and make interpretation easier and more engaging.

Each section of the questionnaire (Sections A–E) was analyzed separately.

Section A focused on demographic data, presented in tables and charts showing distributions of gender, age, level of study, and faculty.

Sections B through E examined key variables such as awareness, ease of use, security and privacy, and overall acceptance of biometric attendance systems.

The results were expressed using percentages and mean values, providing a clear picture of how students perceived different aspects of biometric systems. Charts (such as bar charts and pie charts) were used to visually display the proportions of responses for better understanding.

3.8.2 QUALITATIVE ANALYSIS

Although the study primarily used quantitative data, one open-ended question at the end of the questionnaire allowed respondents to provide additional comments or suggestions about biometric attendance systems. These responses were analyzed qualitatively using thematic analysis which is a method that identifies and categorizes common themes or ideas within open-ended answers.

Through this approach, several recurring themes were identified. For example:

Some students expressed enthusiasm about the introduction of biometric systems, emphasizing benefits such as accuracy, speed, and fairness.

Others raised concerns about possible issues like system malfunctions, poor maintenance, or data privacy risks.

A few respondents also suggested the need for proper orientation and technical support to ensure successful implementation.

Combining both quantitative and qualitative analyses made the study more comprehensive. The statistical data helped to measure general trends, while the qualitative comments provided deeper insights into why students held certain opinions. This balanced analytical approach ensured that the findings reflected not only numerical results but also the real attitudes and experiences of the students.

In summary, the data were analyzed systematically using both descriptive and thematic techniques to provide a full understanding of students' awareness, perceptions, and acceptance of biometric fingerprint attendance systems at UNIBEN.

3.9 ETHICAL CONSIDERATIONS

Every academic research that involves human participants must be guided by strict ethical standards to protect participants' rights, privacy, and well-being. This study was conducted in full compliance with ethical principles such as informed consent, confidentiality, voluntary participation, and honesty throughout the research process.

Because the research involved students of the University of Benin (UNIBEN), special care was taken to ensure that the data collection process was transparent, respectful, and free of coercion.

INFORMED CONSENT

Before respondents filled out the questionnaire, the purpose of the study was clearly explained to them. They were informed that the research aimed to assess students' awareness and acceptance of a proposed biometric fingerprint attendance system, and that their responses would be used purely for academic purposes. Each participant had the freedom to decide whether to take part or not, and participation was entirely voluntary. They were also informed that they could withdraw from the study at any point without facing any consequences.

CONFIDENTIALITY AND ANONYMITY

The confidentiality of participants' information was strictly maintained. No identifying details such as names, registration numbers, or contact information were requested in the questionnaire. Responses were collected anonymously to ensure that individual identities could not be traced back to their data. All information obtained was stored securely and was accessible only to the researcher. This approach encouraged honest responses and maintained participants' trust throughout the process.

VOLUNTARY PARTICIPATION AND NON-COERCION

Participation in the study was completely voluntary. Students were approached politely, and no one was pressured to take part. The researcher explained that there were no rewards or penalties associated with participation. This created an open and respectful atmosphere that encouraged genuine contributions from those who chose to respond.

TRANSPARENCY AND INTEGRITY

Honesty and transparency were maintained at every stage of the study. Respondents were clearly informed about how the information would be used and assured that their opinions would contribute to improving attendance management systems in the university. All collected data were reported truthfully, and no manipulation or misrepresentation of results occurred during analysis or presentation.

ETHICAL APPROVAL

Before beginning data collection, the researcher sought guidance and approval from the project supervisor and complied with the university's ethical guidelines for conducting student research. This step ensured that all research activities were performed responsibly and aligned with UNIBEN's academic standards.

In summary, the research was carried out with utmost respect for participants' rights and privacy. Ethical principles of consent, confidentiality, voluntariness, and transparency were strictly observed from the design of the questionnaire to the analysis of data. These practices not only protected the participants but also enhanced the credibility, reliability, and integrity of the entire research process.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.1 INTRODUCTION

The data analysis presented in this chapter is based on the responses obtained from the administered questionnaire designed to evaluate students' awareness, perception, and acceptance of biometric fingerprint attendance systems at the University of Benin (UNIBEN). A total of eighty-five (85) valid responses were collected and analyzed using descriptive statistical tools such as frequencies and percentages.

The analysis follows the structure of the questionnaire, which consisted of five key sections: demographic information (Section A), awareness and knowledge (Section B), ease of use and user experience (Section C), security, privacy and trust (Section D), and overall acceptance and recommendation (Section E). Each section is presented in tabular form with a corresponding chart type and supported by a detailed discussion that interprets the data in relation to the research objectives.

By analyzing the responses in this manner, the study aims to provide an in-depth understanding of students' readiness to adopt biometric fingerprint systems as an alternative to the manual attendance process currently in use. The interpretation of the results gives meaningful insight into students' levels of technological exposure, perceived usefulness of the system, challenges identified, and their overall acceptance of the biometric approach to attendance monitoring.

4.2 DEMOGRAPHIC INFORMATION OF RESPONDENTS (SECTION A)

Understanding the demographic composition of respondents is essential in interpreting their responses within the appropriate social and academic context. The background information gathered from students of the University of Benin (UNIBEN) provides insights into how gender, age, faculty affiliation, level of study, and previous exposure to biometric systems influence awareness and acceptance of biometric fingerprint attendance systems.

The demographic data presented in this section were analyzed using frequencies and percentages and illustrated with pie charts for better visualization. Each demographic variable is discussed below.

Table 4.1: Gender distribution of Respondents

GENDER	FREQUENCY	PERCENTAGE (%)
Male	40	47.1

Female	44	51.8
Prefer not to say	1	1.1
Total	85	100

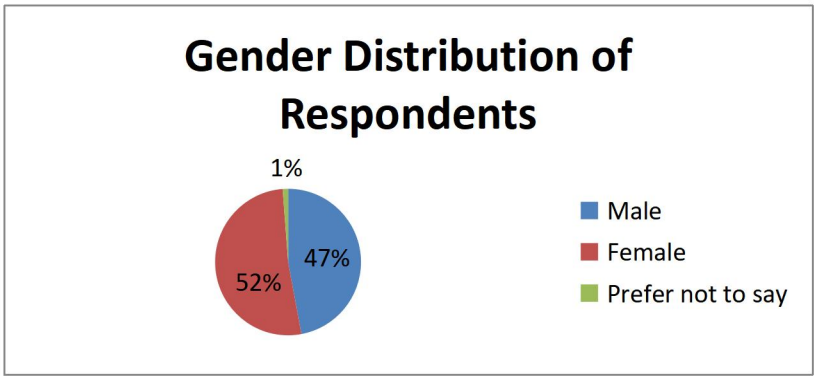


Fig 4.1: Gender distribution of Respondents

ANALYSIS AND DISCUSSION

Among the eighty-five (85) students who participated in the survey, forty-four (44), representing 51.8%, were female, while forty (40), representing 47.1%, were male. Only one respondent (1.2%) chose not to indicate their gender. This distribution reflects a nearly equal participation between male and female students, with females slightly outnumbering males.

The almost equal balance in gender representation strengthens the credibility of the research findings, as both viewpoints are adequately captured. It also indicates that perceptions of biometric attendance systems are not limited to a specific gender group. Moreover, the results suggest that, within the University of Benin, acceptance of digital attendance technology appears to cut across gender lines, implying that both male and female students show comparable openness toward adopting biometric systems in academic environments.

4.2.2 AGE DISTRIBUTION OF RESPONDENTS

Table 4.2: Age distribution of respondents

AGE RANGE	FREQUENCY	PERCENTAGE (%)
Below 18	7	8.2

18–25	71	83.5
26–30	6	7.1
31 years & above	1	1.2
Total	85	100

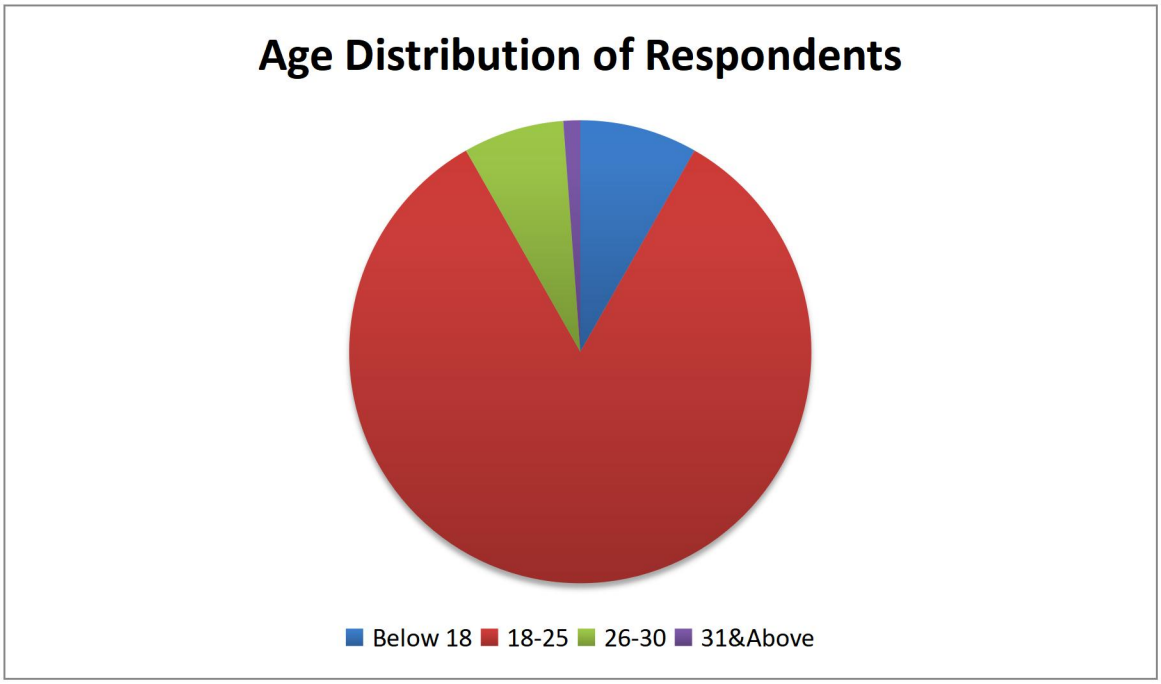


Fig 4.2: Age distribution of respondents

ANALYSIS AND DISCUSSION:

From the survey results, a larger proportion of participants (83.5%) were within the 18–25-year age bracket, while 7.1% fell between 26 and 30 years. Only one respondent (1.2%) was above 30 years of age. This pattern reflects the age profile typically found among undergraduate students in Nigerian higher-education institutions.

The predominance of young respondents is notable because younger students tend to be more exposed to technology, more adaptable to change, and more willing to experiment with innovative systems such as biometric attendance solutions. The predominance of this age group therefore implies a higher probability of positive response and seamless adoption of biometric technology, since most participants belong to a generation already accustomed to digital tools for everyday use including mobile devices, online banking, and virtual learning platforms.

The small share of respondents aged above 25 years may point to limited postgraduate representation or lesser engagement of older students in web-based surveys. Nevertheless, the dominance of younger participants ensures that the findings accurately capture the perceptions of the demographic most directly involved with institutional attendance monitoring systems.

4.2.3 FACULTY DISTRIBUTION OF RESPONDENTS

Table 4.3: Faculty of respondents

FACULTY	FREQUENCY	PERCENTAGE (%)
Science	62	73.2
Social science	5	5.9
Education	7	8.4
Engineering	6	7.2
Others	5	5.3
Total	85	100

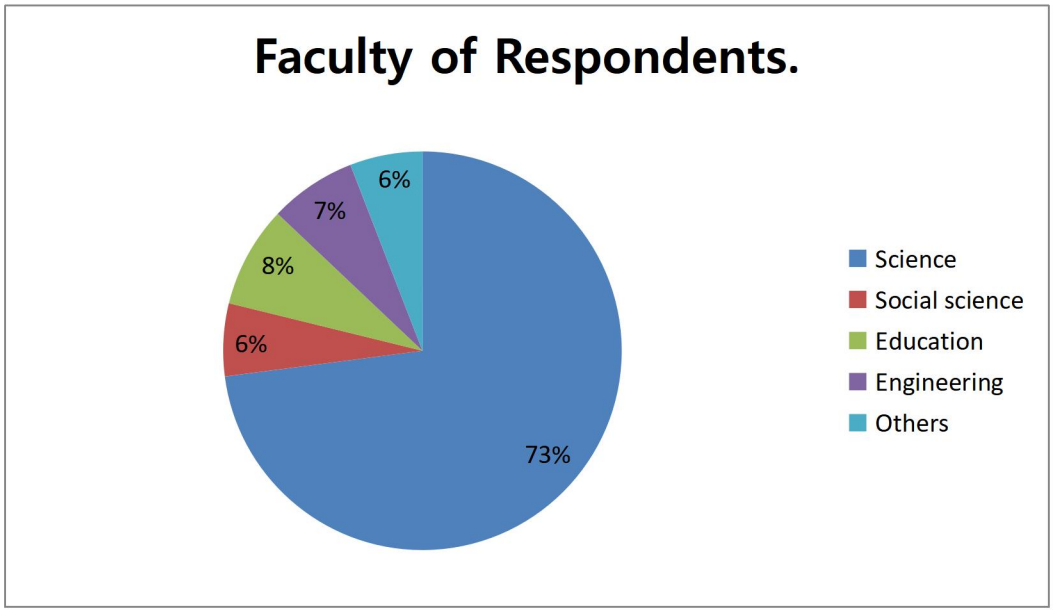


Fig 4.3: Faculty of Respondents

ANALYSIS AND DISCUSSION

The result shows that most of the respondents (73.2%) were from the Faculty of Science, followed by Education (8.4%), Engineering (7.2%), Social Sciences (5.9%), and Others (5.3%). This means that science students made up the largest group in the study.

The high number of science students may be because they are more familiar with technology and often use digital tools in their courses. This makes them more aware of how biometric systems work and how such systems can help improve attendance tracking.

Even though science students were the majority, students from other faculties also took part in the study. Their inclusion helps to make the findings more balanced and shows different opinions from across the university.

4.2.4 LEVEL OF STUDY OF RESPONDENTS

Table 4.4: Level of Study of respondents

LEVEL OF STUDY	FREQUENCY	PERCENTAGE (%)
100Level	8	9.4
200Level	10	11.8
300Level	12	14.1
400Level	33	38.8
500Level	8	9.4
Postgraduate	14	16.5
Total	85	100

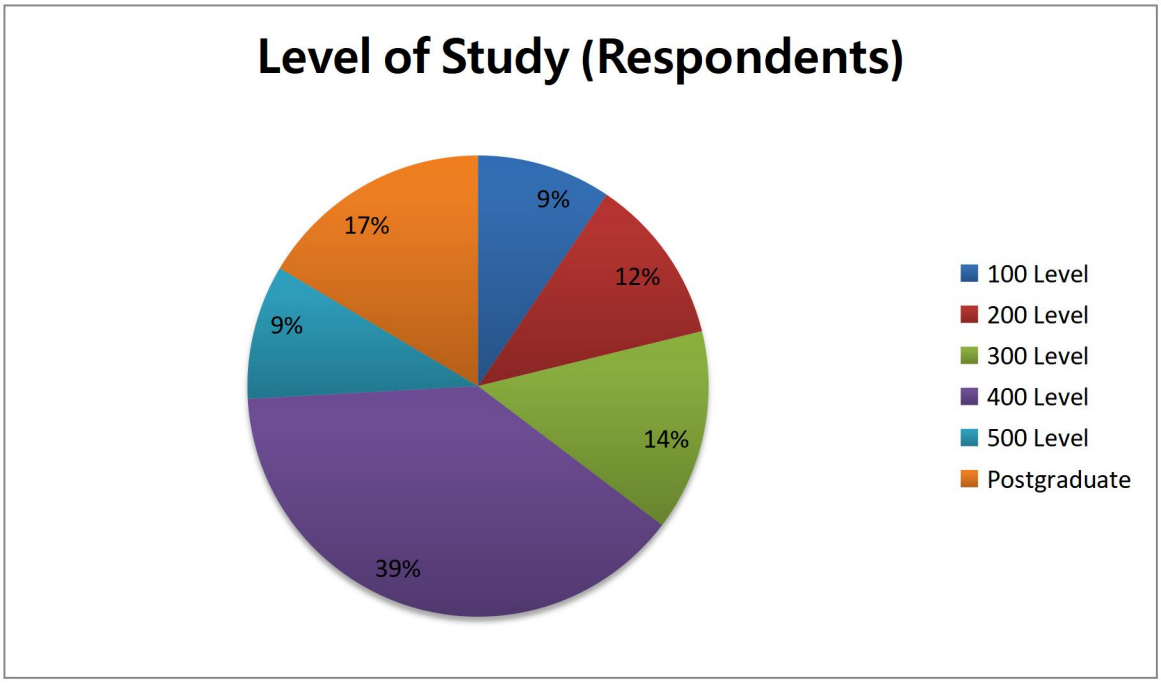


Fig 4.4: Level of study of Respondents

ANALYSIS AND DISCUSSION:

The results show that 400-level students made up the largest group of respondents (38.8%), followed by postgraduate students (16.5%), while 300-level students accounted for 14.1%. This pattern shows strong participation from senior students, who are usually more experienced and more involved in academic work that requires attendance records.

The high number of final-year and postgraduate students also points to their greater exposure to research and technology. These students are more likely to share informed and realistic opinions about the use of biometric fingerprint systems at the University of Benin (UNIBEN).

The smaller number of 100 and 200-level respondents could be because they have had less contact with university technology or less interest in surveys. However, the mix of students from different levels still gives a broad and balanced view of how students at different stages of study accept biometric attendance systems.

4.2.5 PRIOR USE OF BIOMETRIC SYSTEMS

Table 4.5: Use of Biometric Systems

RESPONSE	FREQUENCY	PERCENTAGE
Yes	67	78.8

No	13	15.3
Maybe	5	5.9
Total	85	100

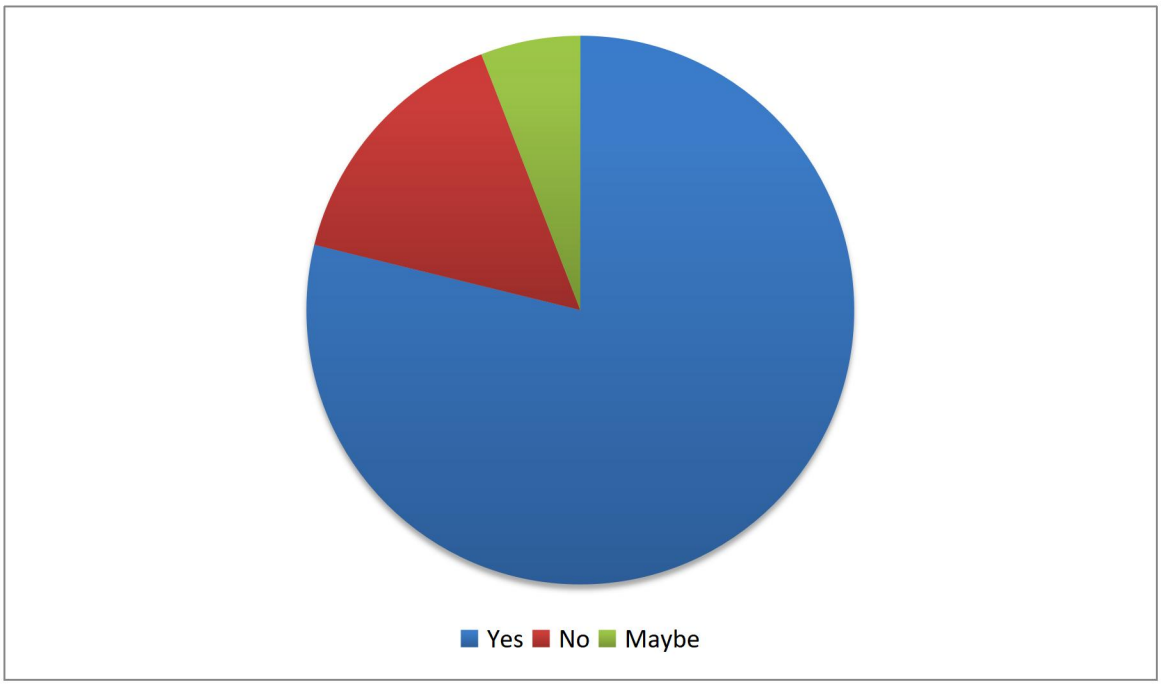


Fig 4.5: Use of Biometric Systems

ANALYSIS AND DISCUSSION:

From the table above, 67 respondents, making up 78.8% of all participants, said they had used biometric systems before. Thirteen (13) respondents (15.3%) said they had not, while five (5) respondents (5.9%) were unsure. This shows that most students at the University of Benin (UNIBEN) have already had some experience with biometric technology.

The high number of students who have used biometric systems suggests that this kind of technology is not new to them. Many may have come across it in places like banks, during national identity registration, or while using mobile phones with fingerprint access. This previous contact can help students feel more confident and willing to use biometric systems for attendance, since they already understand how such technology works.

The few students who have never used biometric systems show that there is still a need for simple training or orientation when introducing biometric attendance at UNIBEN. This will help

everyone, no matter their past experience, to use the system easily. Overall, the results show that students are generally familiar with digital technology, which creates a good base for accepting biometric attendance systems in the university.

4.2.6 DURATION OF USE OF BIOMETRIC SYSTEMS

Table 4.6: Duration of Biometric System Usage

DURATION	FREQUENCY	PERCENTAGE (%)
Less than 6 months	19	22.4
6–12 months	8	9.4
Over 1 year	42	49.4
Never	16	18.8
Total	85	100

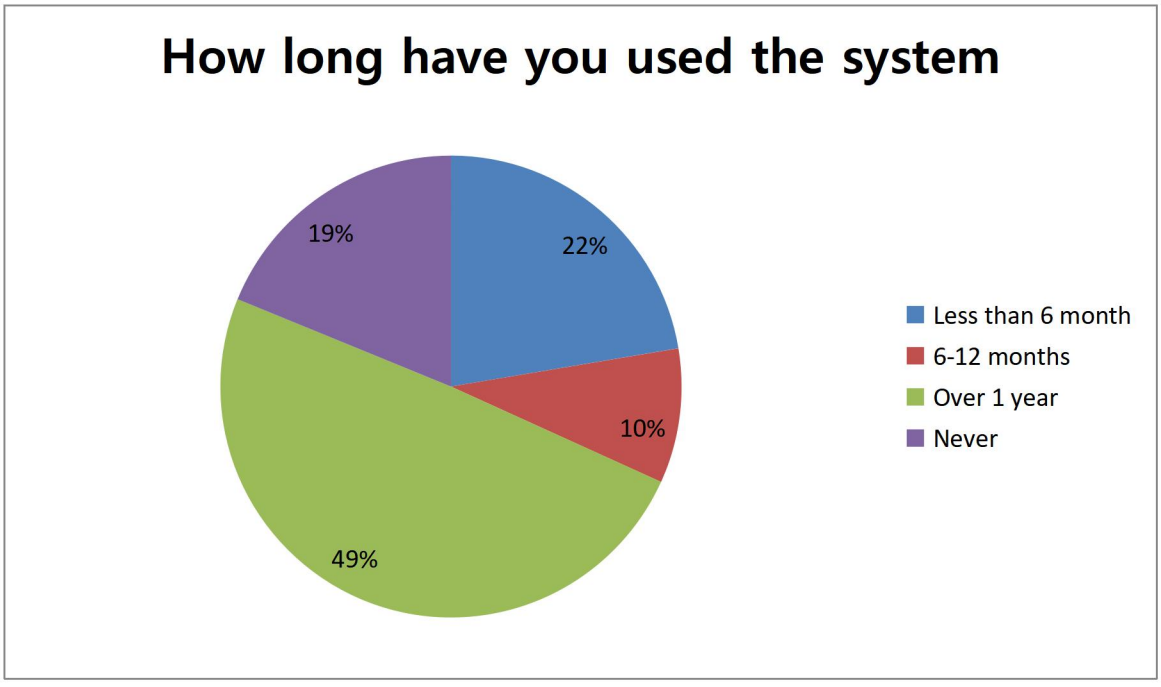


Fig 4.6: Duration of biometric system usage

ANALYSIS AND DISCUSSION:

The results show that almost half of the respondents (49.4%) have been using biometric systems for more than one year. About 22.4% said they have used them for less than six months, while 9.4% reported usage between six months and one year. In addition, 18.8% of the respondents said they have never used any biometric system before.

These findings indicate a generally high level of technological exposure among the students. The large number of respondents who have used biometric systems for over a year suggests that many students are already familiar with such technology and have had enough time to understand how reliable and effective it can be. This long-term experience helps them form realistic opinions about the use of biometric attendance systems in schools.

On the other hand, the 18.8% who have never used biometric systems may need some form of guidance or training when the system is introduced. The University of Benin (UNIBEN) could provide short demonstrations or awareness programs to help all students learn how to use the system easily.

Overall, the demographic results (Sections 4.2.1–4.2.6) show that the sample of students was balanced in terms of faculty, level, and gender, but mainly made up of young and educated individuals who are already used to technology. These qualities give a strong base for understanding students' acceptance, as most of them already have the digital skills and flexibility needed to use biometric attendance systems.

4.3 AWARENESS AND KNOWLEDGE OF BIOMETRIC SYSTEMS (SECTION B)

STATEMENT	STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE
I am aware that the biometric fingerprint attendance system exists in my institution	16	20	17	15	17
I understand the purpose of using biometric	33	34	15	2	1

attendance system in education					
I have received information or orientation about how to use the system.	10	23	23	22	7
I believe biometric attendance system improves record accuracy	43	31	9	1	1
The university has adequately communicated the importance of biometric attendance.	7	11	18	32	17
I have enough knowledge to troubleshoot minor problems with the system	8	15	33	15	14

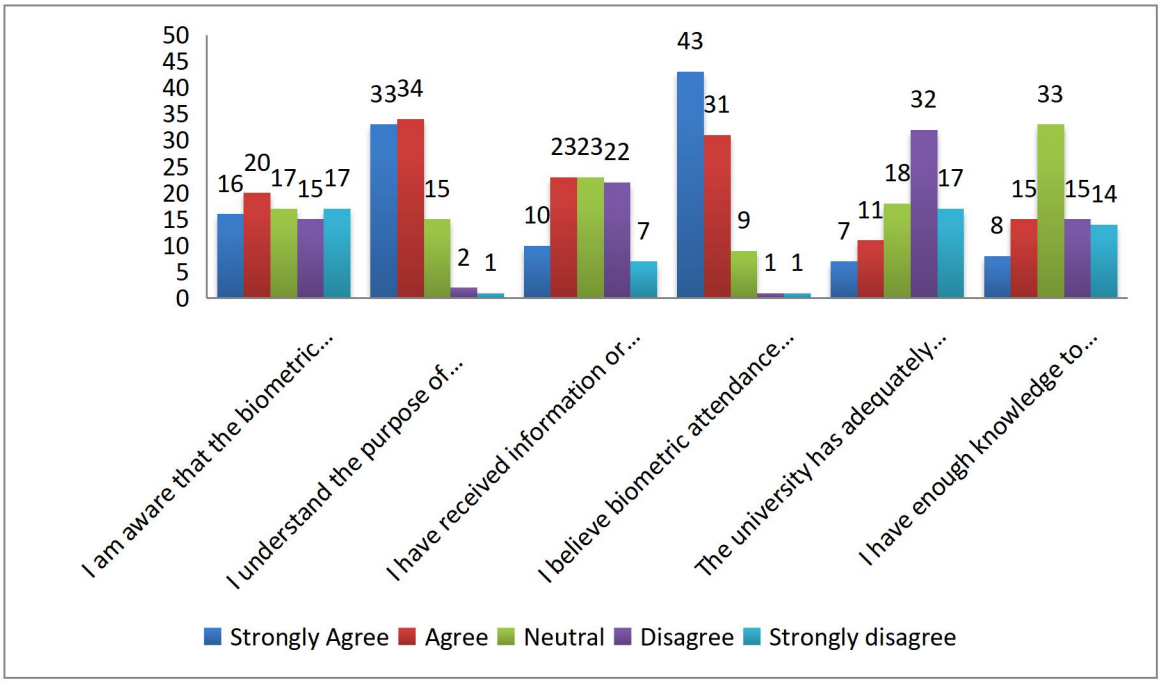


Fig 4.7: Awareness and Knowledge of Biometric Attendance System

ANALYSIS AND DISCUSSION:

The responses in the table above give useful information about how well students at the University of Benin understand and are aware of biometric fingerprint attendance systems.

A large number of respondents showed a good understanding of the purpose and benefits of biometric attendance. In total, 33 students strongly agreed and 34 agreed that they understood why biometric technology is used in schools. This means that about 78.8% of the students are aware that biometric systems help improve accuracy, transparency, and fairness in tracking attendance.

Likewise, most of the respondents just like the 43 that strongly agreed and 31 agreed whom believed that biometric systems improve the accuracy of attendance records. This shows that many students know that using fingerprints can help prevent mistakes and stop impersonation or signing attendance for others, which are problems in manual systems. Their awareness reflects a positive attitude toward digital transformation in school management.

However, the responses also show some weaknesses in how the university communicates about the biometric system. Only 7 students strongly agreed and 11 agreed that the university has properly explained the importance of biometric attendance, while 49 students were neutral or

disagreed. This shows there is a clear gap in communication between school management and students when it comes to technology-related updates.

In addition, only a few respondents (8 strongly agreed and 15 agreed) said they could solve small problems with biometric systems. Meanwhile, 33 were neutral, and about 30% disagreed, showing that many students do not have the technical skills to handle basic issues. This means that while they understand the concept of biometric systems, their practical experience is limited.

4.4 EASE OF USE AND USER EXPERIENCE (SECTION C)

STATEMENT	STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE
The biometric fingerprint system is easy to use.	30	34	19	2	00
The fingerprint scanner works accurately.	14	36	25	10	0
I rarely experience difficulties in verifying my fingerprint	13	28	33	10	1
The attendance process is faster with biometric verification.	23	30	26	4	2
Technical support is readily available when the system fails.	8	17	38	17	5

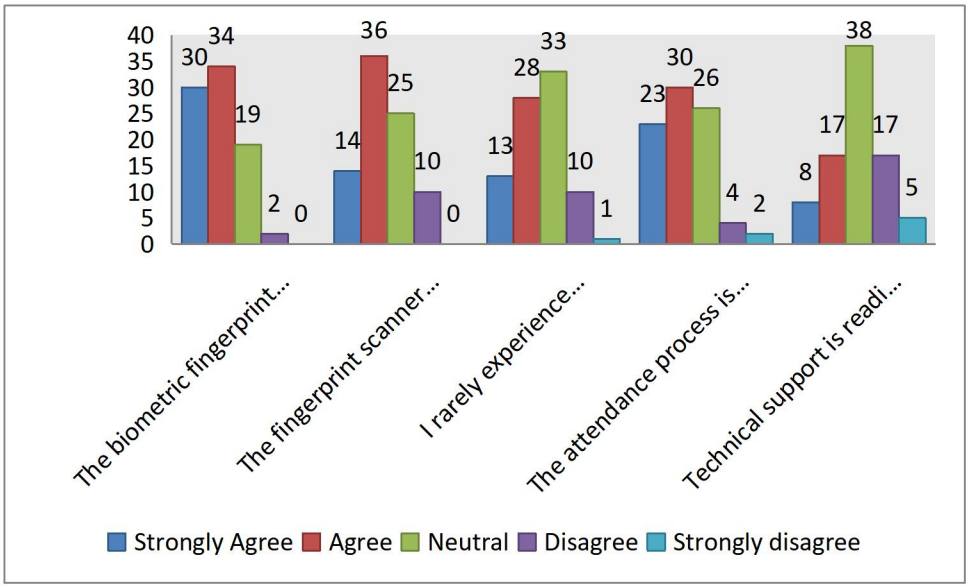


Fig 4.8: Ease of use and user experience

ANALYSIS AND DISCUSSION:

This section examines how students view the ease of use, reliability, and overall experience of biometric fingerprint systems. The results show that most students have a positive opinion about how easy the system is to use, though there are still challenges with technical support and maintenance.

A large number of respondents agreed that the biometric fingerprint system is simple to operate. About 30 students strongly agreed and 34 agreed, making up 75.3% of the total participants. This means most students find the system easy to understand and use, even without much technical knowledge. Ease of use is an important factor because when a system is simple, people are more likely to accept and use it regularly.

Also, many students believe the fingerprint scanners are accurate. Fourteen students strongly agreed and 36 agreed (58.8% in total), showing that students trust the system's ability to record attendance correctly. This confidence in the technology encourages regular use since users are more comfortable with systems, they believe work properly.

However, the results also show that there are still some operational issues. About 33 students (38.8%) chose "neutral" when asked if they rarely face problems verifying their fingerprints, while 11 students (12.9%) disagreed or strongly disagreed. This suggests that although most students find the system easy to use, some still experience problems like failed fingerprint

recognition or slow response. These issues could be caused by dirty sensors, user mistakes, or devices that are not well-calibrated.

In terms of speed, 23 respondents strongly agreed and 30 agreed that the biometric system makes attendance faster. This shows that many students see it as a quicker and more efficient alternative to manual signing or roll calls. The system helps save time and improves record accuracy. However, a few respondents disagreed or were neutral, meaning the system speed may sometimes depend on hardware or network conditions.

One major challenge identified is the lack of strong technical support. Only 8 respondents strongly agreed and 17 agreed that help is available when the system fails. Meanwhile, 39 (45.9%) were neutral and 22 (25.9%) disagreed. This means that maintenance and troubleshooting support are not always available. Poor technical support can reduce user trust and make the system less reliable over time. If problems are not fixed quickly, students may lose interest in using the system.

Overall, the results show that students see the biometric attendance system as easy, fast, and reliable, but technical support from the university is weak. Without regular maintenance and quick repair services, users may become frustrated even if they like the system.

To improve user satisfaction and long-term use, the University of Benin should focus on:

i. Providing Continuous Technical Support: Setting up a quick-response technical team to handle device or verification issues.

ii. Regular Maintenance and Updates: Cleaning, checking, and updating the devices regularly to keep them accurate.

iii. User Education: Teaching students the correct way to place their fingers and use the device properly to reduce errors.

In conclusion, students generally view the biometric attendance system as convenient and reliable, but the lack of consistent technical support limits its full effectiveness. By improving maintenance, training, and response systems, UNIBEN can make biometric attendance smoother and more successful.

4.5 SECURITY, PRIVACY, AND TRUST (SECTION D)

STATEMENT	STRONGLY	AGREE	NEUTRAL	DISAGREE	STRONGLY

	AGREE				DISAGREE
I believe my biometric data is securely stored	18	34	28	4	1
I trust the institution to protect my fingerprint information	16	24	36	7	2
I am aware of how biometric data is used or managed	13	23	31	15	3
I am concerned about possible misuse of my biometric data.	22	33	23	4	3

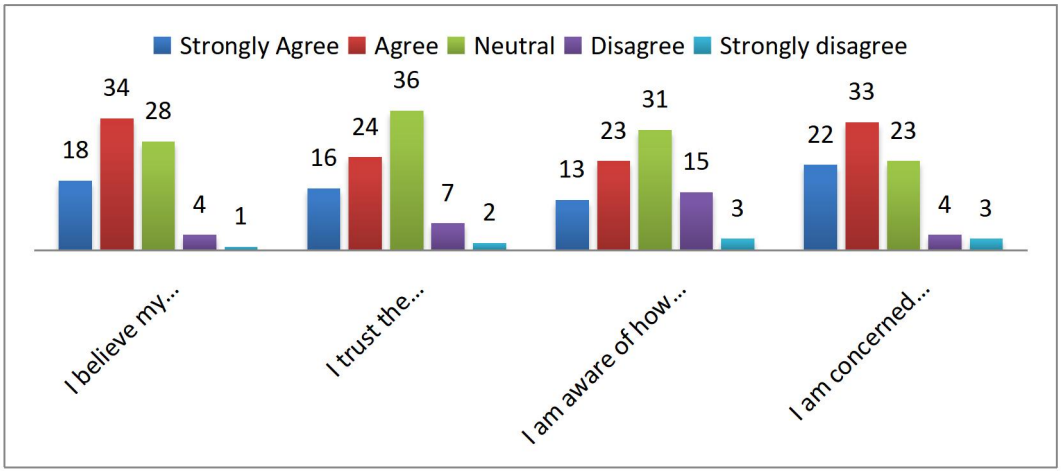


Fig 4.9: Security privacy, and trust

ANALYSIS AND DISCUSSION:

The protection of personal data and the level of trust students have in how their information is managed play an important role in how well biometric systems are accepted. Since biometric fingerprint attendance systems involve collecting and keeping personal identifiers, students' opinions about security, privacy, and how much they trust the university will affect whether they are willing to use the system or not.

The results from this section show a mixed level of trust among students about how safely their biometric data would be handled by the University of Benin.

About 61.2% of the respondents (52 students) agreed or strongly agreed that their biometric data would be stored safely. This means that more than half of the students believe the system is secure. Their confidence may come from past positive experiences with other biometric systems such as bank verification or national ID registration, which are already common in Nigeria. However, 20% of respondents were neutral, and 5 respondents (about 6%) disagreed. This shows that while most students think the system is safe, some still have doubts, probably because the university has not clearly explained how their data will be stored or used.

In the same way, trust in the university's ability to protect fingerprint data was moderate. About 47% (40 students) agreed or strongly agreed that they trust the university to keep their data safe, while 42% (36 students) were neutral. This neutrality suggests that many students are unsure, not because they do not trust the school, but because they have not been given enough information about how the university plans to handle their data. This shows a major gap in communication — the university has not clearly shared how it manages or secures biometric information.

When asked if they understood how biometric data is handled, 44.7% of students chose "neutral," and about 21% (18 respondents) disagreed or strongly disagreed. This means that most students do not fully know how their biometric data is stored, processed, or deleted. Lack of awareness weakens user trust and may cause fear that the data could be misused or monitored. In technology use, trust and openness are very important, especially when sensitive information like fingerprints is involved.

Even though many students said they trust the security of the system, most still worry about data misuse. About 55 respondents (64.7%) agreed or strongly agreed that they are concerned about possible misuse of their biometric data. This means that even students who trust the system's safety still have fears about unauthorized access or data leaks. These concerns are understandable because data breaches and misuse are common issues around the world. In Nigeria, where data protection laws such as the Nigeria Data Protection Regulation (NDPR, 2019) are still growing, students may question whether the university can fully guarantee data safety.

The findings show a clear contrast: students generally believe biometric systems are technically secure but are not fully confident that the university will manage the data properly. In other words, they trust the technology itself more than they trust the institution handling it. This difference is important because successful adoption of biometric systems depends on both the reliability of the technology and the credibility of the institution managing it.

To build stronger trust and encourage wider acceptance, the University of Benin should take the following steps:

i. **Transparency and Communication:** Clearly explain how biometric data will be collected, stored, encrypted, and deleted. When users understand the process, they feel safer and more in control.

ii. **Follow Data Protection Laws:** Ensure full compliance with the Nigeria Data Protection Regulation (NDPR, 2019) and international privacy principles, such as user consent, limited data storage, and access rights. This shows accountability and professionalism.

iii. **User Education and Awareness:** Organize seminars, orientations, and workshops to teach students how the system works and how their information is protected. This will reduce fear and build confidence.

iv. **Strong Cybersecurity Measures:** Use advanced encryption, limited access, and regular system checks to make sure biometric data is safe from hackers or misuse.

In conclusion, while most students at UNIBEN trust that biometric attendance systems are technically safe, many still worry about how their data will be managed. To solve this, the university needs to be open about its data policies, follow national data protection laws, and communicate regularly with students. Without these measures, trust may remain low, even if the system itself works efficiently.

4.6 OVERALL ACCEPTANCE AND RECOMMENDATION (SECTION E)

STATEMENT	STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE
The Biometric attendance	28	27	15	2	3

system should be adopted across faculties					
I am satisfied with the performance of the system so far.	13	23	41	7	1
The Biometric system is better than manual attendance system.	36	28	17	2	2
I would recommend continuous use of biometric attendance system	36	28	14	4	3
I believe the biometric system will improve institutional efficiency.	34	28	19	1	3
I believe the biometric system will improve students discipline.	41	26	16	0	2

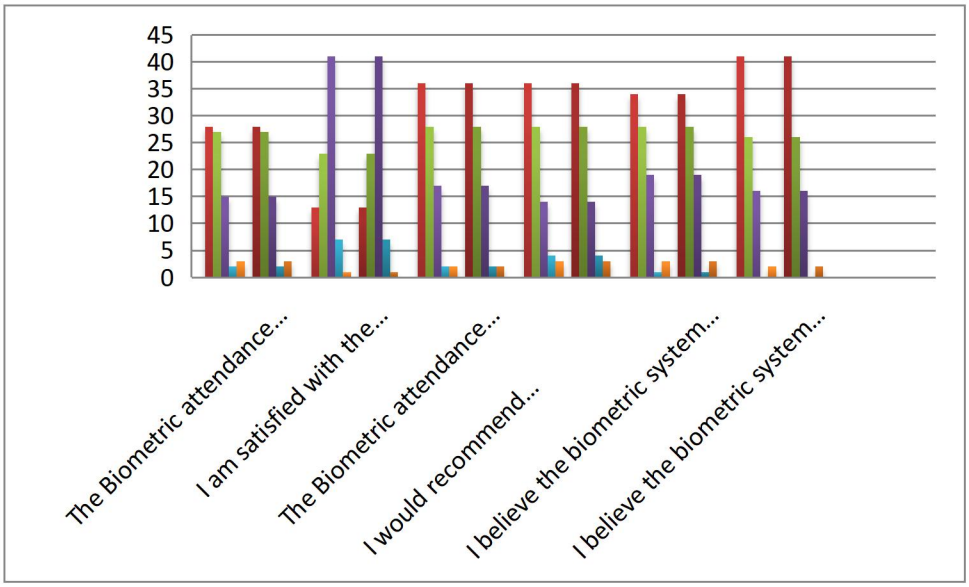


Fig 4.10:Overall Acceptance and Recommendation.

ANALYSIS AND DISCUSSION

This part explains how students at the University of Benin feel about using biometric fingerprint systems for attendance. The results show that most students strongly support the idea of using this technology instead of the manual method.

A large number of students (about 65%) agreed that biometric attendance should be used in all faculties. This means most students believe the system is fair, accurate, and reliable. Their positive response shows that they are not only familiar with the system but also ready to see it fully used across the university.

When asked about how satisfied they are with the system's performance, 42% of the students said they were satisfied, while about 48% were neutral. This shows that many students have not used the system often enough to fully judge it. However, since very few expressed dissatisfactions, it means that the system works fairly well and students do not have major complaints.

When comparing biometric systems with the manual attendance method, 75% of students said that the biometric system is better. They believe it is faster, more accurate, and prevents impersonation or fake signing. This shows that students appreciate how the biometric system makes attendance more transparent and organized. It also reflects how students are becoming more comfortable with technology in their learning environment.

In addition, about 75% of respondents said they would recommend continued use of the biometric system. This strong approval means students see real benefits and believe the system should be part of the school's normal operation.

Another key finding is that 78.8% of students believe the biometric system will make the university more efficient. They understand that automated attendance reduces manual work for lecturers, saves time, and keeps records accurate. This is especially useful in a large school like UNIBEN, where taking attendance manually can be slow and stressful.

The same percentage (78.8%) also believe that biometric attendance will improve student discipline. Since fingerprints cannot be faked, students will have to be present in class to be marked present. This helps reduce lateness and absenteeism while encouraging punctuality and honesty.

Overall, the findings show that students have a very positive attitude toward biometric attendance systems. They see it as a modern, fair, and effective way to record attendance. Although some students are still neutral, probably because they have not used the system often the general opinion is that it should be fully introduced and supported across the university.

To make sure the system works well and students continue to support it, the following steps are suggested:

i. **Full Implementation:** Introduce the biometric attendance system in all faculties to make it a standard practice across the university.

ii. **Ongoing Awareness:** Organize regular workshops, sensitization, and feedback sessions so students understand how the system works and can share their experiences.

iii. **Improve Support and Maintenance:** Provide steady electricity, regular device checks, and quick technical help when issues occur.

iv. **Regular Monitoring:** Review the system's performance from time to time to fix problems and make improvements.

v. **Integration with School Records**: Connect attendance data directly to academic systems to make record-keeping faster and more reliable.

In conclusion, students at UNIBEN show strong approval and trust in biometric attendance systems. They believe it is better than the manual method, helps save time, improves discipline,

and promotes fairness. With proper communication, maintenance, and training, the university can successfully adopt this system as part of its everyday operations.

4.7 SUMMARY OF FINDINGS

The analysis of data from 85 student respondents at the University of Benin shows clear trends in students' awareness, perception, and acceptance of biometric fingerprint attendance systems.

The demographic results revealed a fairly balanced gender distribution and a mostly young population aged 18–25. This suggests that most respondents belong to a technologically inclined group familiar with digital tools. Many students had already used biometric systems elsewhere, showing their readiness to accept such technology in their institution.

Findings from the awareness section show that students generally understand what biometric systems are and their main benefits. However, there are gaps in communication and orientation from the university. Even though most students agree that the system helps improve accuracy in attendance records, many still lack full knowledge of how it operates. This highlights the need for better sensitization and user training.

In terms of usability, most students found the system easy to use, fast, and more reliable than manual attendance. Still, some mentioned challenges such as occasional verification errors and poor technical support, which could affect smooth operation over time.

Regarding privacy and data trust, students expressed moderate confidence that their information is protected. However, some remain concerned about possible misuse of their biometric data. This shows that the university should provide clearer policies and stronger assurance on data security.

Overall, students showed strong acceptance of the biometric fingerprint attendance system. Many agreed that it should be fully implemented across all faculties because it can improve efficiency, reduce absenteeism, and promote discipline. Although satisfaction levels were not very high, the general opinion toward the system was positive.

In conclusion, the findings reveal that students are ready and willing to adopt biometric attendance systems. For lasting success, the university must improve communication, provide reliable infrastructure, ensure proper technical support, and maintain strict data protection measures.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION.

5.1 INTRODUCTION

This study assessed how students of the University of Benin accept and perceive the use of a biometric fingerprint attendance system. It examined their level of understanding, willingness to use the system, and opinions about its effectiveness in managing academic attendance. The study arose from the need to solve the problems of inaccuracy and inefficiency often found in manual attendance methods used in many Nigerian universities.

As technology continues to improve administrative processes worldwide, biometric systems are becoming known for their accuracy, reliability, and ability to ensure accountability in institutions.

The research focused on key factors that influence acceptance such as awareness, ease of use, trust, data security, and communication from the institution. Data were gathered from 85 students across different faculties to ensure a balanced view of opinions. The responses helped to show how ready students are to adopt the system, their level of trust in data protection, and their general belief in the system's efficiency.

The purpose of this chapter is to summarize the main findings, draw conclusions, and make useful recommendations that can guide the University and other institutions in adopting biometric attendance systems. It also outlines the limitations faced during the research and suggests areas for future studies. Overall, this chapter connects the findings to the wider discussion on digital transformation and the growing use of technology in Nigerian higher education.

5.2 SUMMARY OF THE STUDY

This study examined students' perception and acceptance of a biometric fingerprint attendance system at the University of Benin. It aimed to evaluate how students view the system's feasibility, efficiency, and security as an alternative to the manual attendance method currently in use. The research also explored the major factors that influence adoption, including user awareness, ease of use, data privacy, trust in university management, and perceived benefits in improving accuracy and accountability.

A descriptive survey design was used to collect opinions and experiences directly from students across various faculties. Data were gathered through a structured questionnaire distributed both physically and online. In total, 85 valid responses were obtained, representing students from the Faculties of Science, Social Sciences, Education, Engineering, and Management Sciences. The

questionnaire was designed to measure demographic characteristics, level of awareness, understanding of system use, trust and privacy concerns, and overall acceptance of the biometric attendance system.

The responses were analyzed using descriptive statistics such as frequencies, percentages, and mean scores. Tables and charts were used to clearly present the results. Findings showed that most students were already familiar with biometric systems through their experience with bank verifications, national identification, and other institutional uses. This exposure helped increase their readiness to accept biometric technology for attendance purposes.

The results also showed that while students were highly aware and willing to use the biometric system, there were still some areas needing improvement. Weaknesses included poor communication from the institution, limited user training, and low awareness of data security measures. Despite these issues, most respondents believed that biometric attendance would make record-keeping more accurate, reduce impersonation, save time, and promote fairness in attendance tracking.

To ensure credibility, the questionnaire was reviewed by the researcher's supervisor and peers to confirm clarity and relevance. Ethical standards were also maintained by ensuring voluntary participation and respondent anonymity. The collected data were analyzed objectively to reflect genuine student opinions.

In summary, the study found that students at the University of Benin strongly support the adoption of a biometric fingerprint attendance system. They believe it will improve efficiency, transparency, and accountability in academic management. However, full implementation will require the university to strengthen communication, provide proper infrastructure, conduct user training, and ensure strong data protection policies.

5.3 SUMMARY OF MAJOR FINDINGS

The analysis of data collected from 85 student respondents at the University of Benin (UNIBEN) produced several key findings on the acceptance of a biometric fingerprint attendance system. The main points are summarized below:

i. **Demographic Composition and Representation:** The demographic data showed a fairly balanced gender distribution, with 47.1% males and 51.8% females. Most respondents (83.5%) were between 18 and 25 years old, representing the typical undergraduate population in Nigerian universities. A large number of participants (73%) were from the Faculty of Science, showing that many respondents were already familiar with technology. Most students were in higher academic levels (400 level and postgraduate), suggesting that mature and experienced students participated in the study.

ii. **High Technological Familiarity and Exposure:** About 78.8% of students had previously used biometric systems such as bank verifications, national ID registrations, or security access points. Nearly half (49.4%) had used these systems for more than one year. This shows a strong level of technological exposure, which makes students more open to adopting biometric attendance systems in the university.

iii. **Awareness and Knowledge of Biometric Systems:** Most respondents understood the purpose and benefits of biometric systems in improving record accuracy and reliability. However, few students agreed that the university had properly communicated or explained how the system works. This points to a lack of awareness programs and limited institutional orientation on the use of biometric systems.

iv. **Ease of Use and User Experience:** A majority of respondents (about 75%) agreed that the biometric system is easy to use and efficient. Many students found fingerprint scanners accurate and believed the system saves time compared to manual attendance. However, some reported that inadequate technical support and poor maintenance could affect reliability and long-term confidence in the system.

v. **Security, Privacy, and Trust Concerns:** Although many students trusted that their biometric data would be securely stored, some expressed fear about how the data might be managed. Over 60% believed their data would be safe, but around 65% still worried about possible misuse or unauthorized access. This shows that while technical trust is fairly strong, privacy and transparency concerns remain significant.

vi. **Institutional Communication and Transparency:** One major weakness identified was poor communication from the university about biometric attendance. Many respondents said they had not been properly informed or trained on how such systems operate. This communication gap could affect user confidence and system effectiveness during full implementation.

vii. **Overall Acceptance and Recommendation:** Overall acceptance of biometric attendance systems was very positive. About 65% of students supported full-scale adoption across all faculties, while 75% agreed that biometric methods are better than manual ones. In addition, 78.8% believed the system would improve efficiency, discipline, and accountability in the university. These results show strong user approval and support for digital transformation.

viii. **General Readiness for Implementation:** Students at UNIBEN showed high readiness and enthusiasm toward using biometric attendance systems. Their technological background and previous exposure suggest an easy transition once implemented. However, the university will need to ensure stable infrastructure, maintenance, user training, and strict data protection policies to sustain trust and acceptance.

ix. Key Areas for Improvement:

- Although acceptance is high, the study identified some areas that require improvement:
- Increase user awareness and technical training.
- Provide regular and reliable technical support.
- Establish and communicate a clear data protection policy.
- Maintain system reliability through consistent updates and checks.

In conclusion, the study's findings reveal that students at the University of Benin have strong awareness, positive attitudes, and readiness to adopt biometric fingerprint attendance systems. Their acceptance is driven by the system's perceived accuracy, ease of use, and efficiency. However, full success will depend on how well the university addresses privacy concerns, improves communication, and ensures stable support systems.

5.4 CONCLUSION

This study examined the acceptance of a biometric fingerprint attendance system among students of the University of Benin (UNIBEN) to understand their level of awareness, perception, and readiness toward its possible use. The findings showed that most students were already familiar with biometric technology, mainly through its use in national identity registration and banking systems.

The results revealed that students generally see biometric attendance systems as accurate, fast, and dependable alternatives to manual methods. They believe the technology can reduce impersonation, improve transparency, and promote punctuality and discipline. Many also recognized that biometric systems could enhance administrative efficiency by simplifying attendance records and minimizing human error.

However, the study also identified some challenges that could affect successful implementation. Several students were uncertain about how their biometric data would be stored and protected, showing a lack of clear communication from the university about privacy and data use. In

addition, issues such as poor technical support, weak infrastructure, and limited user training were noted as possible barriers to smooth operation.

Another key observation was that, although students understand what biometric systems are, they have not received enough institutional orientation on how the system functions or how their data will be secured. This indicates the need for proper awareness programs, training sessions, and transparent data management policies before full deployment.

In conclusion, students at the University of Benin are willing and ready to adopt biometric fingerprint attendance systems. Their positive attitude reflects trust in the technology's ability to improve efficiency, fairness, and accountability. To achieve successful implementation, the university must combine technical efficiency with strong data protection measures, clear communication, and continuous user support. When these conditions are met, the biometric attendance system can become a reliable and accepted tool for academic management at UNIBEN.

5.5 RECOMMENDATIONS

Based on the findings and conclusions of this study, the following recommendations are proposed to ensure the successful implementation and effective management of a biometric fingerprint attendance system at the University of Benin (UNIBEN) and other similar institutions:

i. **Enhance Institutional Awareness and Orientation**: The university should organize awareness campaigns, sensitization programs, and practical demonstrations to educate students and staff on how the biometric system works. This will help correct misconceptions, promote transparency, and build user confidence in the system's purpose and benefits.

ii. **Develop a Comprehensive Data Privacy Policy**: A clear and transparent data protection policy should be created to address concerns about data security and misuse. The policy must clearly define how biometric data will be collected, encrypted, stored, and deleted after use. Compliance with national regulations such as the Nigeria Data Protection Regulation (NDPR) will strengthen trust and ensure legal accountability.

iii. **Provide Adequate Technical Support and Maintenance:** The university should ensure that trained ICT personnel are available to provide timely technical support whenever issues arise. Regular maintenance, software updates, and calibration of biometric devices should be carried out to reduce system downtime and maintain reliability.

iv. **Ensure Reliable Power and Network Infrastructure**: Since biometric systems depend on constant power and internet access, the university should provide backup power sources such as inverters or generators and secure stable network connections. This will help ensure continuous operation even during power or connectivity interruptions.

v. **Conduct Pilot Testing Before Full Implementation**: A pilot test should be carried out in selected faculties to identify potential challenges and gather user feedback. Insights from the pilot phase will help refine the system's technical setup, policies, and operational procedures before a full campus-wide rollout.

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