Design of Integrated Employee Management Information System (IEMIS) using Fingerprint Biometric Authentication to tract Employees of Biase Local Government Education Authority, Cross River State, Nigeria

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ABSTRACT

Employees are considered the most valuable and dynamic assets within an organization, acting as the foundation upon which its success is built. Their performance, particularly in management, significantly influences the overall success of the organization. A Management Information System (MIS) serves as a comprehensive platform that collects, manages, and tracks information related to all employees within the organization. This study aims to design an Integrated Employee Management Information System (IEMIS) to address the challenges associated with traditional manual record-keeping methods, such as document loss and excessive manpower requirements. The system incorporates fingerprint-based attendance monitoring to enhance employee management. The research utilizes the Object-Oriented Analysis and Design Methodology (OOADM) to tackle the existing issues. The system's Graphical User Interface (GUI) was developed using Visual Basic 6.0, while MYSQL, a Relational Database Management System (RDMS), was employed for database development. For simplicity, the system is structured into various modules. Upon testing, the system successfully facilitated computerized management of employee personnel records, wage computation, and attendance tracking using biometric fingerprint data. The developed system proved to be highly effective, streamlining the staff data processing workflow, and enhancing the efficiency and effectiveness of human resource management. Additionally, the system is user-friendly and offers query capabilities for retrieving information.

Key Words: *Management Information System, Integrated Employee Management Information System, Object-Oriented Analysis and Design Methodology, Graphical User Interface*

1.0 Introduction

The competition among companies today centers around the acquisition and strategic use of human resources to maximize profits. Without skilled and competent personnel, organizations face significant challenges in meeting profit expectations and business objectives. Historically, from ancient times to the modern era, companies have recognized the value of a well-developed workforce, positioning employees as their most valuable assets (Smith & Williams, 2023). In contemporary society, significant changes in the business landscape are evident, especially in the

rising costs of goods and services, which have led to increases in employee wages and the cost of living. Employee wage growth is largely influenced by shifts in organizational structure and management practices (Brown, 2022).

Traditional human resource management (HRM) primarily focuses on supporting personnel behavior by collecting employee data, monitoring performance, and ensuring individuals meet organizational goals. To meet these objectives, there is an increased reliance on effective human resource management practices, which not only support the achievement of organizational goals but also drive value through strategic actions, such as adjusting work schedules and fostering professional development within HR management (Ulrich & Dulebohn, 2024).

The widespread adoption of modern Information Technology (IT) has significantly impacted HRM functions. According to Patel & Choudhury (2021) and Larson et al. (2022), the integration of IT has facilitated the sustenance of various HR activities, while enhancing overall HR effectiveness. They also predict that continuous use of Human Resource Information Technology (HRIT) will lead to substantial benefits for HR professionals and further integrate HR services into organizational operations. Ulrich & Dulebohn (2024) concurs, noting that the use of HRIT not only elevates the status of HR professionals but also contributes to the overall importance of HR within the organization.

The Human Resource Management Information System (HRMIS) is designed to streamline and expedite HR processes, improving their quality through automation of essential activities. The adoption of HRMIS has proven advantageous, prompting many organizations to implement it to enhance HR activities. Developing HRMIS as a unified standard is crucial for improving efficiency and transparency in HR management, particularly in public and governmental sectors (Dessler, 2024)."

2.0 Review Of Related Works

In recent years, there has been considerable debate surrounding the nature and role of Human Resource Management (HRM), especially due to the lack of a universally agreed-upon definition and its evolving significance (Storey, 2024, as cited in Bratton & Gold, 2024). While there are various interpretations of HRM, several definitions are widely regarded as foundational (Jones & Liu, 2023).

Haines (2024) defines HRM as an organizational function that focuses on managing people. He further argues that HRM often serves as a supportive function within the broader organizational structure, emphasizing that its effectiveness is critical in addressing human resource-related issues (Haines, 2024).

Bratton and Gold (2024) characterize HRM as a strategic approach to managing employee relations, with the aim of leveraging human capabilities to gain sustained competitive advantage. This is achieved through an integrated set of employment policies, practices, and programs. According to Bratton and Gold (2024), key HR functions include strategic planning, performance appraisals, and employee relations, among others (Bratton & Gold, 2024). **They further identified HRM with the field it covers as shown in figure 1.**

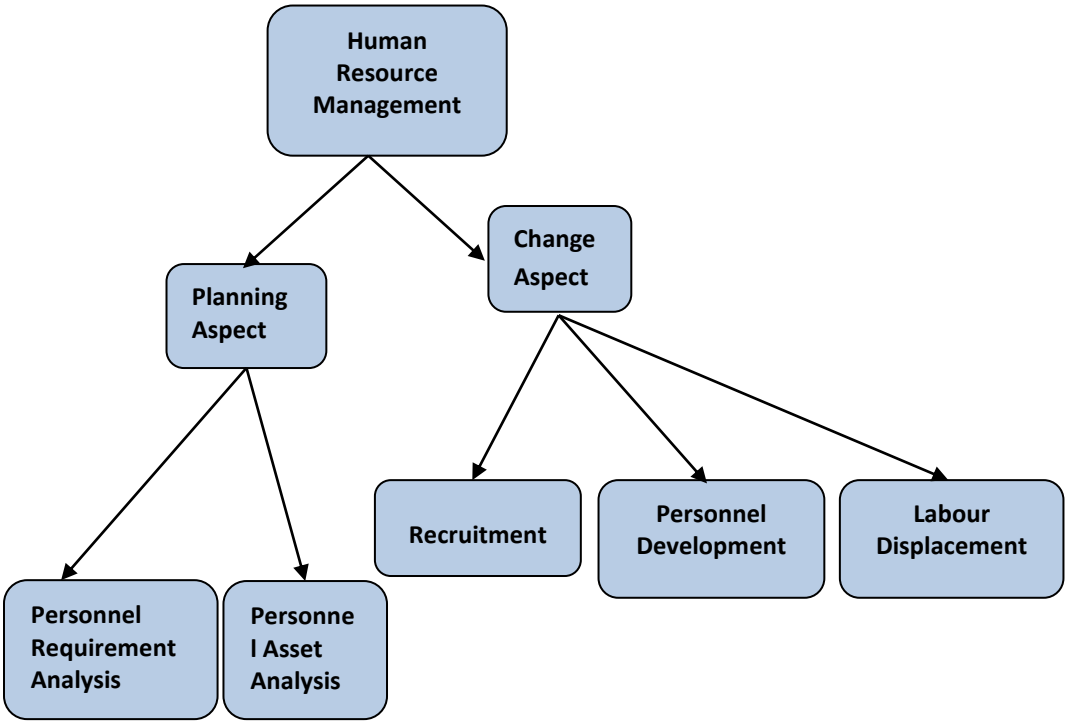

Figure 1: Fields of HRM (Source: Abecker et al., 2004)

3.0 Human Resource Management Processes

This section outlines the key processes involved in Human Resource Management (HRM) duties. These processes include various HR functions such as preparation, employment, career development, and performance assessment. The explanation that follows draws on the work of Dessler et al. (2024) to elaborate on these processes.

The first HRM process is **Planning**. According to Dessler et al. (2024), the primary responsibility of HR is to regularly assess the workforce to ensure that the organization has the right number of employees with the required skills to meet its objectives. Human Resource Planning (HRP) involves forecasting future workforce needs based on projected organizational goals, while also planning for workforce supply to align with those needs. This process requires anticipating labor demand and adjusting the workforce accordingly to ensure that the organization's staffing levels and competencies remain adequate.

The second process is **Recruitment**. Recruitment refers to the process of attracting a sufficient number of qualified candidates to fill job vacancies within the organization (Dessler et al., 2024). The recruitment process begins when a vacancy is identified and ends when candidates have submitted their applications, typically in the form of resumes or application forms. Recruitment involves several steps: identifying job vacancies, determining job requirements, and selecting appropriate recruitment methods. The HR department, sometimes in collaboration with other departments, identifies these vacancies. Afterward, job specifications and descriptions are reviewed to determine the exact qualifications and competencies required. At this stage, the most suitable recruitment methods are

chosen, with no single method being universally best. As Itika (2024) notes, recruitment plays a crucial role in ensuring the organization attracts the right talent, which ultimately impacts the quality of the workforce. Clear policies on recruitment and selection are important to avoid biases and ensure transparency throughout the process.

The third process is **Selection**. Selection involves choosing the most qualified candidates to fill positions within the organization. The process typically begins by reviewing applicants' data, including information about their current employers, whether they are being considered for promotion, or if they are applying as external candidates. The selection process generally follows a structured sequence, starting with receiving applications, screening candidates, conducting aptitude tests, holding interviews (e.g., preliminary, reference checks, and supervisory interviews), and performing job previews. The selection process is governed by legal and managerial frameworks to protect both the candidates and the organization (Dessler et al., 2024).

Finally, the processes of **Orientation, Training, and Development** are essential for integrating and improving employees within the organization. Orientation helps new employees familiarize themselves with the organization's culture, values, expectations, and work environment. It is part of the organization's broader commitment to social responsibility (Dessler, 2024). Training equips employees with the necessary skills and knowledge to perform their current roles effectively, while development focuses on preparing employees for future responsibilities, particularly in management. Training addresses current job needs, while development aims to prepare employees for potential future challenges and enhance their competencies for long-term organizational success. These processes are crucial in ensuring that organizations not only hire the right people but also support their ongoing development to meet both current and future needs.

4.0 Development Of Human Resource Management Information System

Recent advancements in technology have led to the development of real-time, information-based, self-service, and interactive job environments. Human Resource Information Systems (HRIS) have evolved from simple computerized record-keeping systems in the 1960s into comprehensive reporting and decision-making tools in recent years (Gerardine, 2024). Today, both human resource managers and employees are increasingly taking on tasks once considered the exclusive domain of HR experts and administrative personnel. This shift reflects a significant improvement in managerial efficiency and marks a departure from traditional practices. With greater authority and easy access to critical information, decision-making processes are accelerated, allowing both managers and employees to respond to changes more swiftly (Lengnick-Hall & Beck, 2024).

Laudon and Laudon (2024) explain that an information system is technically defined as a set of interrelated components that perform functions such as data processing, storage, retrieval, and sharing of information to support control and decision-making within an organization. They further argue that in addition to these fundamental functions, information systems help managers and employees analyze challenges, envision complex problems, and develop new products.

Kovach et al. (2024) describe HRIS as an organized system that performs key functions such as collecting, storing, maintaining, retrieving, and validating the information needed by organizations to manage human resources, personnel activities, and other organizational requirements. Additionally, HRIS helps to integrate human resource management (HRM) with information technology, enhancing both HR operations and decision-making.

4.1 System Design and Methodology Adopted in the research

Object-oriented analysis and design methodology (OOADM), which is adopted in this work, is seen as a set of standards for application design and system analysis. It

employs a formal, systematic approach to the analysis and design of information systems. Object-oriented design (OOD) elaborates the analysis models to create implementation specifications (Smith & Johnson, 2024; Harris, 2024). Figure 2 shows a typical structure of OOADM.

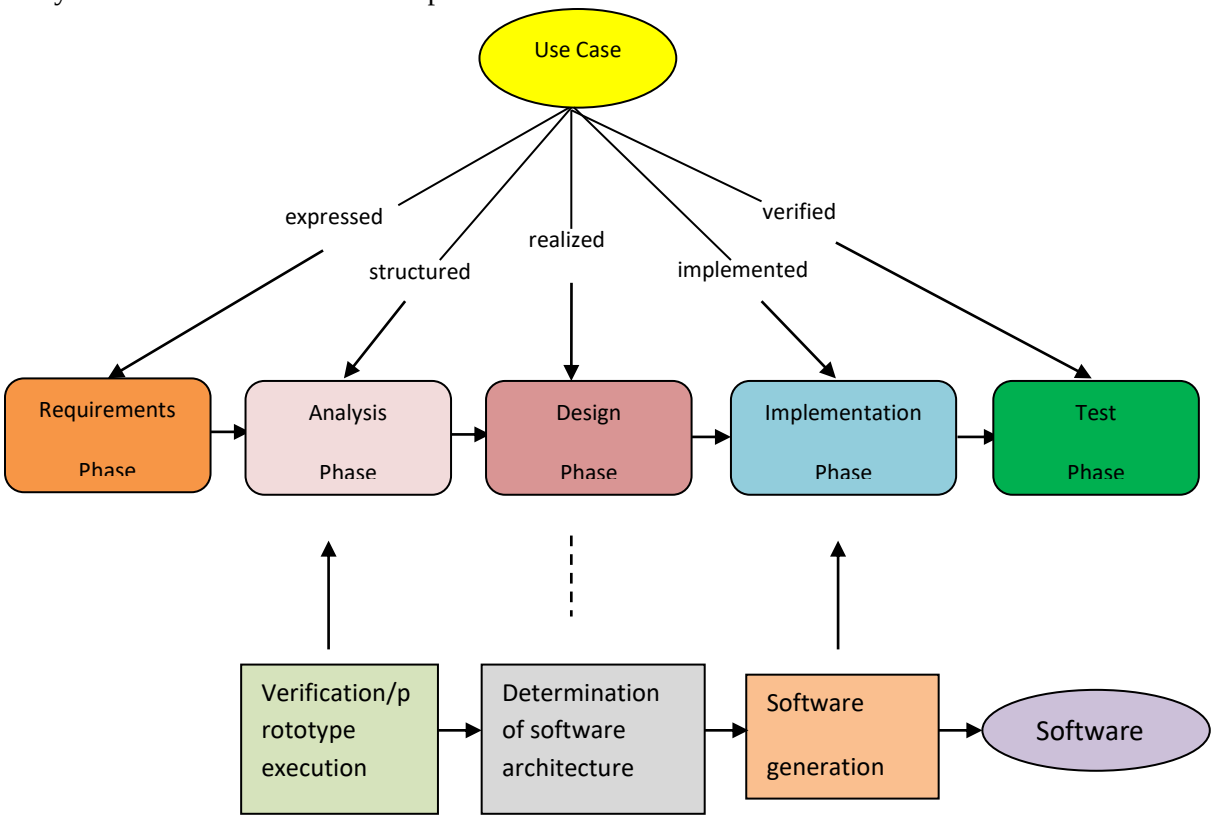

Fig. 2: Typical Structure of OOADM

Object-oriented analysis and design methodology (OOADM) which is adopted for this research, makes use of Object Oriented Programming (OOP), which does not use centralized control, rather, all objects are created equal and control is an interaction between the objects that collaborates to achieve a certain functionality.

4.2 Analysis of the Existing system

The human resources unit is one of the most essential components of any organization. It is managed by an administrator who is typically supported by competent personnel, as shown in the organizational structure of the human resources department (Johnson & Thompson, 2023). These specialized officers include managers responsible for human resource development services, officers in charge of public (social) service sections, the training manager, and the public officer responsible for insurance policies. Additionally, the human resources department houses personnel officers, lawyers, and clerks who handle specific roles within the organization (Martin & Green, 2021). Figure 3 shows the human resources department's organizational structure.

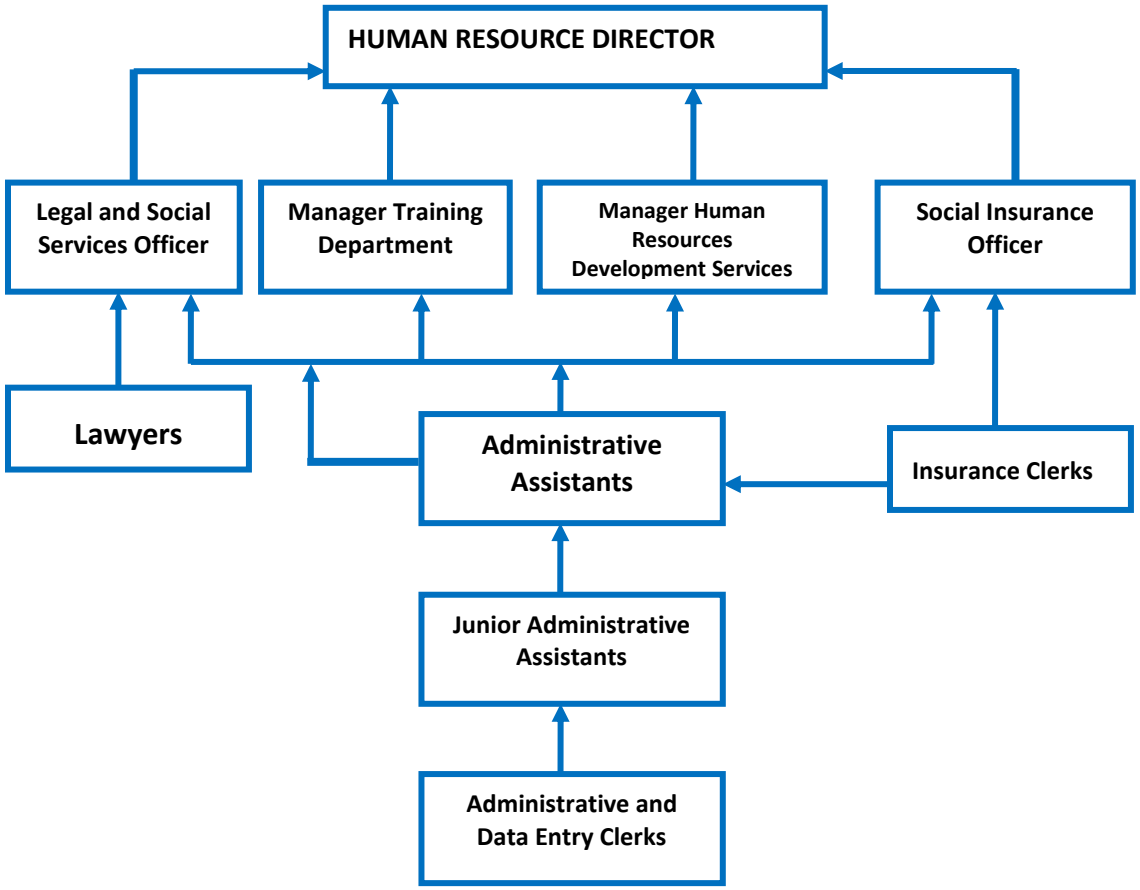

Fig. 3: Human Resources Department's Organizational Structure.

The human resources department's responsibilities in any functional establishment are stated below:

i. advertisement, employment and declaration of vacant posts within the organization.
ii. employee information management.
iii. Manages as well as monitors the progress of employee from their entry point to their retirement, or to other forms of termination.
iv. management of internal and external grievances within the organization.
v. manages labour force. This usually aids them in performing for instance yearly projections for the number of employees who are due retirement.

Formerly, this department depended on Microsoft excel sheets and Microsoft Word for the storage and management of employee data. Most often, because of the dimension of the establishment, the stored files in several cases becomes too large for the organization and then retrieving of data from them for reference purposes or updating is always cumbersome.

4.3 Weakness of the current system

Here are some of the problems associated with the existing systems of employee management information system.

i. Staff file are always large and scattered in different locations that it takes a lot of time to gather the files together and sort out the employee details.
ii. Due to lack of central database for employee information, change of department by an

employee, may result in loss of information on his/her previous performance records and attendance monitoring.

iii. Computation of salary is cumbersome and results in most cases to error.

iv. Compiled payroll report may take longer time that payment will be delayed since the computation is done on a Microsoft excel file departmentally.

4.4 Analysis of the Proposed System

The proposed model of HRMIS contains 3 components (i.e. modules):

i. Administrative module;
ii. Attendance module;
iii. Payroll module.

In the new system, increase of the HRMIS essential components is probable, which include performance records, training and learning, task manager etc. The human resource departments still have the ability of handling the huge task of administering information for all the workers irrespective of the fact these departments are independent. So, for the department to be functional and able to meet up with the activities like updating of employee's information which are spread through the whole firms.

The new information system would serve as a major source of information for employee, and would guarantee quick retrieval of information especially to officers that are due retirement. It would also help management to easily and conveniently forecast when an employee is due retirement or due promotions. Ministries Departments and Agencies (MDAs) as well as International Donor Agencies (IDAs) would also depend on these information systems as a source of information for their various functions.

Before now, processed documents were kept in files and stored in file cabinets. This system of storing hard copies files was very primitive and disadvantageous because retrieval of information from them was very difficult. In most cases time consuming, and sometimes leads to lose of employee files hence loose vital information about the employee.

In addition, there may be a common need of identifying an employee full name, especially for elderly employees who cannot retain their identification number. This system would search and fetch the information very easily. The designed system monitors staff attendance using biometric data capture. Staff clocks in and out every day. The system will automatically surcharge a staff once he/she is late to work. It will compile the surcharge and deduct it from the staff salary at the end of the month. Access limitations and database security is highly maintained in the new system. Each user is required to supply his details before having access to the new system. This data is encrypted so as to avoid hackers from gaining access to the system. The administrator can also terminate user's access to the system as the need arises.

Access to reports generated by the new system and the computation platform is shared among various departments that make input to the new system.

4.4.1 Strength of the Proposed system

The new model of an employee management information system developed has so many features that helped to solve the problem with the existing system. The features include:

1. Employee's records are authenticated using fingerprint thereby eliminating impersonation in signing attendance
2. Computations are automatically carried out by the system, here eliminating erroneous computations encountered in manual computations.
3. Staff data is centralized hence it is easy to track records.
4. Compilation of reports is easier and timely

4.4.2 Data collection methods

The researcher relied on the following for the purpose of data collection:

i. Interview Method: Unstructured interview was conducted with a few individual within the sample frame to find out their opinion about the subject matter of the research. The method of staff recruitment, management, and computing payroll in the organization, the formula used for calculating tax, allowances and other deductions was obtained. Also sample employee forms and staff appraisal were collected for the purpose of designing the new system.

ii. Libraries: Intensive and extensive use of the libraries both public and private ones were made. Secondary data were obtained from materials such as books, periodicals, journals, magazines and dailies. Such data were used mainly to provide the theoretical framework for the study. Also materials were downloaded from internet for the purpose of this research work.

4.4.3 Model of the Proposed system

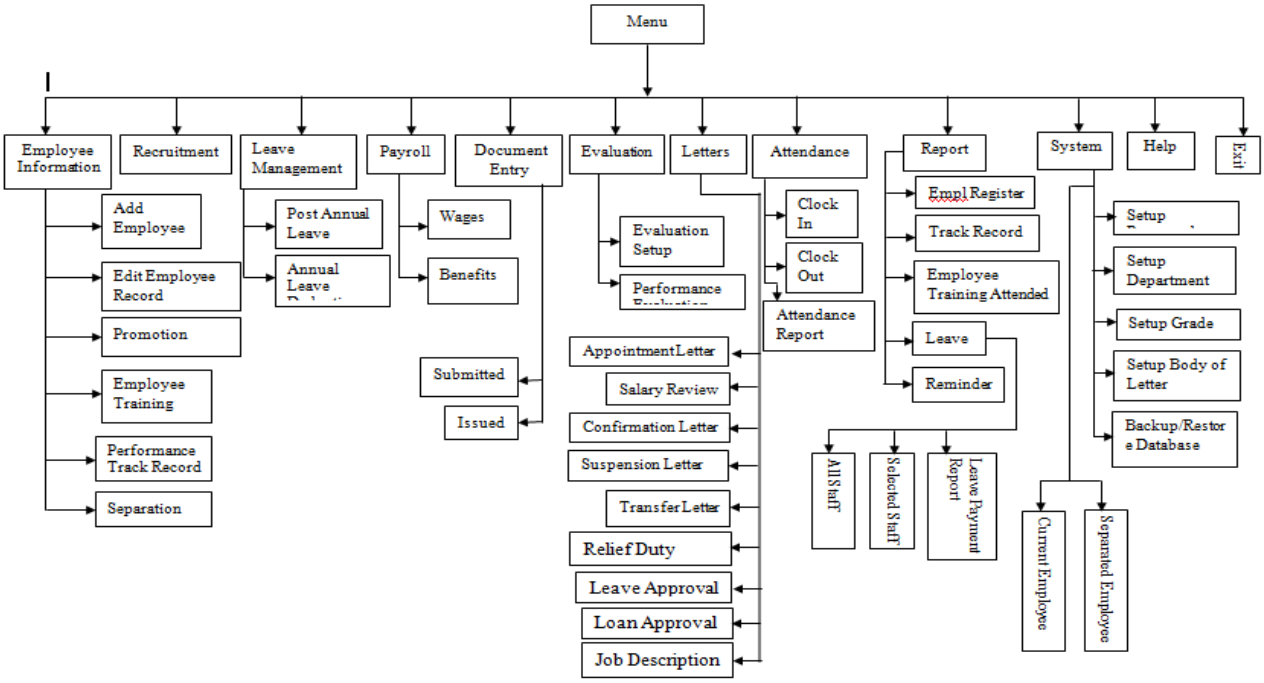

Figure 4: High Level Model diagram of the Proposed System

4.4.4 Data Flow Diagram of the Proposed system

A data flow diagram (DFD) uses a graphical representation to show the "flow" of data through an information system. It is often used as a introductory step for the creation of an overview of a system. DFDs can also be used to show diagrammatically the data structure of the system. It essentially used to show the direction of information in a system. Figure 5 shows the DFD of the proposed employee management information system depicting vividly the flow of information in the system.

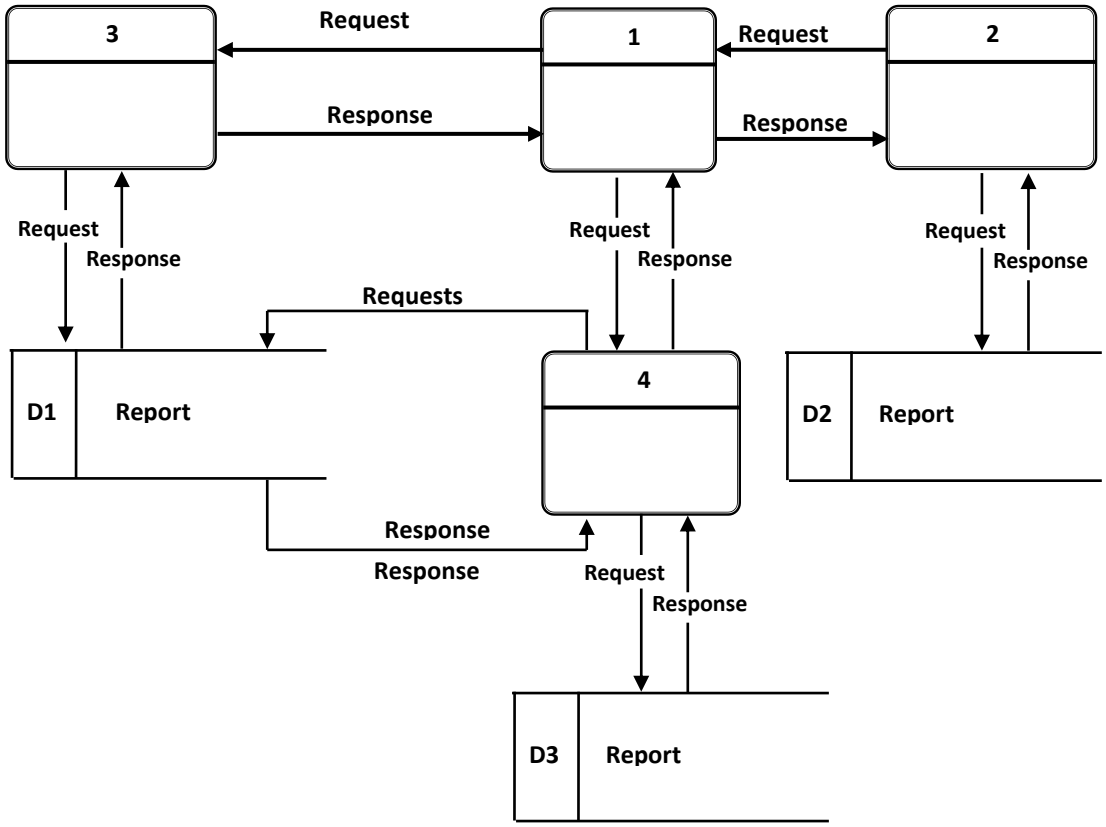

Figure 5: Data Flow Diagram of the Proposed System

4.5
Database Specifications of the Proposed system

The database was designed using Microsoft Structured Query Language (MySQL). The database consists of 11 tables and each table perform specific task in the overall system. Table 1 shows the structure of the attendance table having fields like name, date, time in, time out etc, and the various data types. Table 2 is the table that clearly shows the performance structure of employee and has attributes like officer reporting, officer concern, report, date etc. Other tables are table 3 shows course attended table structure, Table 4; leave table structure, table 5; letters table structure, table 6; recruitment table structure, table 7; shows reminder structure, table 8; staff registration table structure, table 9; staff benefits table structure, table 10; performance evaluation table structure and table 11 clearly shows the payroll table structure having attributes like name, date, designation, amount etc. For want of space, these tables are not included. But we have included a description of their structure in the explanation for purpose of clarity and better understanding of the functionality of the application.

4.6 Database Entities Relationships

Entity Relationship diagrams is a expert graphics that is used to demonstrate the interrelationship between entities in a database. Here, ER diagrams and symbols
will be used to explain interactions within the database of the proposed system. In figure 6, linked objects in the database are presented using Cow's Foot Notation. A discretionary

association is displayed between employee, attendance and biometric.

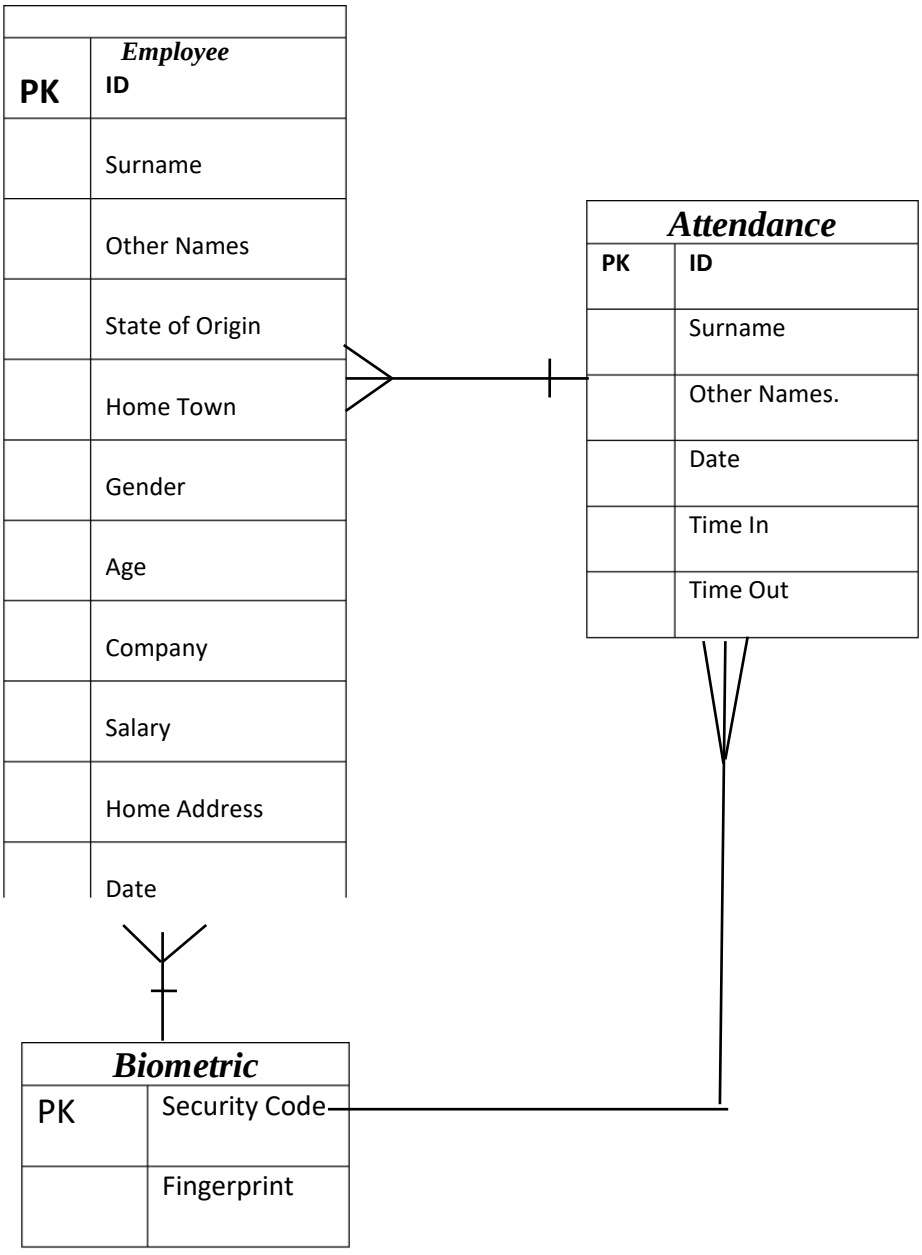

Fig. 6: Database Entity Relationship Model

4.7 Data Dictionary of the Proposed System

Table 1: Data Dictionary

Data Variable	Meaning
Id	Identification no of employee in the database
Name	Name of the employee
Address	Residential address
Phone	Mobile phone number of the person
State	State of origin
Company	Name of the employer
Finger	Fingerprint captured for the individual
Date	Date of employment
Sex	Gender of the employee
Age	Age of the employee
Email	Email address of the registered person
login	This is a module that handles the validation and authentication of user login credentials
pic	This is employee picture or image.
HRMIS	Human Resource Management Information System
HR	Human Resources

5.0 Results and Discussion

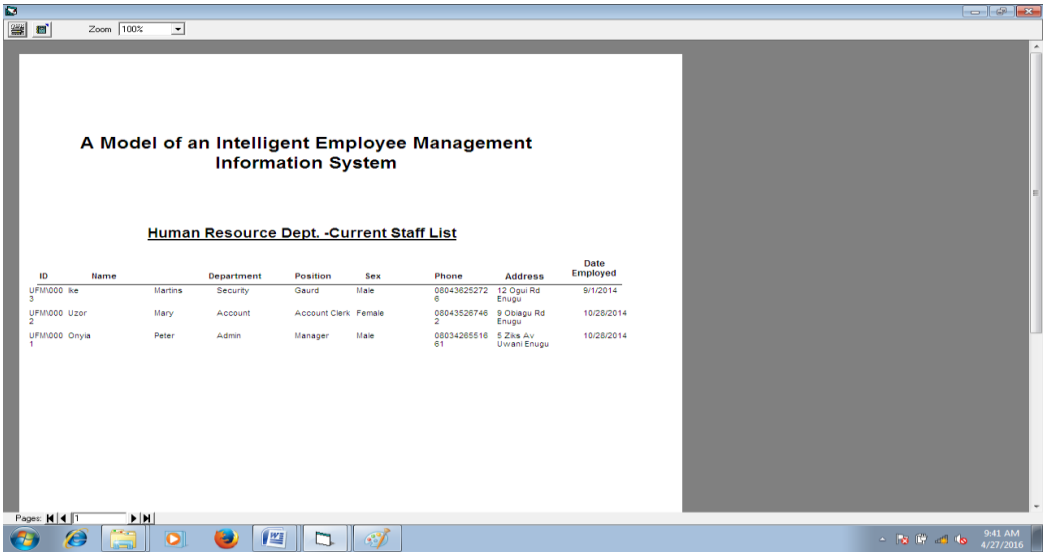

Fig 7: Current Staff Report

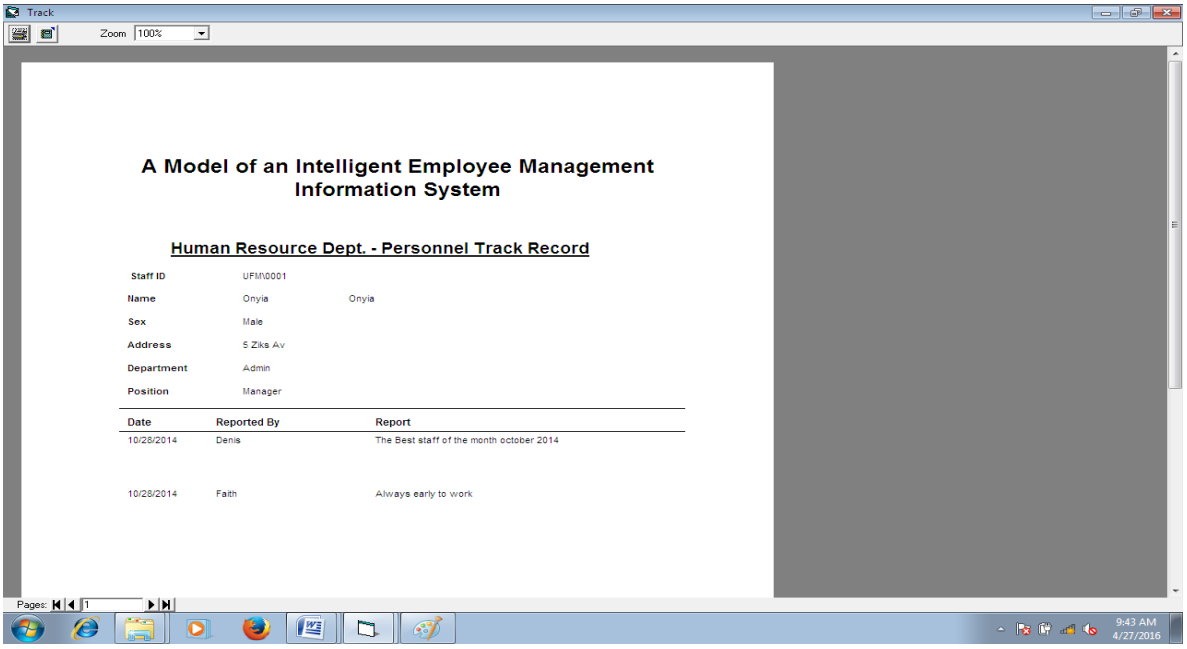

Fig 8: Staff Track record Report

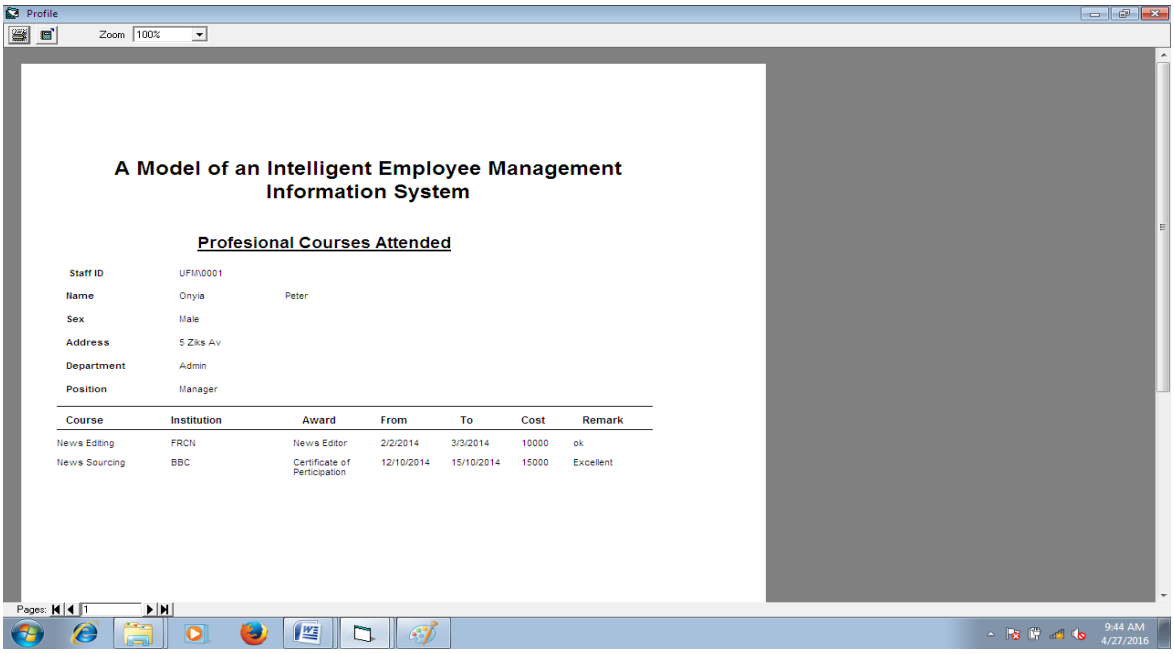

Fig 9: Staff professional courses attended Report

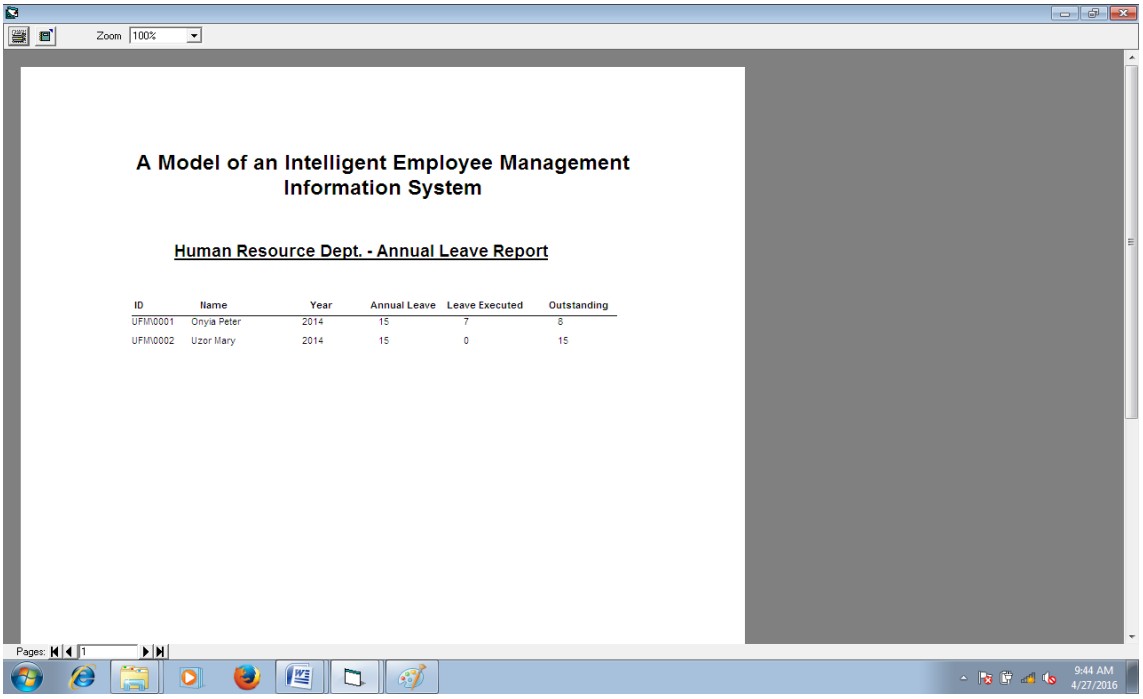

Fig 10: Staff annual leaves Report

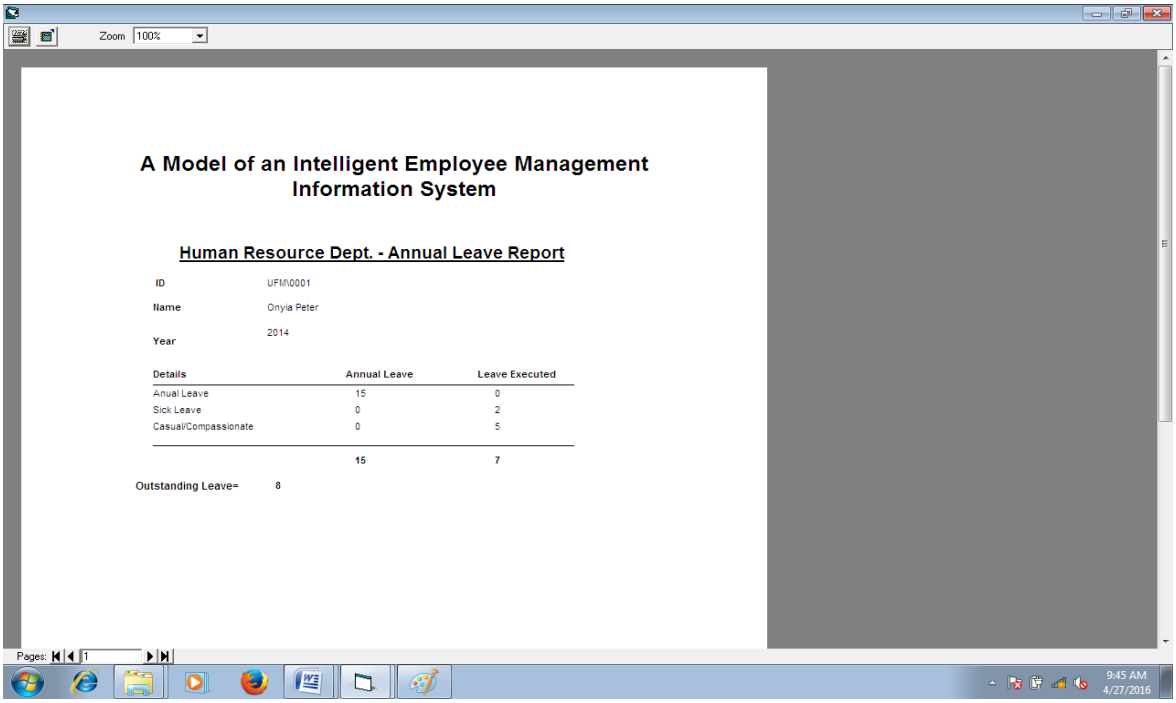

Fig 11: Staff annual leaves details Report

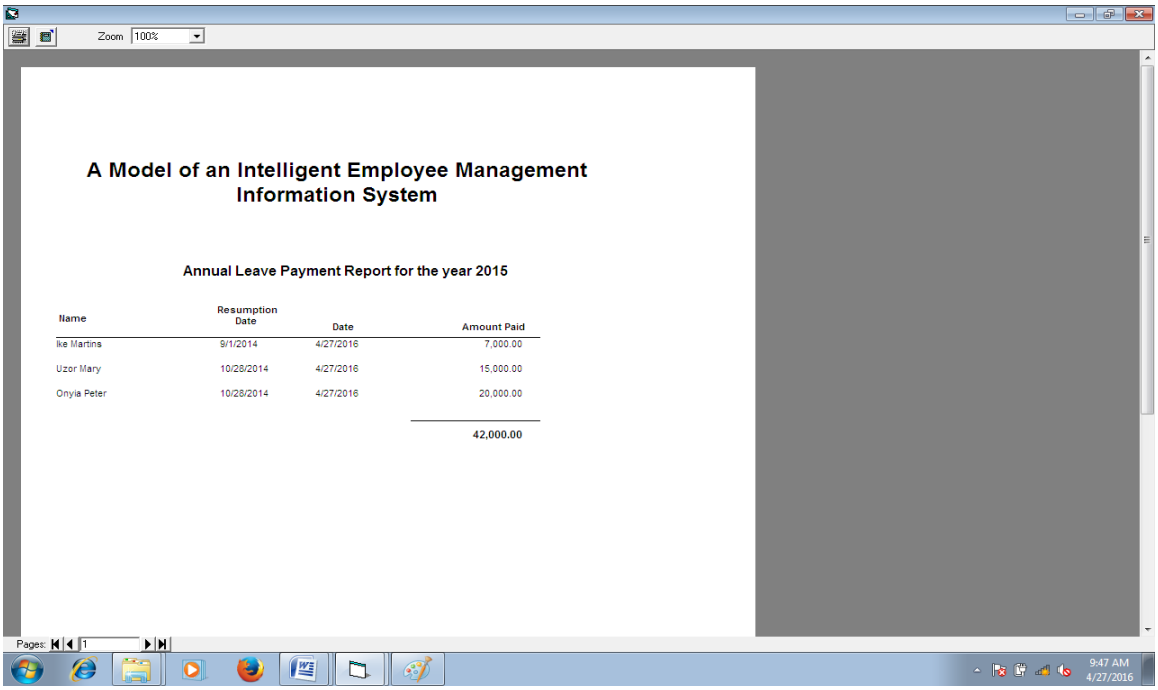

Fig 12: Staff annual leaves payment Report

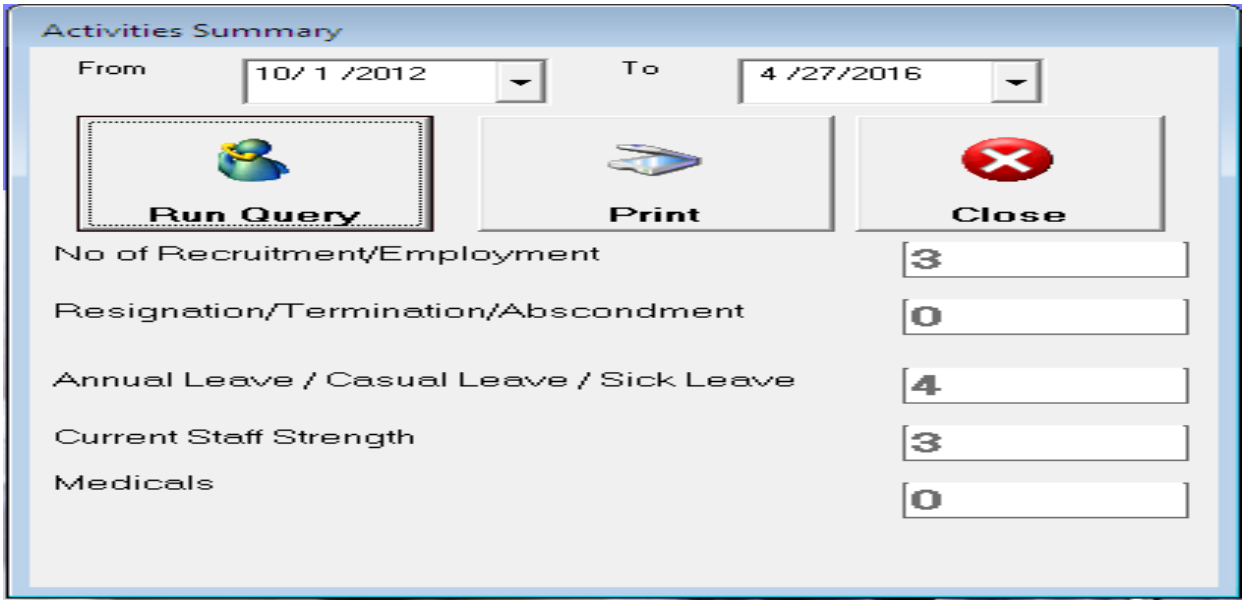

Fig 13: HR Activities Report

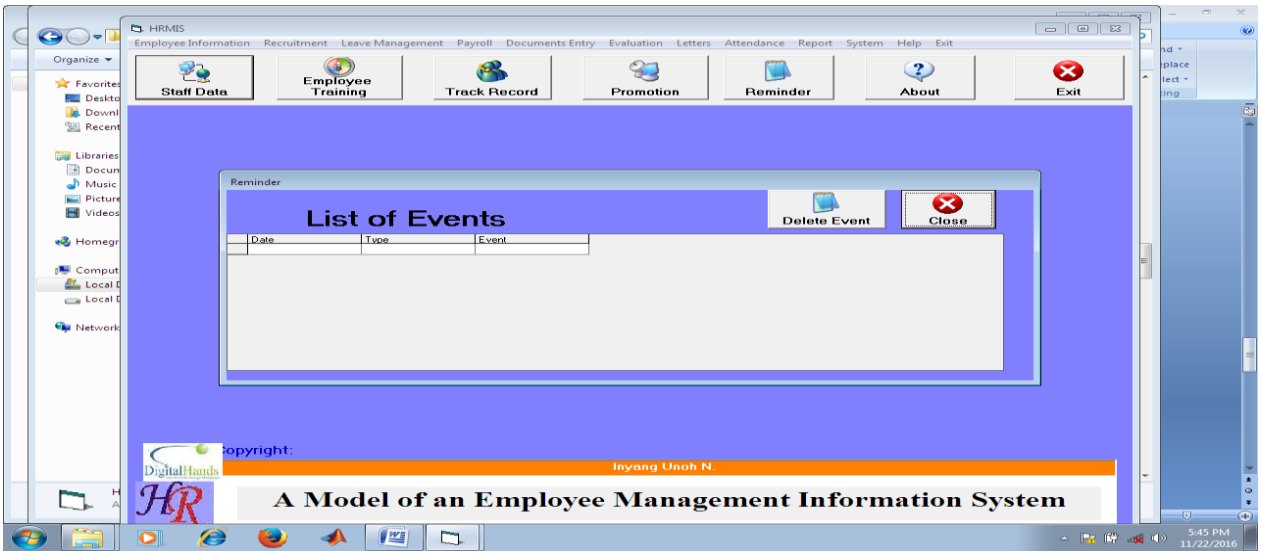

Fig 14: Automatic Events/Document Expiry Alert

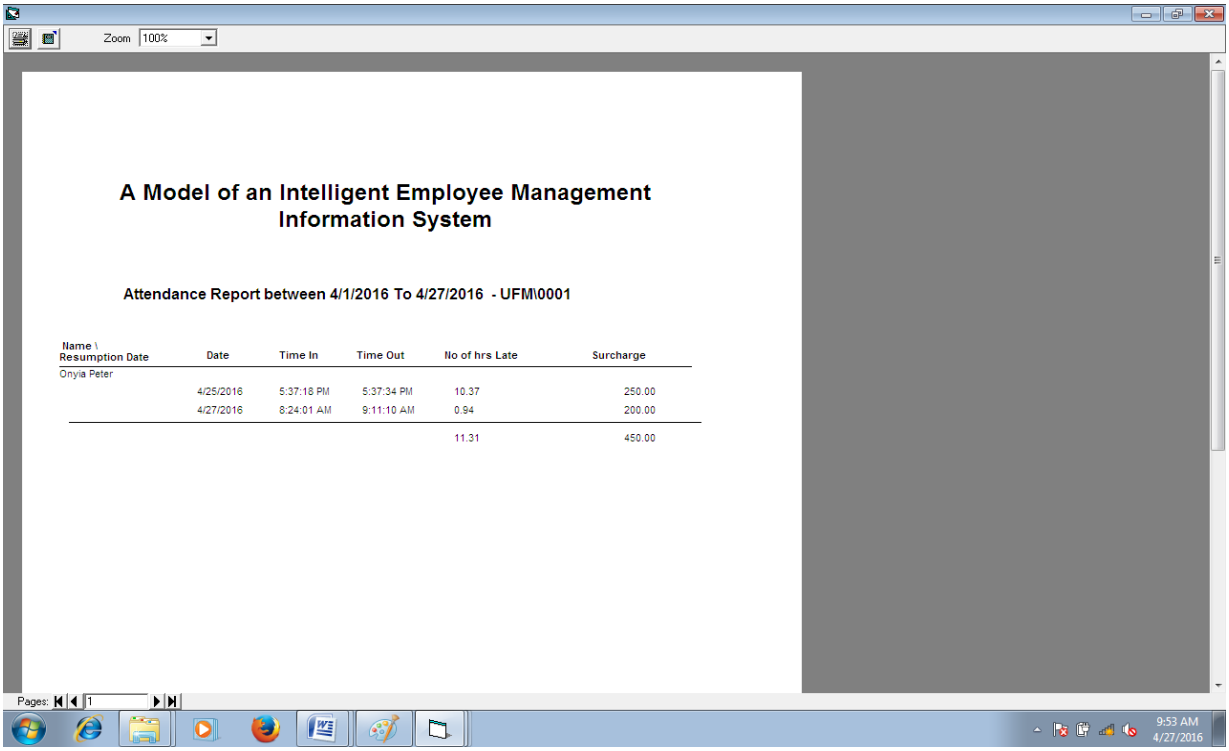

Fig 15: Staff Attendance Report

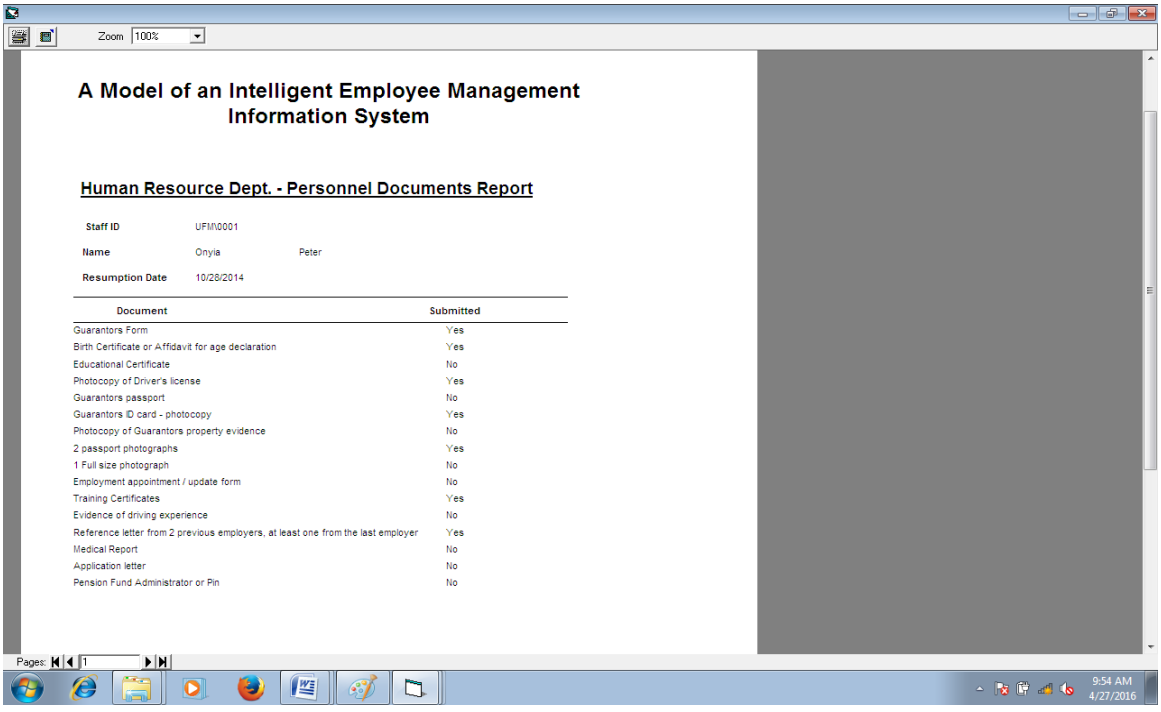

Fig 16: Staff Document Submission Report

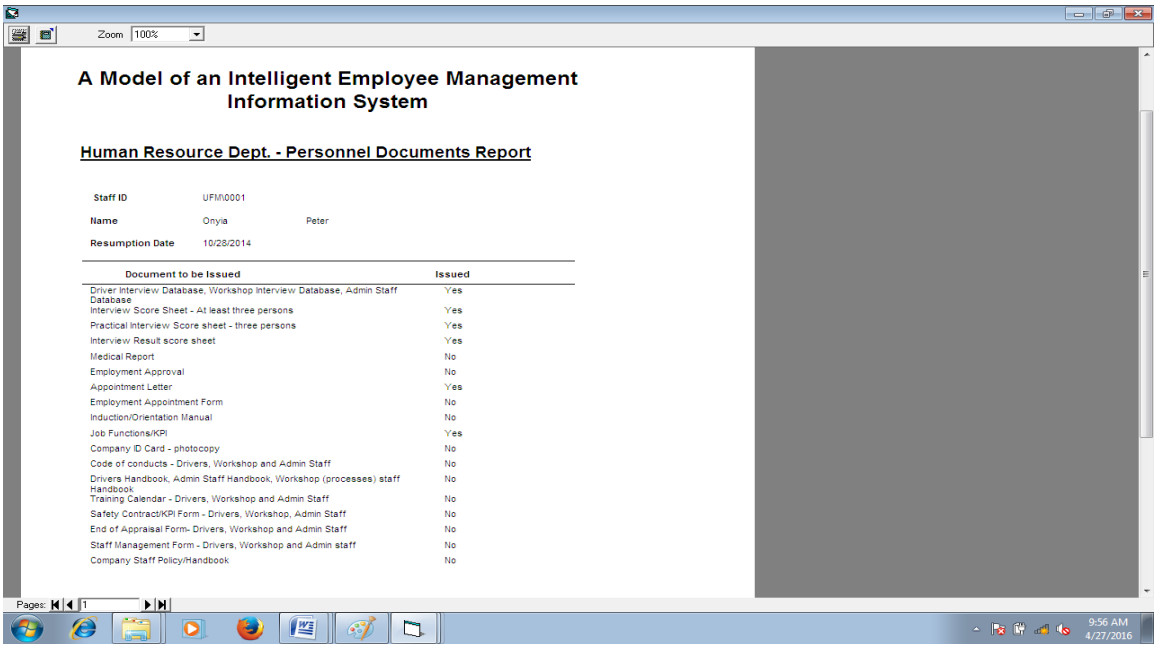

Fig 17: Staff Document Issued Report

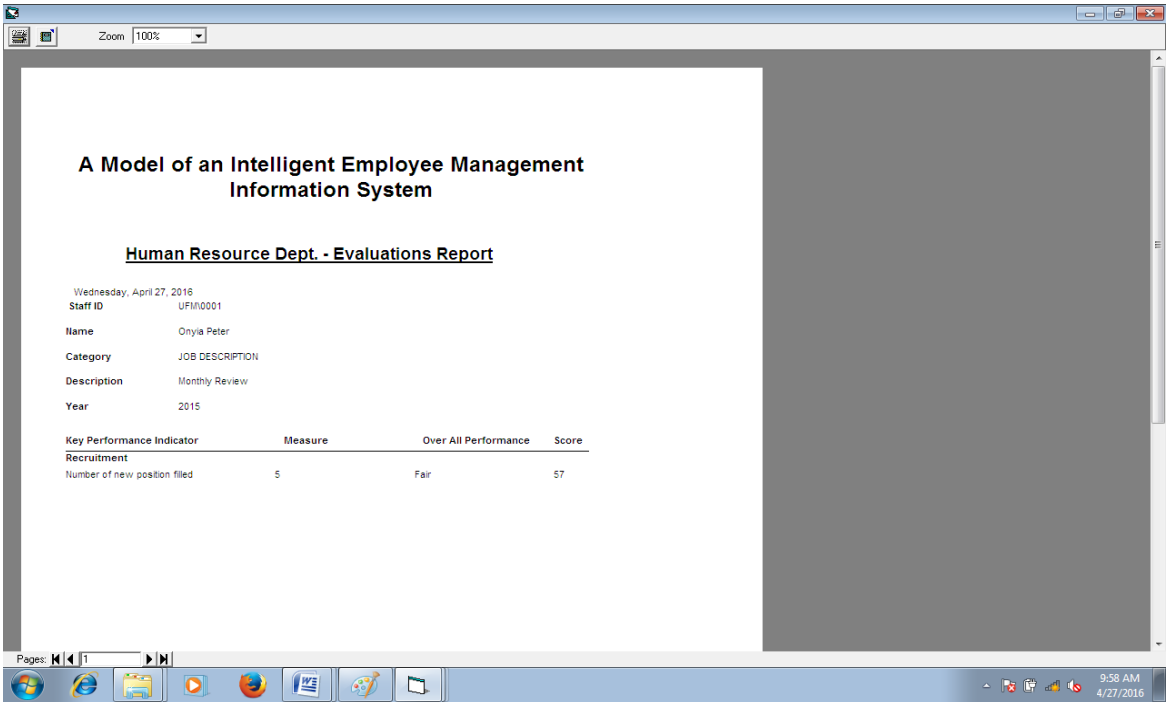

Fig 18: Staff Performance Evaluation Report

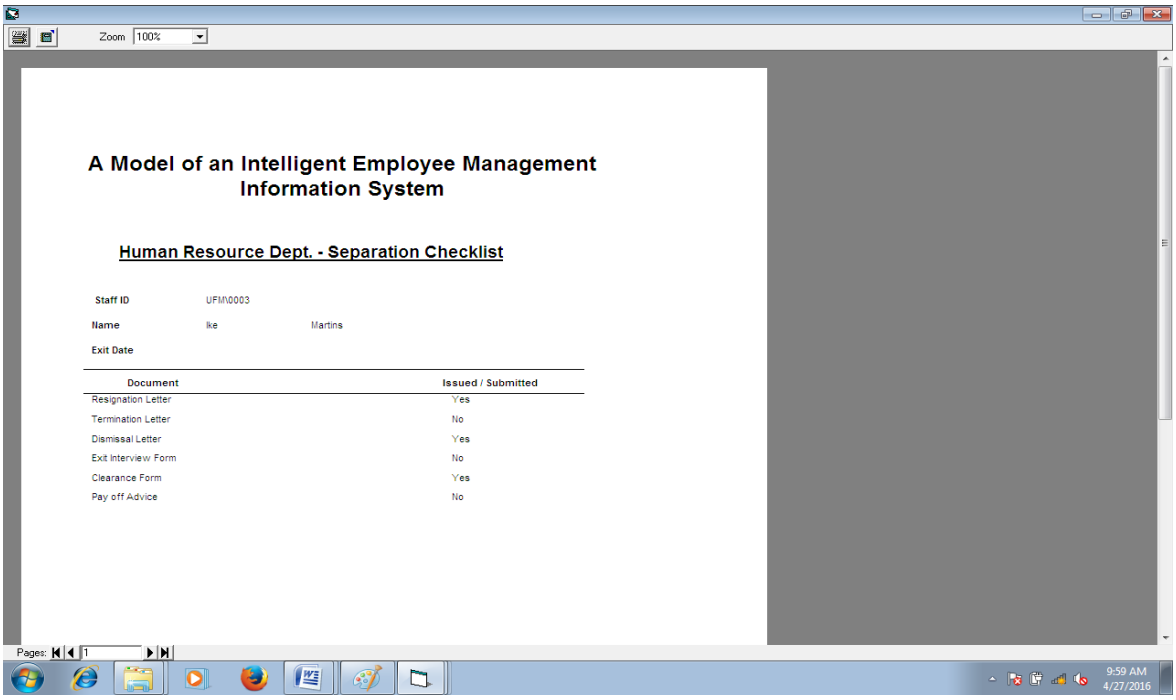

Fig 19: Staff Exit document Report

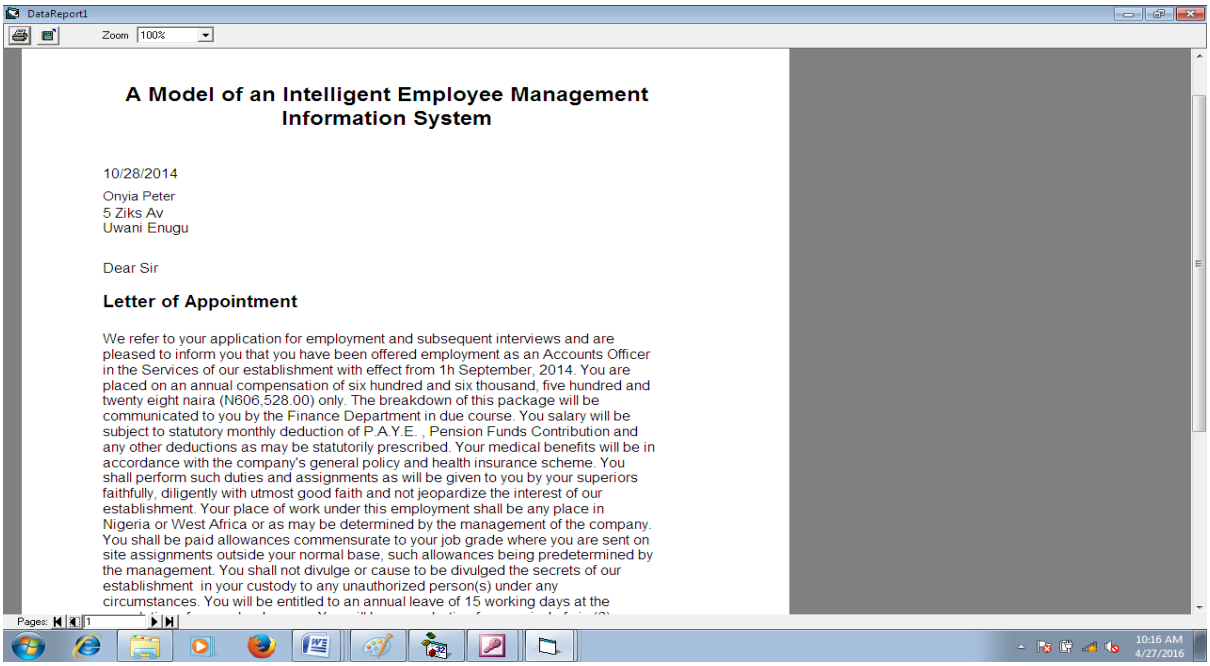

Fig 20: Staff Electronic mail Report

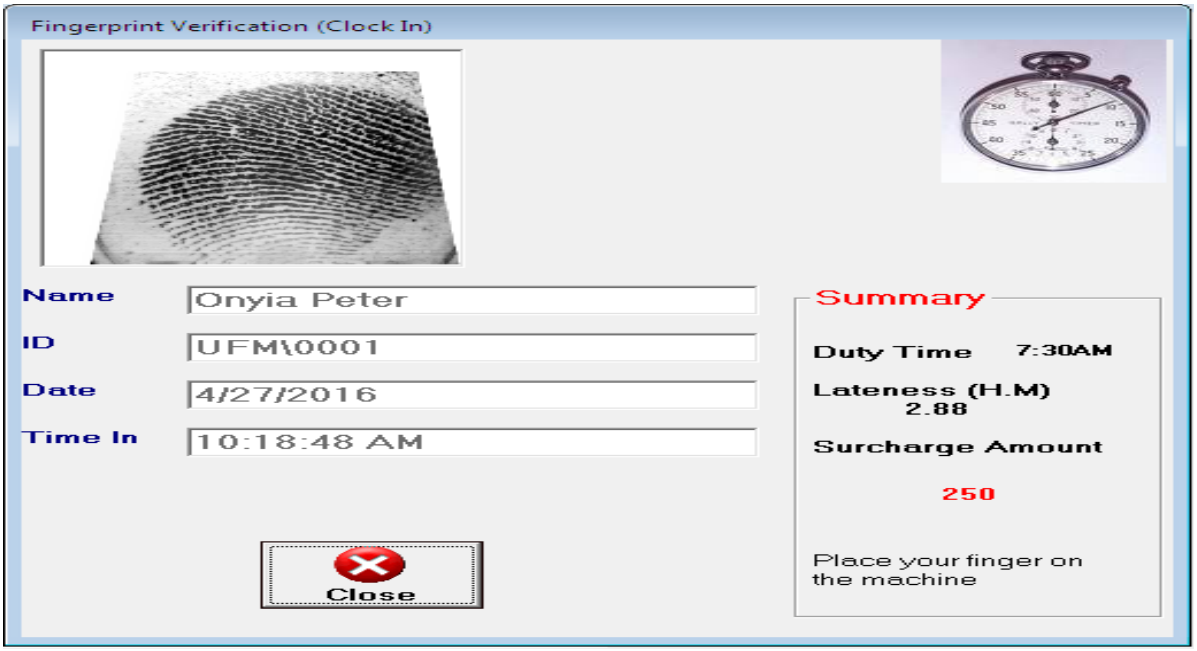

Fig 21: Staff biometric attendance (Clock In)

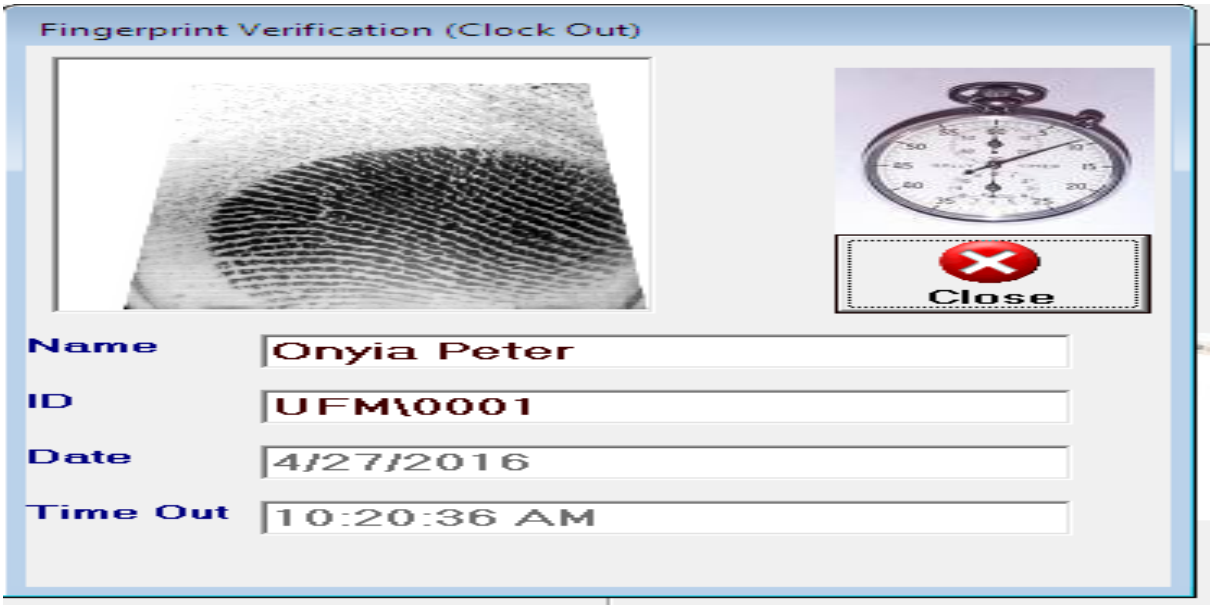

Fig 22: Staff biometric attendance (Clock Out)

6.0 Conclusions and Recommendations

The Human Resource (HR) unit plays a very important role in the administration of every organization. Attention to labour matters on employee recruitment, performance assessment, training, remunerations; issues relating to management and the need to interact effectively with the overall employee management information system are the most crucial ones. Modern employee management information system in large organizations requires the use of electronic device such as computers to cope with these challenges. An employee management information system solution will reduce the costs and errors associated with the collection, submission, approval and administration process, thereby greatly reduce inaccuracies caused by human error, report preparation time, management of labour costs and time misappropriation due to late arrivals and early departure.

The study reveals the fact HR is an integral part of management activities. No doubt, this allows the benefits associated with automation to be exploited to its fullest. It had really assisted many organizations in the areas of communication and or reporting. Management benefits by receiving more accurate, up-to-date information, from which it can forecast, plan and control.

Deadlines on issues relating to the employee management (e.g. recruitment, performance assessment, payment of wages, salaries, allowances, size of staff etc.) and other management issues (e.g. surcharge deductions) become administratively and operationally effective due to benefits derived in automation. The research shows that fingerprint has served several organizations well. No two fingerprints have ever been found identical in many trillions of human and automated computer comparisons. Fingerprints are the basic tool for the identification of people with a criminal history in every security agency. It remains the most commonly gathered forensic evidence worldwide and in most jurisdictions, fingerprints examination out numbers all other forensic examination case work combined together. Moreover, it continues to expand as the premier method for identifying persons, with tens of thousands of people added to fingerprint repositories on daily basis far more than other forensic databases. This facilitated the use of fingerprint in marking daily attendance.

So far, the various modules have been tested and each has proven to be very efficient as an entity (i.e Modules). The system was intergrated and tested which shows all the modules intergrated into subsystem and standing as main system. However, in spite of the success recorded during the test running of this system, future works are hereby recommended:

1. **Improvement on Leave Management:** The leave management module should be improved. This can be achieved by having all leave requests approved by the head of units or departments before submission, rather than going straight to the HR manager. This feature is imperative because the Head of Department should know which of his employees is on leave or to proceed on leave.
2. In future, the system should be implemented using other robust programming tools like Oracle which is more tolerant to many user's access at a time, and more appropriate for a network environment.

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