**COMPUTERIZED EMPLOYEE CLOCKING SYSTEM**

**ABSTRACT**

Biometric technology offers an advanced verification of human identity used in some organizations for recording the daily attendance (login and logout) and generating the payroll of the employees. This study uses the biometric technology to address the problems of many companies or institutions such as employees doing the proxy attendance for their colleagues, stealing company time, putting in more time in the daily time record (DTR), and increasing the amount of gross payroll resulted of buddy punching. The developed system for employee’s attendance and processing of payroll is achieved by the use of fingerprint reader. The employee uses one finger to record his or her time of arrival and departure from the office through the use of the fingerprint reader. The DTR of employees is recorded correctly by the system; the tardiness and under time in the morning and in the afternoon of their official time is also computed. The system was developed using the Java SE programming language, MySQL database software, and Software Development Kit (SDK) for the fingerprint reader. The Employee Attendance and Payroll System (EAPS) showed that the verification and identification of the employees in companies using the biometric technology provides a reliable and accurate recording in the daily attendance, and generate an effective monthly payroll.

**CHAPTER ONE**

**INTRODUCTION**

* 1. **Background of the study**

Nowadays, many organizations are experiencing technological advancement and changes in the mode in which they carry out their business processes. With the rise of globalization, it is becoming essential to find an easier and more effective system to help an organization improve their employees’ productivity. In spite of this matter, some organizations are still using the old manual method of recording employee’s attendance and processing of payroll. Biometric technology offers an advanced verification for employees used in some schools and companies. This technology involves the identification and verification of individuals by analyzing the human body characteristics and has been widely used in various aspect of life for different purposes. Despite the numerous advantages of the biometric system and its impact to various work sectors across the globe, most users of biometric technology still face the challenge of defining the right and accurate biometric technology system that will be cost effective in solving particular problems in specific environment. In any company or institutions, it is very important to monitor the employee’s attendance or time for accurate payroll and discipline. Some companies and schools are using a manual punch card to record the employee’s attendance and others are still using a logbook. Using a logbook, employees are writing down their names, time and signature to login and logout in the office/school. In the use of a punch card machine, employees are inserting the time card or punch card into a slot on the Bundy clock as they login or logout in the office. Using these, employees can easily do the proxy attendance of others. The study conducted by Harris Interactive Inc. showed that 21 percent of hourly employees admit to stealing company time. While only 5 percent participated in buddy punching, 69 percent said they punch in and out earlier or later than scheduled, 22 percent put additional time on their time sheet, and 14 percent did not punch out for unpaid lunches or breaks. The American Payroll Association (APA) estimates that time theft, tardy arrivals, buddy punching, lollygagging (wasting time getting to the work area), extended breaks and early departures costs businesses 1.5 to 5 percent of gross payroll, amounting to hundreds of billions of dollars every year. Industry studies support these estimates and in recent APA surveys, employees were reported to be stealing an average of 4.5 hours each week, equivalent to a six-week paid vacation per year. According to a Nucleus Research study, buddy punching is experienced by 74 percent of organizations. A global provider of IT advisory and research services, found that 74% of organizations experience payroll losses that are directly related to ‘buddy punching’. Nucleus Research found that organizations can save 2.2% of gross payroll annually on average by eliminating ‘buddy punching’ through the use of innovative biometric technology. In dealing with this matter, the researcher uses the biometric technology to facilitate the recording of the employees’ attendance and generate automatically the payroll. This proposed technology minimizes the buddy punching and payroll losses as experienced by the other organizations. The employee uses the fingerprint reader to verify and identify the fingerprint image and record their attendance in the company, basis for the generation of payroll. The system generates the daily time record (DTR), computes the tardy and under time of an employee, automates income tax deduction, and manages refunds, allowances and deductions.

Biometrics comes from a Greek language and it is derived from the words bio meaning life and metric meaning to measure. Biometrics is also the development of statistical and mathematical methods applicable to data analysis problems in the biological sciences. With regard to technology, Biometrics is the term given to the use of biological traits or behavioral characteristics to identify an individual. Biometrics is the science and technology of measuring and analyzing biological data. Among all the biometric techniques, fingerprint-based biometrics is the oldest method which has been successfully used in numerous applications. Everyone is known to have unique, immutable fingerprints.

Fingerprints are popular for identification due to the fact that they are easy to obtain, reliable and most importantly unique. Yet another reason for popularity of the fingerprint is its amenability to automation. A fingerprint may be resolved into group of patterns bearing certain characteristics. A fingerprint consists of dark and light lines. The dark lines are the ridges while the lighter lines are referred as the valleys. The points where a ridge breaks into two are known as bifurcations and the points where a ridge discontinues are called the ridge ending. These points together are known as minutiae which distinctively and uniquely identify the fingerprint. Most automatic systems for fingerprint comparison are based on minutiae matching. The fingerprint verification schemes are either automated or in some cases two prints can be matched manually.

* 1. **Statement of Problem**

The attendance management practices that are adopted by organizations can influence their operational performance, which can be manifested in terms of employee punctuality, productivity and customer satisfaction levels. Computerized biometric employee clocking system provides an opportunity for organizations to manage employee attendance, employee identification and payroll computation in ways that can influence operational performance. Previous studies have attempted to establish a relationship between biometric attendance management system and organizations performance (Akinduyite, et. al, 2013; Cupido, 2011; Shawlo, 2013). Most of the empirical studies (Mulumba, 2012; Omobogo, 2015; Adewole, et.a, 2014) have shown a positive relationship in the link between biometric attendance management systems and organizational performance. Literature suggests that using computerized biometric employee clocking system enhanced operational performance, yet the variable used by the researcher have not been used in a single study known to the researcher. The researcher has used the variables to attempt to explain the influence of computerized biometric employee clocking system on operational performance. Hence, the need for the current study hick intended to answer the question; Does computerized biometric employee clocking system influence operational performance of organizations?

* + 1. **Disadvantages of Unimodal System**

Despite having many inherent advantages, the large scale deployment of biometric identification systems have been hampered due to various reasons. Biometrics is used in many applications such as border control and voter id issuance. Theoretically, Unimodal biometric identification might seem very proficient but in reality there are numerous challenges when enrolling large populations using just a single (Unimodal) biometric. The major issue with Unimodal biometric system is that no one technology can be suitable for all applications and hence using a multimodal biometric system will compensate the limitations of Unimodal biometric system.

The following are the limitations of Unimodal biometric systems:

1. Susceptibility of the biometric sensor to noisy or bad data: The captured biometric trait might be distorted due to imperfect acquisition conditions. This limitation can be seen in applications which use facial recognition. The quality of the captured facial images might get affected by illumination conditions and facial expressions. Another example could be in fingerprint recognition where a scanner is unable to read dirty fingerprints clearly and leads to false database matches. An enrolled user might be incorrectly rejected whereas an impostor might be falsely accepted.
2. It might not be compatible with certain groups of population. Fingerprint images might not be properly captured for the elderly and young children because of faded fingerprints or underdeveloped fingerprint ridges. Though the biometric traits are expected to exist among every individual in a given population, there could be some exceptions where an individual is unable to provide a particular biometric. For example, iris images might not be acquired if the subject has a pathological eye condition.
3. Within a large population, unimodal biometrics is prone to inter-class similarities. Facial recognition may not work correctly for identical twins as the camera might not be able to distinguish between the two subjects leading to inaccurate matching
4. Unimodal biometric systems are quite vulnerable to spoof attacks where the data can be imitated or forged. For example, fingerprint recognition systems can be easily spoofed using rubber fingerprints.
   1. **Aims and Objective**

The research study objective was to find out the influence of computerized biometric employee clocking system to the operational performance of organizations.

Specifically, it aims to the following:

* 1. Develop a module for recording the attendance (arrival and departure) of the employees using the fingerprint scanner;
  2. Develop a module for processing the payroll and generate an essential reports such as pay slip, and remittances;
  3. Conduct the testing of the system in terms of biometric fingerprint scanning and processing of payroll.
  4. **Significance of the Study**

Administrators and management of organizations can benefit from the study to inform improvements in their human resource management systems. The management may take into account the findings of the study when formulating or revising existing policies on employee attendance management in different organizations.

Policy makers in the government sector can also benefit from the insights of the proposed study. The insights from the proposed study may provide new dimensions in reasoning the policies that have been formulated and implemented in the past. The findings of the study can inform policy formation and implementation to better manage the man power and productivity of government offices and secretariats.

Researchers and scholars may benefit from the gaps in research that have identified and suggested for further research. The researchers may utilize the findings of the study to explore new areas of research that have hitherto not been considered.

**1.5 Scope of the Study**

The project scope defines the description of the work that is required in delivering the housing maintenance account system. The main aim of the study was to establish the effect of computerized biometric employee clocking system on operational performance of organizations. This project based its focus on Nigeria and aimed at implementing a biometric attendance and automated payroll generating system to be used by indigenous organizations.

**CHAPTER TWO**

**LITERATURE REVIEW**

**2.1 Preamble**

A literature review is defined as a survey on scholarly articles, books and other sources (e.g. dissertations or conference proceedings) relevant to particular issue, area of research, or theory, providing a description, summary, and critical evaluation of each work. The purpose of literature review is to offer an overview of significant literature published on a topic. This chapter provides review of literature related to the study. Important theoretical and practical problems were analysed; aspects pertaining to computerized biometric employee clocking.

A fingerprint in its narrow sense is an impression left by the friction ridges of a human [finger](https://en.wikipedia.org/wiki/Finger) Scientific Working Group on Friction Ridges Analysis an Technology (SWGFAST; 2012). Fingerprints are easily deposited on suitable surfaces (such as glass or metal or polished stone) by the natural secretions of sweat from the eccrine glands that are present in epidermal ridges. These are sometimes referred to as "Chanced Impressions.

In a wider use of the term, fingerprints are the traces of an impression from the friction ridges of any part of a human or other primate hand. A print from sole of the foot can also leave an impression of friction ridges.

According to Olsen, Robert D. Sr (1972) deliberate impressions of fingerprints may be formed by ink or other substances transferred from the peaks of friction ridges on the skin to a relatively smooth surface such as a fingerprint card. Fingerprint records normally contain impressions from the pad on the last joint of fingers and thumbs, although fingerprint cards also typically record portions of lower joint areas of the fingers.

According to Bhanoo, Sindya N. (2015) human fingerprints are detailed, nearly unique, difficult to alter, and durable over the life of an individual, making them suitable as long-term markers of human identity. They may be employed by police or other authorities to identify individuals who wish to conceal their identity. or to identify people who are incapacitated or deceased and thus unable to identify themselves, as in the aftermath of a natural disaster .Fingerprint analysis, in use t he early 20th century, has led to many crimes being solved. This means that many criminals consider gloves essential. In 2015, the identity of gender by use of a fingerprint test has been reported.

**2.2 Review of General Text**

It involves taking the measured characteristic and trying to find a match in a database containing records of people and their characteristic. This method requires a large amount of processing power and solutions, if the database is very large. It is often used in determining the identity of a suspect from crime scene information. The primary function of fingerprint automation and verification system is to eliminate crime and avoid impersonation. One of the most recent innovation uses of fingerprint verification is being employed by the Nigerian Independent National Electoral Commission (INEC), which used the technology to weed out duplicated voter card registration. During the last voter card registration, some people registered several times under different names so they can vote more than once. Conventional methods have not been very successful at catching these people. Using the fingerprint authentication and verification system to search through biometric images in the voter’s database for duplicate at the time of registration, new images are compared to the records already on the file to catch those who attempt to register under different names. The technology was successfully used in the last general election. Biometric systems using fingerprint have the best performance since the False Reject Rate (FRR) and False Acceptance Rate (FAR) rates are very low for these identifiers *(Jain, A.K.; Uludag, U., “Hiding biometric data”, Pattern Analysis and Machine Intelligence, IEEE Transactions.On, Volume: 25, Issue: 11, Nov. 2003.)*

**2.3 Computerized Biometric Employee Clocking System**

The computerized biometric employee clocking system is an automated biometric time clockin process that verifies workers idenity like personal number and captures employee traits with high speed (one second or less) with high levels of accuracy, ease of enrollment (Ononiwu & Okorafor, 2012).

Computerized biometric empoyee clocking systems capture individual traits that are unique to an individual. These characteristics may include finger prints, hand geometry and an individual’s voice. The biometrics data is captured by specialized devices in the workplace. (Schneider & Price, 2001).

**2.4 Payroll Computation**

Biometric system is an accurate and reliable way to determine whether an employee was actually present for payment purposes. The technical operation of computerized biometric employee clocking system can be ecaluated on the ability of the system to match the individual users’ traits with the templates with accuracy (Jain et al., 2000). The computerized biometric employee clocking system ensures that data is available for use at all times. The data that is obtained from the computerized biometric employee clocking system can be utilized for payroll computation in real time.

The initial biometric data that is captured by the biometric system is critical for subsequent authentications of the user. As a result of this, the quality of the biometric template must be ascertained to ensure that it is suitable , if not, another biometric template should be obtained from the user (Schneider & Price, 2001).

Templates are produced after biometric data is captured by the biometric machine. The quality of biometric templates that are subsequently processed depend on the type of biometric technology utilized (Battesse, 2005). The computerized biometric employee clocking system enhances the quality of data.

Biometric features neither compared nor stored in their raw format. The raw templates have some irrelevat data, which should not be kept on record. The templates are processed to ensure that only the important characteristics are extracted and retained on the records. This helps in reducing the quantity of data (Oloyede, 2014). Biometrics enables employees to keep records of their employees’ time more accurately for payroll computation. The computerized biometric employee clocking system stores payroll accurate data. The computerized biometric employee clocking system enhances employee job satisfaction and retention (Lawson, 2003).

**2.5 Summary of the Reviewed Literature**

This chapter examined the various aspects relating to computeried biometric empoyee clocking system and operational performance. The resource based theory reveals that the resources that an organization has that include time and people can make an organization to enjoy a competative advamtage over its competitors. The time management theory emphasizes the crutial need of managing time for optimum benefit from organizational resources.

**CHAPTER THREE**

**METHODOLOGY AND DESIGN**

**3.1 Preamble**

This stage basically incorporates some of the first step of problems analysis. Activities during this stage focus on describing and analyzing problems of existing system, specifying possible solutions alternatives. It is a detailed review of a system in which the objectives are to access the work ability, effectiveness or the efficiency of the system. This stage is the description of the system and the explanation of system behaviors.

**3.2 Method of Data Collection**

Data collection methods are the means taken to father facts that enable the researcher to discover why the existing system was introduced and how it is operated.

In an attempt of writing this project, some techniques of data collection used are:

1. Record inspection
2. Internet Browsing

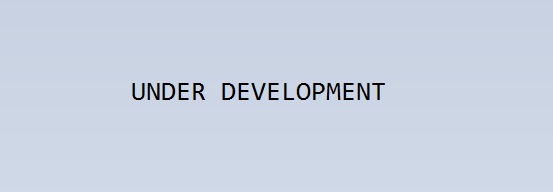
**i. Record Inspection**

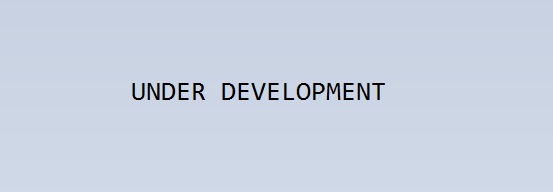
This method involves collecting data in which the investigator reads through records, document reports, bulletin etc. In this method of data collection, sample output of the folio was given of how they prepared billing.However, a close study of the form currently being used should give the best guide to current practices which may be the original requirements.

**ii. Internet Browsing**

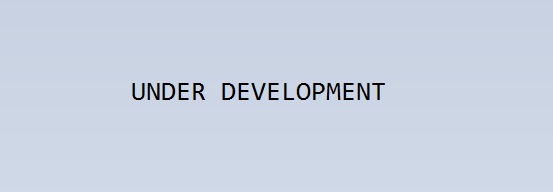
Internet is the collection of computers connected together for the purpose of sharing resources, information among other things: internet is a method of data collection which is secondary in nature. The web was used in sourcing for information through various web sites such as [www.freestudentproject.com](http://www.freestudentproject.com), www.nairaland.com, [www.google.com](http://www.google.com), www.wikipedia.com.

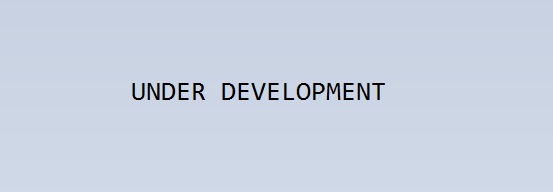
**3.3 Systems Modeling (Using UML – Unified Modeling Language)**

**i. Use Case Diagram**

**ii. Class Diagram**

**3.4 Database Design**

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**3.5 Output Design**

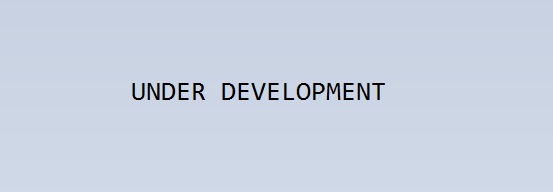
**OUTPUT MEDIUM**

1. Printer

2. Monitor

**3.6 Input & User Interface Design**

Input facilities are the entry of data into the computer system. Input design involves the selection of the best strategy for getting data into the computer system at the right time and as accurately as possible. This is because the most difficult aspect of input designs is accuracy. The use of well-defined documents can encourage users to record data accurately without omission. For example, if an offender’s telephone number is a needed input data, the offender registration form should have a specific line that is clearly labeled ‘customer telephone number’. Input errors can be greatly reduced when inputting directly by using appropriate forms for data capture and well designed computer screen layout.

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**INPUT MEDIUM**

The input medium consists of the following hardware which includes

1. Keyboard
2. Mouse

**3.7 System Requirement**

The system requirement consists of two types which are the software requirement and hardware requirement. The basic hardware requirement for the Computerized Employee Clocking System for staff is a simple local area network with a server and client machines. The client side requires no more than the standard Java Development Kit (JDK) installed on the local machine. The computer system may be a simple pentium system with monitor and printer. The basic software requirement for the system is MySQL, JDK 7 or above and Windows Operating System.

**3.9 Choice of programming language**

The programming language used to design and implement this project is Java SE 8. Why I used this particular programming language and version is due to the following reasons:

1. **Ease of Use**: Application programmers can focus on their domain object model and leave the details of persistence (field-to-field storage of objects) to the Java implementations.
2. **Portability**: Applications written with Java can be run on multiple implementations without recompiling.
3. **Database independence:** Applications written in Java are independent of the underlying database. Java supports many kind of transactional data stores including relational and object databases, XML, flat files, MS Access and others.
4. **High Performance:** Application programmers delegate the details of persistence to Java implementation, which can optimize data access patterns for optional performance.
5. **Popularity:** Java is so popular so, there are many good resources (Books, web sites and more) that can help you learn the language. You can find the answers to your programming problems much more easily than other programming language.

**CHAPTER FOUR**

**SYSTEMS IMPLEMENTATION EVALUATION**

**4.1 Preamble**

System Implementation is the realization, execution of a plan, idea, model, design, specification, standard, algorithm or policy. In Computer Science, an implementation is a realization of a technical specification or algorithm as a program, software component, or other computer system through computer programming and deployment. Many implementations may exist for a given specification or standard. The Software development tools contain implementation of programming language.

System Implementation benefits generally from high levels of user involvement and management support. First, if users are heavily involved in systems design, they move opportunities to mould the system according to their priorities and business requirements and more opportunities to control the outcome.

**4.2 System Testing and Evaluation**

Before actually implementing the new system into operation, a test run of the system is done for removing the bugs, if any. It is an important phase of a successful system. After coding the whole programs of the system, a test plan should be developed and run on a given set of test data. The output of the test run should match the expected results. Sometimes, system testing is considered a part of implementation process. Using the test data following test run are carried out:

**Unit Testing**

In computer programming, unit testing is a software testing method by which individual units of source code, sets of one or more computer program modules together with associated control data, usage procedures, and operating procedures are tested to determine if they are fit to use.

Intuitively, one can view a unit as the smallest testable part of an application. In Object Oriented Programming, a Unit can be an Interface, such as a class, but could also be an individual method.

When the programs have been coded, compiled and brought to working conditions, they must be individually tested with the prepared test data. Any undesirable happening must be noted and debugged (error corrections).

**Integrated Testing**

After carrying out the program test for each of the programs of the system and errors removed, then system test is done. At this stage the test is done on actual data. The complete system is executed on the actual data. At each stage of the execution, the results or output of the system is analyzed. During the result analysis, it may be found that the outputs are not matching the expected output of the system. In such case, the errors in the particular programs are identified and are fixed and further tested for the expected output. When it is ensured that the system is running error-free, the users are called with their own actual data so that the system could be shown running as per their requirements.

**4.3 System Conversion Plan**

Conversion includes all those activities which must be completed to successfully convert from the manual system to the automated system.

Large file of information must be converted from one medium to another before programming and testing are completed.

* File conversion program must be tested for accuracy
* Adequate control
* Existing files must be kept for a period of time until sufficient files are accumulated for backup. This is necessary incase the file must be reconstructed from scratch after a “bug” is discovered later in the conversion routine.

**Pilot Approach**

It tests the new system with only a part of the organization to test their effectiveness, before it is later implemented in the rest of the organization. The method is less expensive than the parallel and in this case, the risk is controllable since the implementation is limited to certain areas, without affecting the entire enterprise.

**Direct Approach**

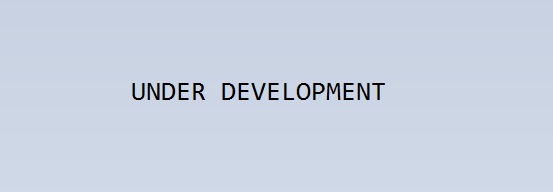
We abandoned the old system and immediately adopt the new system. This can be extremely risky because if something goes wrong, it is impossible to return to the previous system, the corrections must be made on the fly. Regularly, a new system often causes problems for small and large organizations. Case of large systems, a problem can spell disaster, destroying or delaying the performance of the entire organization.

**Parallel Approach**

Information systems operate both old and new until the new system proves to be reliable. This method has low risk. If the new system fails, the organization can maintain its activities with the old system. But it may require a high cost to have staff and equipment to work with two systems, so this method is reserved specifically for cases in which the cost of failure would be substantial.

**4.4 System Installation**

The new system can be installed with the following procedure:



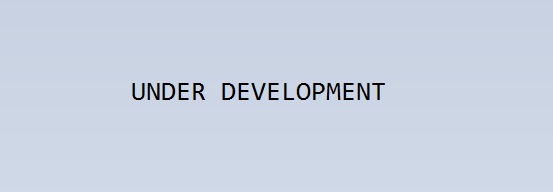
**User Manual**

A User Manual is a set of written instructions that document a routine or repetitive activity followed by an organization. The development and use of User Manual are an integral part of a successful quality system as it provides individuals with the information to perform a job properly, and facilitates consistency in the quality and integrity of a product or end-result.

User Manual details the regularly recurring work processes that are to be conducted or followed within an organization. They document the way activities are to be performed to facilitate consistent conformance to technical and quality system requirements and to support data quality.

The development and use of user manual minimizes variation and promotes quality through consistent implementation of a process or procedure within the organization, even if there are temporary or permanent personnel changes.

Below is the operational procedure of the proposed system.

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**CHAPTER FIVE**

**SUMMARY, CONCLUSION AND RECOMMENDATIONS**

**5.1 Introduction**

Chapter five presents a summary of findings, conclusions and recommendations of the research study. The chapter was guided by the research study objective that sought to establish the influence of computerized biometric employee clocking system on operational performance of organizations.

* 1. **SUMMARY**

The main purpose of the research study was to establish the influence of computerized biometric employee clocking system on operational performance of organizations. The research study set out to answer question, Does computerized biometric employee clocking system influence on operational performance in organizations?. The results showed positive and statistically significant influence of attendance timing and employee identification aspects of computerized biometric employee clocking systems on operational performances. The research study established no statistically significant link between pay computation and operational performance.

**5.2 CONCLUSION**

The Employee Attendance and Payroll System (EAPS) was designed and developed for teaching and non-teaching staff in a tertiary institution. The system uses the fingerprint reader and the webcam device to facilitate the recording of the DTR and generate payroll for the employees. The DTR of the employee was recorded by the system reliably and accurately, and the system includes the identification of fingerprint image, calculation of the time arrival and departure at the school or office, and printing the DTR.

Also, the system generated effectively the payroll and other reports such as pay slip and remittances of the employees. For further improvement of the study, the system needs to include the fingerprint image enhancement for better results of recognition and verification of the system. In matching of the fingerprint image stored in the database, the system requires additional time using the sequential order particularly in a large number of records. However, this could be designed to convert the fingerprint image to a unique equivalent number to lessen the time of searching or matching the fingerprint image.

**5.3 RECOMMENDATION**

On the basis of the conclusions made by the study, it is recommended that organizations need to enhance the utilization of the computerized biometric employee clocking system for improved operational performance. Attendance timing and employee identification processes should be streamlined for increased operational performance; however pay computation should be linked to operational performance.

Organizations should invest on technologies that ensure efficiency in operational performance. Operational performance should be kept in mind as organizations upgrade their employee attendance management systems.

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