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An Improved Design and Implementation of a Pension Contribution Monitoring System

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ABSTRACT
Based on the problems of stress, time wasting and inconsistency with the traditional approach employed in monitoring the correct estimation of pension remittances of workers under the contributory pension scheme, there is need for a robust web-based pension contribution monitoring system capable of accurately estimating retirement savings of employees by the inclusion of penal charges on delayed remittance of employees' contributions. This work focuses on the design and implementation of a web-based pension contribution monitoring system to address the gap of non-monitoring of prompt remittance of monthly contributions and non-inclusion of penal charges on late remittances in existing pension management systems. The performance evaluation of the proposed system based on the analysis of administered questionnaires on forty users shows that the system is user friendly, fast, accurately reliable and responsive as attested to by 90%, 97.5%, 85% and 90% of respondents respectively.

Key words: Contributory pension scheme, monitoring, penal charges, pension contribution, remittance

1. INTRODUCTION
Pension matters have been of utmost concern to policy makers in many countries of the world in recent times. Most of the policy makers see pension as a means of making possible privately funded retirement income savings by an ageing employee (World Bank, 1994). The pension system is aimed at expediting equalization of consumption by compulsorily making provision for post service era (Olatunde & Onyinye, 2014; Nervin, 2016).

Contributory pension scheme has been adopted in various forms by many countries, in which the employee contributes certain percentage of his / her monthly salary to a retirement savings account from which their monthly pension would be paid after retirement (Odia and Okoye, 2012).

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Pension is the amount paid an employee by the employer (government or private organization), after the employee must have spent some specified number of years, seen to be too old or not medically fit to work, or have attained retirement age. It can also be defined as a sort of income earned by workers or their dependants after leaving work due to retirement, disability or death (Elekwa *et al*. 2011). Much importance has been attached to pension and gratuity by employers due to the belief that workers tend to be more committed and productive if their future needs are guaranteed. As a result, the need for good and workable pension scheme has been advocated by governments, organizations and labour unions (Adebayo, 2006; Odia and Okoye, 2012).

Nigeria adopted the Contributory Pension Scheme based on the pension Reform Act of 2004, which was amended in 2014. Under this scheme, the employees contribute a minimum of 7.5 percent of their Basic Salary, Housing and Transport Allowances and 2.5 percent for members of the armed forces. Employers shall contribute 7.5 percent in the case of the former and 12.5 percent in the case of the later. In the case of private sector, workers and their employer will contribute a minimum of 7.5 percent each. An employer is duty bound to deduct and remit contributions to the pension fund custodian within 7 days from the day the employee's salary is paid (Pension Reform act, 2014).

In spite of the numerous benefits of contributory pension scheme over the old order, such as guaranteed funding, portability and profitability, uniformity of benefits among others. One major problem facing the implementation of the scheme is the non-remittance of deducted contributions as and when due by some employers, especially in the Nigerian public sector (Uzor and Anekwe, 2018). This has greatly affected the returns on retirement savings of the concerned employees. Monitoring of pension contributions in this kind of circumstance using the traditional / manual approach of estimating actual remittances had been observed to be faced with challenges like time wastage, stress and inconsistency. Moreover, existing automated pension management systems in (CPAS V5; Pension calculator; Okolie, Kuyoro, Lawal and Aina-Marshal, 2012) failed to provide means of monitoring prompt remitting of monthly contributions and inclusion of penal charges on late remittances. Hence, in this study, a Web-based Pension Contribution Monitoring System that is capable of efficiently assisting employees to monitor the correctness of their remitted monthly contributions via the inclusion of penal charges on delayed remittances by defaulting employers is proposed.

2. RELATED WORK

CPASSystem Incorporated v5 is a pension administration system which offer total solution to problems with administration of defined benefit, and defined pension contribution as well as insured benefits for employees and retirees. The browser based software has the capability of efficiently handling the acceptance, management and delivery of information required by stakeholders over the web. It provides integrated pension and benefit plan administration capabilities needed to reduce processing time. The solutions offered addressed management of contributions and benefits, as well as effective delivery of information to members. However, no provision was made for monitoring accurate estimation of remitted contributions.

Pension Calculator is an application that can in a few easy steps give an estimate of the user's retirement savings balance at the time of retirement. This will include approximate gain / loss within the period and basic employer / employee contributions. The user only needs to supply the current / intended working age, date of first contribution and basic pension income amount. The user is also expected to choose the retirement age, calculate the target income of choice at retirement, and state any additional contributions like gratuity, legacy funds and any other sources of income. There is also no provision for the inclusion of penal charges on late remittance of contributions.

Okolie *et al.*, (2012) proposed a web based application to replace the manual method of managing pension fund by the Pension Fund Administrators (PFA). The proposed system aimed to achieve; automation of pension fund management process, managing of pension fund investment activities, and reduction of queues in PFAs offices, providing information to pensioners and keeping their records, and ensuring prompt payment of pension. The system focused on the management of funds remitted to the PFAs, but failed to address the monitoring of prompt remittance of pension contributions and inclusion of penal charges due to delayed remitting of contributions.

Asaleye, Ogala, Aremu, Ogala, Lawal, Inegbedon and Popoola (2019) proposed a secure computerized pension verification system for pensioners to access information on payment of their pension with ease. The system was limited to providing a system where workers can easily be reached without undergoing the stress of standing in a long queue to be screened. However, no attempt was made to monitor prompt and accurate remittance of monthly pension contributions.

The inherited deficiency in the related works reviewed is the non-inclusion of the means of monitoring prompt remittance of contributions by employers, as well as addition of estimated penal charges due to delayed remittances to the pension contributions, which formed the basis for this study.

3. THE PROPOSED SYSTEM

The proposed system is capable of proffering solutions to the problems with the manual method of monitoring pension remittances, such as, stress of calculating penalties for large numbers of employee, keeping of large volumes of paper documents, manual preparation of reports and waste of time due to manual checking of records of employees on request. The proposed system being web-based also allows employers to monitor their pension remittances from their various locations using their digital devices. The rapid application development (RAD) model of software development was used for the development of the system. The RAD model enhances flexibility and adaptability as developers can make adjustments quickly during the development process. RAD is a software development methodology that uses minimal planning in favor of rapid prototyping. Since a prototype is a working model that is functionally equivalent to a component of the product, the system prototype is developed based on one module after another.

Standard software design tools such as use case diagram, block diagram and system flowchart were employed to design the system. The block diagram showing the modules of the system is as shown in Figure1. The proposed system consists of five modules namely; login, employee, user, contribution and report / monitoring modules. The functions performed by each of the modules are described as follows:

Login: This is responsible for managing users' access authentication.
Employee: This module is used for registering new staff and managing their records.

User: This module handles creation of users and their passwords..
Contribution: The module loads monthly contributions and estimates actual monthly retirement savings for all employees.
Report/monitoring: This module is responsible for generating both individual and general reports of employee's monthly contributions used for the pension contributions monitoring..

Figure 2 represents the flowchart of the proposed system. The figure shows the sequence of flow of actions from start to stop. The user starts by logging in and is authenticated as either an admin or an employee. The admin is allowed into the admin window where access to create user, add employee, process contribution and view reports menus is granted. The other user (employee) is allowed into the employee window where individual reports can be viewed.

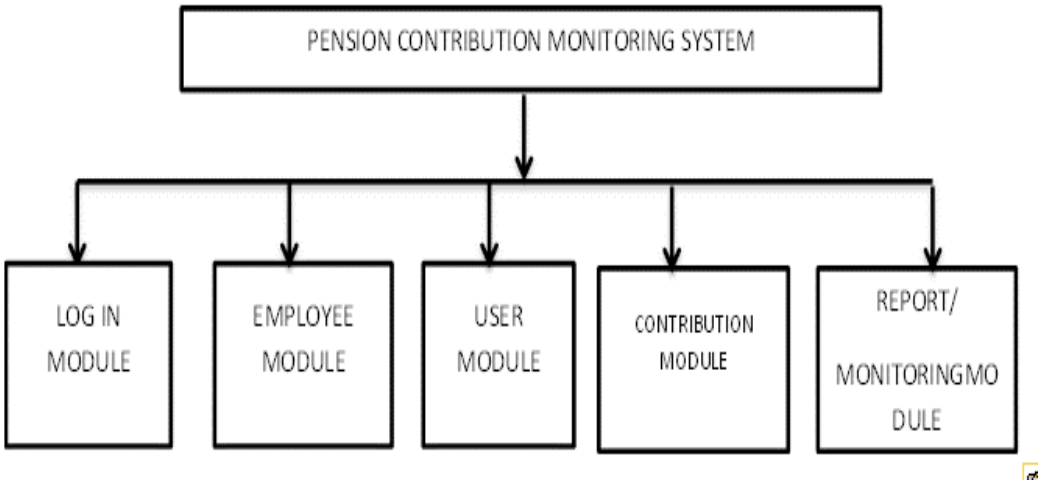

Figure 1: Block Diagram of the proposed system

The use case diagram for the proposed system is as shown in Figure 3. It demonstrates how the users (actors) perform their roles. The two actors in the system are the Admin and Employee. The Admin can login to the system, create user / password, add new employee, process remittances, view reports and log out of the system. The other actor, Employee can login to the system, view individual report and log out of the system. Dynamic web development approach was used due to its advantage of allowing more interaction with the website by the user. (Microsoft, 2013).

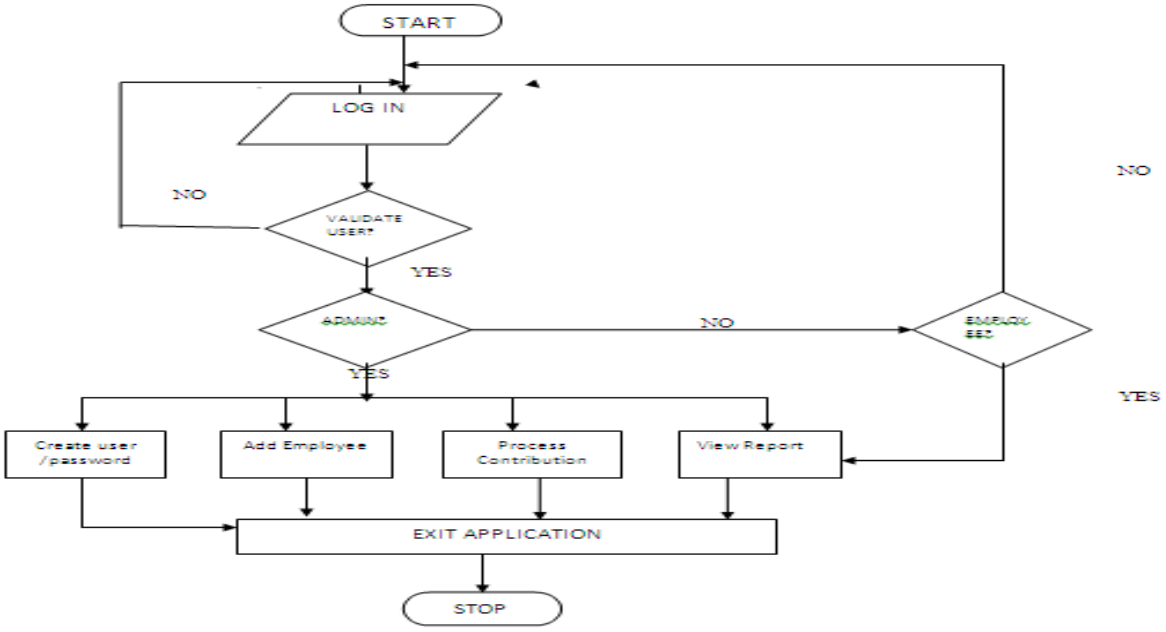

Figure 2: The Proposed System Flowchart

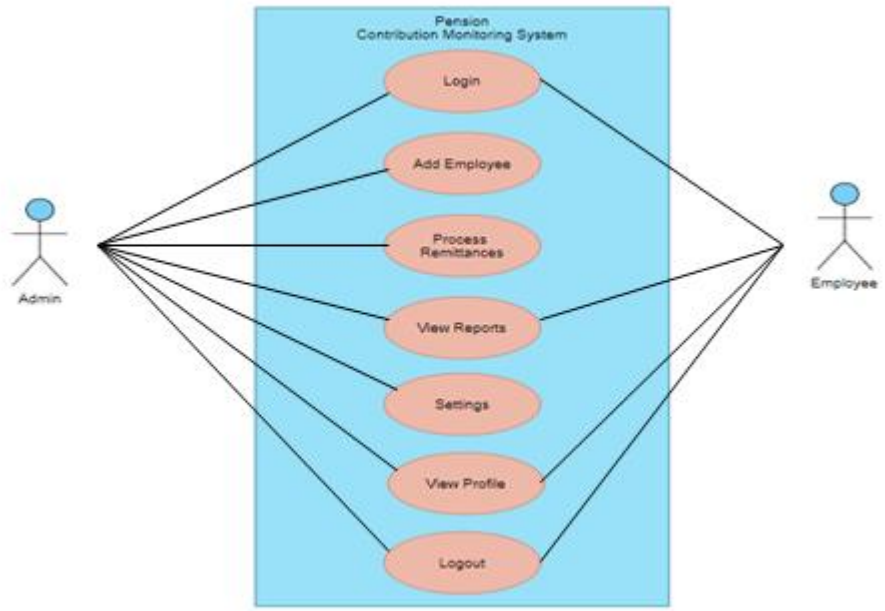

Figure 3: Use Case Diagram of the Proposed System

3.1 Functional Requirements

Functional requirements refer to all relevant external system output behavior notably: consistency, unambiguousness, non-redundancy, and non-contradictory with reference to what the system presents to the users. These specific statements describe the system to be provided and how it should react to particular inputs.

The following are some of the inputs sources:

i. The User, who might be any of these: employee, or admin
ii. An employee should have access to the system with unique ID and password.
iii. An employee should be able to view is monthly pension contribution.
iv. An employee should be able view the detailed financial report
v. An employee should have access to account details
vi. Admin should have access to the list of members of the scheme who are currently employees with vital information about each of them.

3.2 Non-functional Requirements

The non-functional requirements refer to the system quality attributes which enable the system to carry out and fulfill functional requirements. Some of these requirements include:

i. System availability: The system should be accessible 24/7 being an online based system so that the users can access at will.
ii. System authorization and authentication: The system should only allow users with the correct login details to the backend of the system. The system should be accessible by the authorized people and should require user membership to use it and should it have a minimum number of people operating it.
iii. System Integrity and Security: The system should provide a means to trail each action performed in the system. Only authorized persons should input and manipulate the data.

4. SYSTEM IMPLEMENTATION AND EVALUATION

The proposed web-based pension contribution monitoring system was implemented using HTML, CSS, PHP and My SQL for the database. Evaluation of the proposed system was carried out in two phases. First, the functionalities of the system were tested starting with each of the modules and the integrated testing of the overall system functionality. Here, the basic functionality of the individual modules of the system was tested first, one at a time and after integrating it with other modules continuously, and performing functionality test. This includes; testing functionality of each module based on requirements specification, checking validity of data and independence of modules. Also, the database was tested by performing data checks like insert, update and retrieval for all possible transactions. Data validity checks were also done. Screenshots of some of the application interfaces during implementation are shown in Figures 4, 5, 6, 7, 8 and 9.

Secondly, the system was evaluated using questionnaires containing some questions relating to the performance of the system which were administered on forty academic staff of Osun State Polytechnic Iree, Nigeria who had been enrolled in the system and were given access to make use of the system in real life before providing responses to the questionnaires. This evaluation covered four tests which the questions were tailored towards. The usability test was performed to know the efficiency and effectiveness of the developed system in terms of ease of use and user friendliness. The speed test was also performed to show how fast the system is compared to the manual computation of penal charges and the difference between remitted and actual contributions. The reliability test was done to know if the system performed as expected without failure. Lastly, the responsiveness test was carried out to find out the way the system responds to users' requests and invalid inputs.

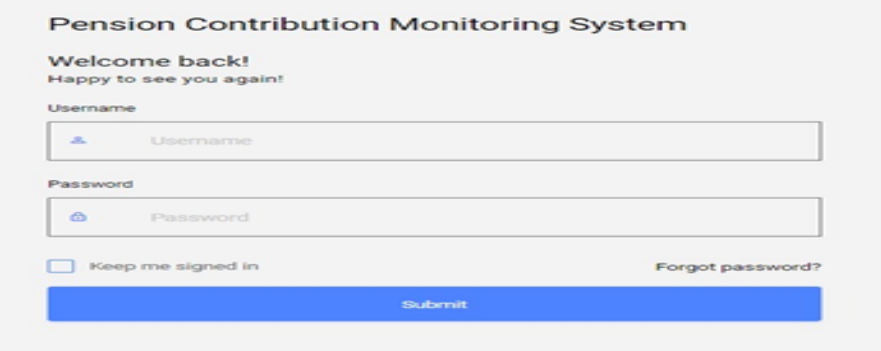

Figure 4: The Login Page

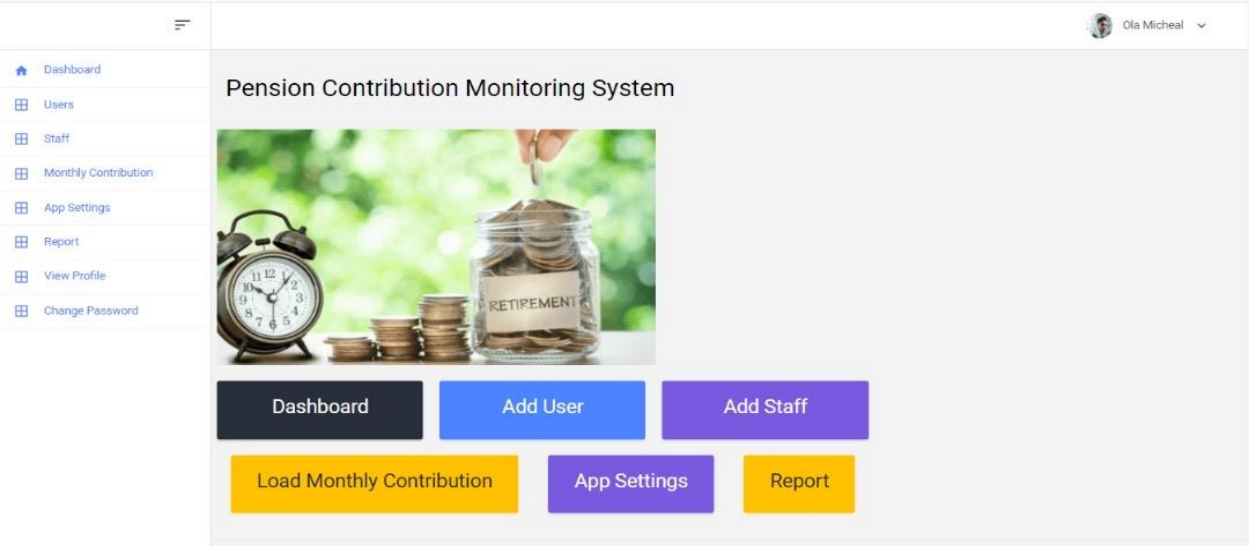

Figure 5: The Admin Dash Board

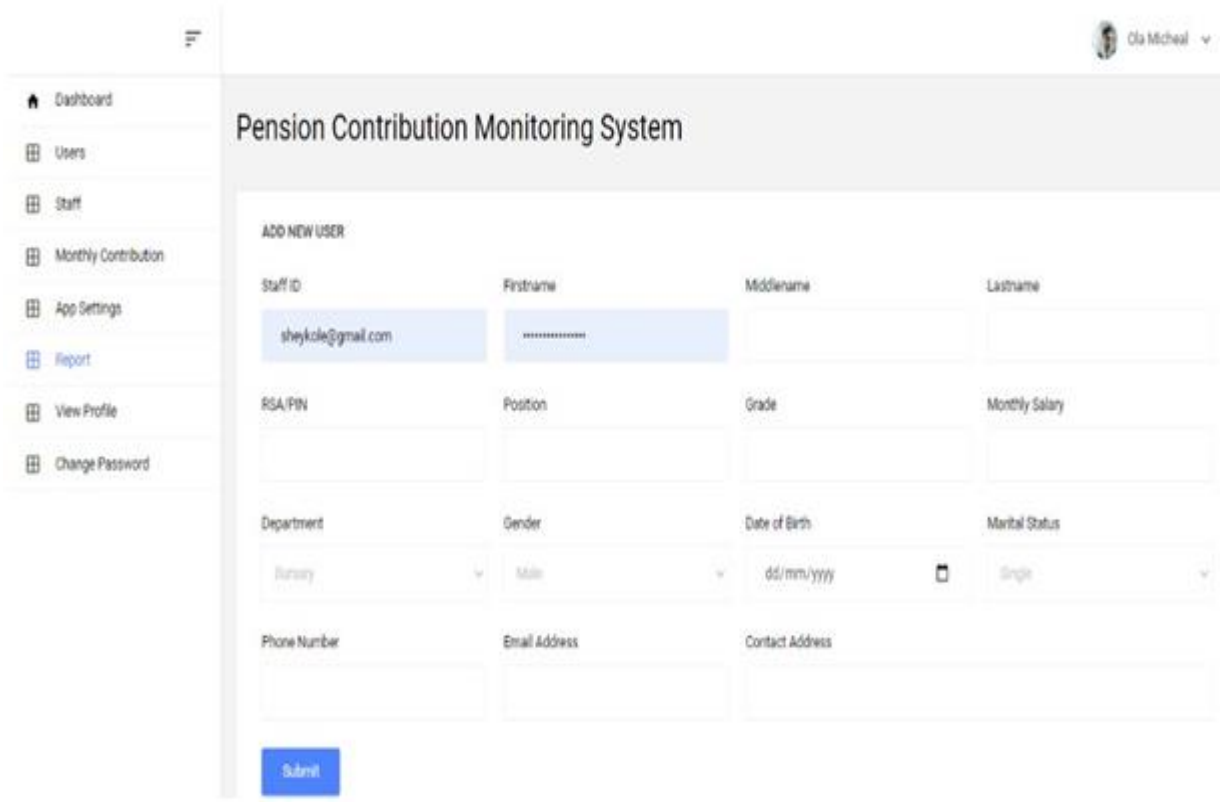

Figure 6: Staff /Employee Page

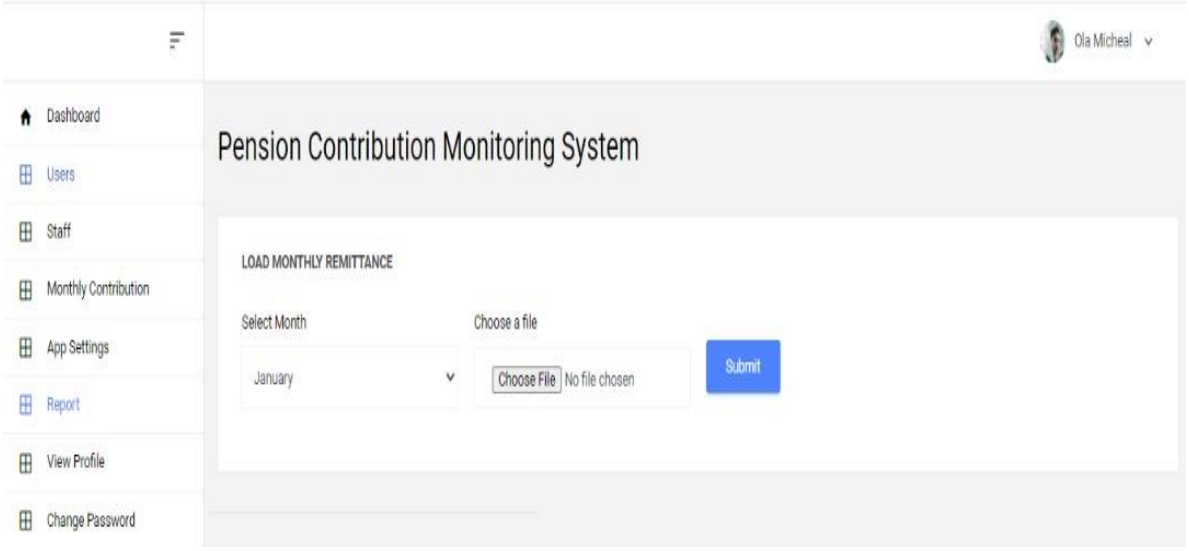

Figure 7: Monthly Contribution Page

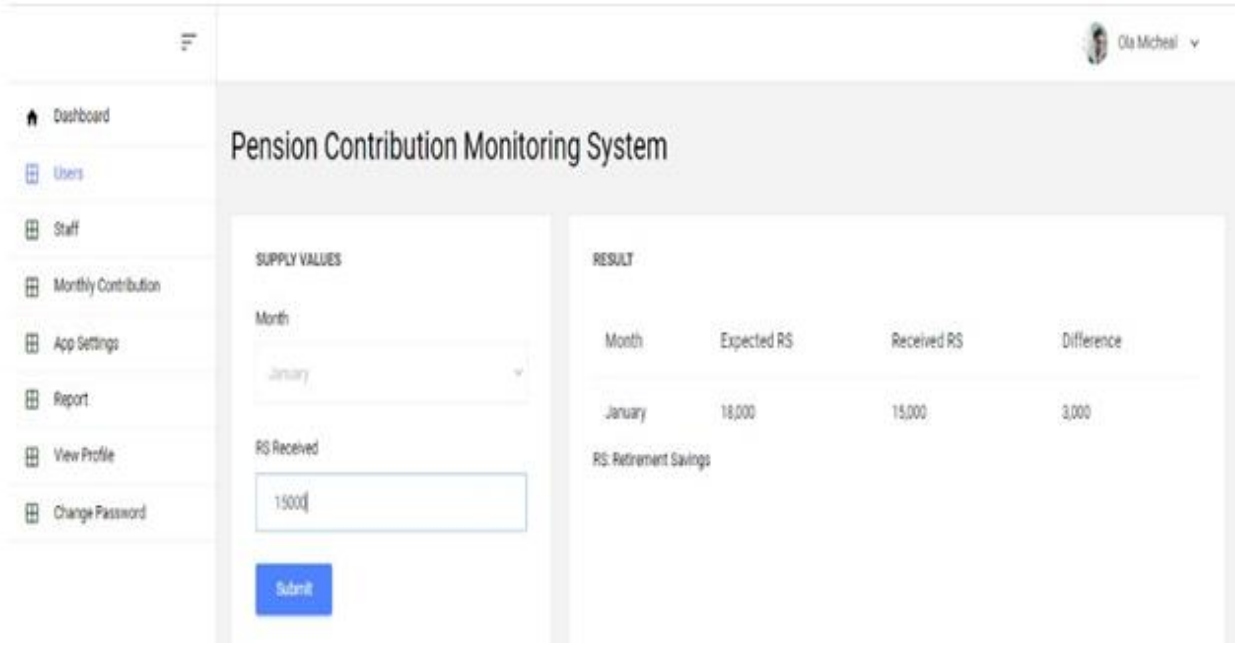

Figure 8: Individual Contribution Report

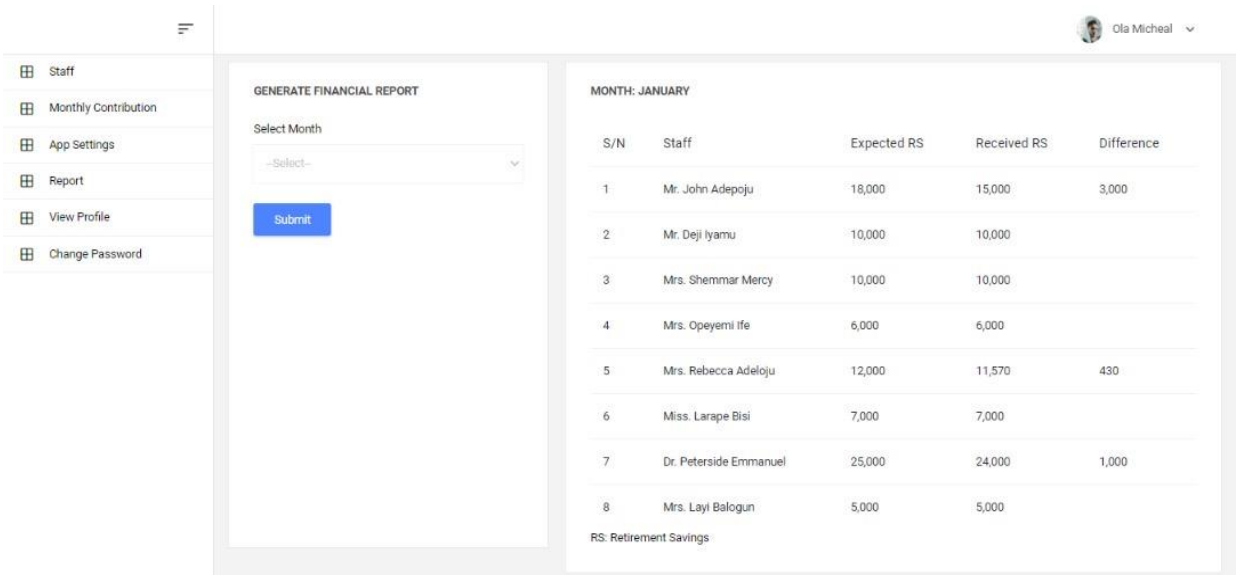

Figure 9: Admin Report Page

5. RESULTS AND CONCLUSION

The results of testing the functionalities of the web-based pension contribution management system showed that all the modules worked properly when tested individually. They rejected invalid inputs and responded promptly to user requests. Database operations such as insert, update, delete and add that were performed yielded expected results, and data consistency / integrity was maintained in the reports generated.

The integration between modules worked properly, for instance, users that were not created were not able to login to the system. Also report is not to be generated for any employee whose contribution was not processed. The results of the second phase of system testing based on responses obtained from the administered questionnaires and graphical feedbacks are as shown in Figures 10 to 13.

The feedback from the questionnaires administered shows that out of 40 users, 36 (90%) of them affirmed that the system is easy to use and friendly, while 4 (10%) did not agree. This shows that the developed system is easy to use and worked properly. 39 (97.5%) of the users agreed that the developed system is faster than the existing one, while only 1 (2.5%) did not agree. This shows that the proposed system operates faster than the existing system. The reliability test result showed that 34 (85%) of the users affirmed the reliability of the system, while 6(15%) did not agree. The higher number of respondents with negative response here may be due to network issues around their locations. Thus, the developed system is reliable and hardly record failure. The responsiveness test also revealed that the system is highly responsive as agreed by 36 (90%) of the users with 4 (10%) not in agreement.

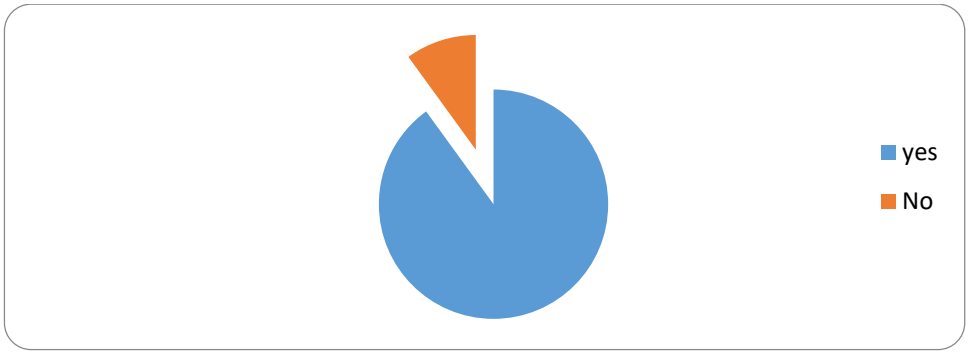

Figure10: Graphical representation of users' response on system usability

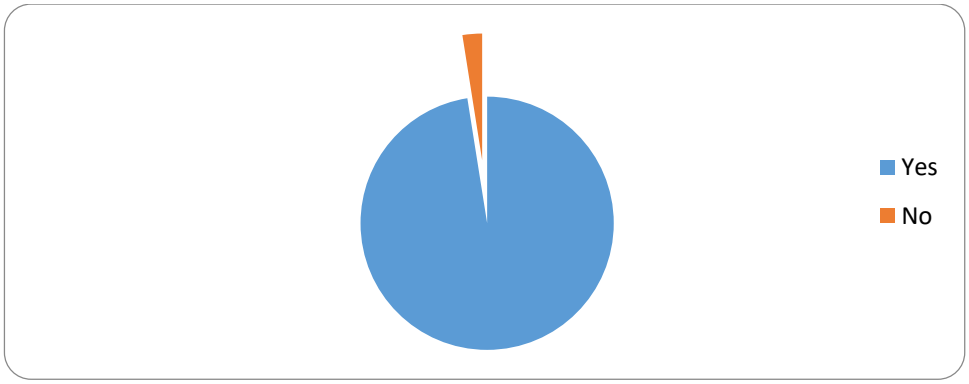

Figure 11: Graphical representation of users' response on system speed

Figure 12: Graphical representation of users' response on system reliability

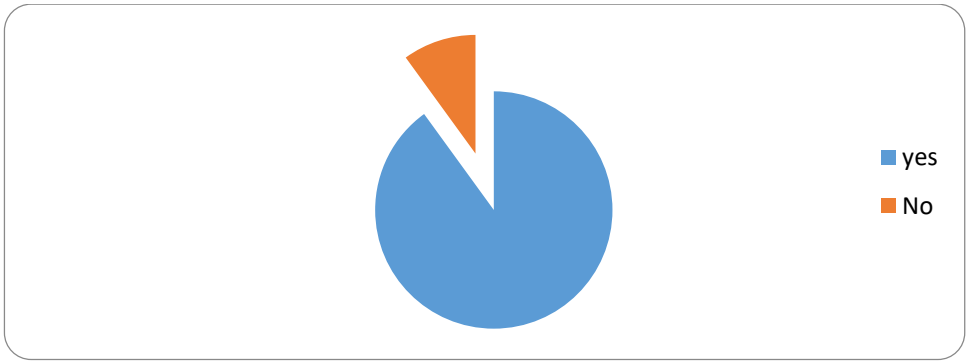

Figure 13: Graphical representation of users' response on system responsiveness.

6. CONCLUSION AND RECOMMENDATION

In this work, we have presented the development and implementation of a web-based Pension Contribution Monitoring System with the capability of monitoring the accuracy of pension contribution remittances for employees under the contributory pension scheme. We used block and use case diagrams, and system flowchart for the system design which makes the system simple and having user friendly interfaces for any user including those that are not familiar with computer software. HTML, CSS, PHP and My SQL were used for the design implementation. This system has many advantages over the existing system such as speed, accuracy, accessibility, ease of use, automated generation of reports and security. It is therefore concluded that a web-based and highly interactive system that efficiently monitored and detected shortfalls in pension remittances for employees under the contributory pension scheme had been developed. It is therefore recommended for future work, that the application be improved to automatically send SMS alerts to employees detected to have discrepancies in their remittances.

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