Developing an Enhanced Payroll Management System

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ABSTRACT: Payroll, as a part of human resource management, is the process of accurately calculating employees' salaries and emoluments. The process of salary computations is quite tedious if done manually and therefore requires more effort, time, and energy, especially in a large organization. Hence, the objective of this paper is to develop an Enhanced Payroll Management System for Improved Efficiency and Accuracy using appropriate computational techniques. The system was developed and implemented using the Bootstrap framework, Personal Home Page (PHP), Hypertext Mark-up Language (HTML), Cascading Style Sheet (CSS), JavaScript (JS), Ajax, and MySQLi databases. Some results obtained from the proposed system show significant improvement in terms of accuracy, efficiency, trustworthiness, and flexibility. This development demonstrates that data confidentiality, integrity, and availability of the system have increased and equally provided a user-friendly environment for employers to analyze salaries, all payments, allowances, and deductions, as well as be able to print reports and pay slips for decision-making.

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Computer technology has created efficient and effective systems to streamline the management of an organization, which makes it a much-needed device for business, education, government, banks, health, and many more due to its accuracy, speed, flexibility, and ability to execute many tasks at a time without any delay or difficulty. In the rapid growth of modern technology, information sharing and communication have become easier due to convenience, low cost, wide reach, and the ability to support the achievement of real-time communication. Nowadays, rural and remote areas are being connected to the Internet, attracting more users worldwide. The Internet technology cannot be glorified; governments and non-governmental organizations alike make use of the Internet to automate their processes as well as deliver services to customers and clients in real-time (Rahul, 2021). While individual users continuously find comfort with the system, many take advantage of the Internet to purchase goods and services, pay bills, and much more. The Internet has brought different technologies together by connecting more devices. However, it is estimated that by the year 2025, over three billion devices will connect to the Internet worldwide (Turner, 2020). As more devices connect to the Internet, the system becomes increasingly vulnerable to external attacks. This is evident in the growing trends of cybercrime taking place today

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(Richardson, 2020). In recent years, more organizations have become increasingly dependent on digital systems and internet technology for their day-to-day activities. Consequently, there is an increase in the number of system security breaches affecting several organizations and individuals, which require the serious attention of cybersecurity experts to address the issues quickly Hossain *et al.,* (2021).

However, the banking sector of the economy has been exploring this technology through new platforms such as computerized payroll systems, online banking, mobile banking, and other services. This allows hackers to devise several ways to gain control of organizations' resources by exploiting the systems with malicious code, system flaws, etc. Donald *et al.* (2020) which has become necessary to enhance security and safeguard the systems.

The term payroll generally refers to all the financial records and data related to salaries, wages, overtime, bonuses, deductions, withholding, and garnishments related to the employees, owners, or partners paid for services rendered during a specific period of time (Mate, 2016). Payroll is a serious process for every organization to pay employee salaries and emoluments accurately and on time.

Over the years, many government agencies have been using manual systems to compute workers' salaries, which are characterized by obstacles and shortcomings, among which are slow, tedious, inaccurate, insecure, unreliable, and time-wasting.

Another major problem associated with the manual payroll system is that records are not confidentially safeguarded and are error-prone due to human factors; hence, this is this is a big problem to handle. While the computerized payroll system adopted by some government agencies has shortcomings in the wrong deductions of loans, taxes, allowances, etc., data integrity, confidentiality, and availability pose a major problem to data accessibility.

In addition, the system is characterized by being unsecured, inaccurate, inefficient, and not flexible. These reasons motivated the writers to propose a computerized payroll system capable of mitigating the shortcomings of the systems outlined earlier for government agencies.

MATERIALS AND METHODS
This section discusses the approach used to achieve the objectives of the research. The research work adopted both a qualitative and quantitative approach.

A random sampling technique was used in carrying out the research. However, the research work examines the challenges and weaknesses of the payroll management system in government agencies in Nigeria. The study chose a questionnaire as the research instrument, and the questionnaire was divided into three sections. Section A requires respondent personal data. Section B, related to payroll management systems, and lastly, information and communication technology (ICT). A total sample of one hundred (100) questionnaires was distributed to four (4) different government agencies. However, out of 100 questionnaires distributed, 88 were returned for analysis.

Sample Size: Among the 27 local governments in Borno state, the researcher was able to determine the sample size by using the formula developed by Yamane (1967) and given in equation 1

$$n = \frac{N}{(1 + N(e)^2)} \qquad (1)$$

Where N=population size, n=sample size, e=level of statistical significance set at (5%)

The determination of the sample was an indication of the employee confidence interval of 95%. It is a justification for having a manageable size while considering the resources available as well as time constraints. It also justifies a better analytical process free from laborious tasks.

Additionally, to determine the sample size for every unit or level, proportionate sampling was used, as given in equation 2.

$$n_i = \frac{(n * N_i)}{N} \quad \ldots\ldots \quad (2)$$

Where, n_i = Sample of ith units, n = Targeted Sample, N_i = Population of ith units and N = Total Population.

A Review of The Proposed Payroll System: The proposed computerized payroll system was developed to enhance and eliminate the shortcomings and challenges of the previous system. The proposed system assures data confidentiality, integrity, and availability (CIA).

It equally provides a user-friendly environment with a graphic user interface (GUI) so that a user can view his salary, allowances, deductions, print payslips anywhere, anytime, etc.

In addition, the proposed payroll system represented in Figure 1 was developed and implemented using the Bootstrap framework, Personal Home Page (PHP), Hypertext Mark-up Language (HTML), Cascading Style Sheet (CSS), JavaScript (JS), Ajax, and MySQLi databases.

i. Encryption: The software formulates a mechanism for shielding payslip statements by setting the payslip output in portable document format (PDF), and all generated payslips are encrypted.

ii. MySQLi: This is an advanced technology that is used to shield database access from hackers and intruders and has additional parameters for passing authentication that require a username, password, database name, server name, and port before executing an instruction. However, MySQLi is an improved version of MySQL, which has more advantages.

iii. Report on failed login attempts: The proposed system presents the Quick Response Intruder Detection System (QRIDS). Which vigorously monitor brute-force login attempts? The QRIDS is responsible for sending information and alerting the administrator via text message whenever a login attempt fails three times. This feature helps the system administrator take immediate and prompt action.

iv. Inactivity timeout: The proposed software uses an inactivity timeout mechanism in order to protect data integrity and confidentiality by automatically logging out of the user account after a certain period of inactivity (120 seconds).

v. Automatic Backup Feature: The database is the heart of any software system. The proposed system automatically backups data on the cloud, which reduces the pain of disasters such as accidental deletion, malware, virus attack, hard drive crashing, natural disasters, etc.

vi. Reliability/Accessibility: The system is reliable and accessible, unlike the previous system, because whatever is stored in a database can be accessed anywhere, anytime, no matter the geographical location, as long as there is active internet connectivity.

vii. Web-based Interface: The proposed web-based interface can be accessed by all types of browsers and devices once authorized by the system administrator.

viii. Concurrent Operations: Wamp Developer Pro was used to host the software, which allowed the concurrent number of users to reach 200.

ix. Ends Users' Compatibility: The platform is compatible with both mobile phone users and laptop, iPad, or PC users because the Bootstrap framework has inbuilt collections of functionalities that help with Rapid Application Development (RAD).

x. Graphic User Interface (GUI): Graphics are the most precise and summarized way of presenting information, particularly to non-technical users.
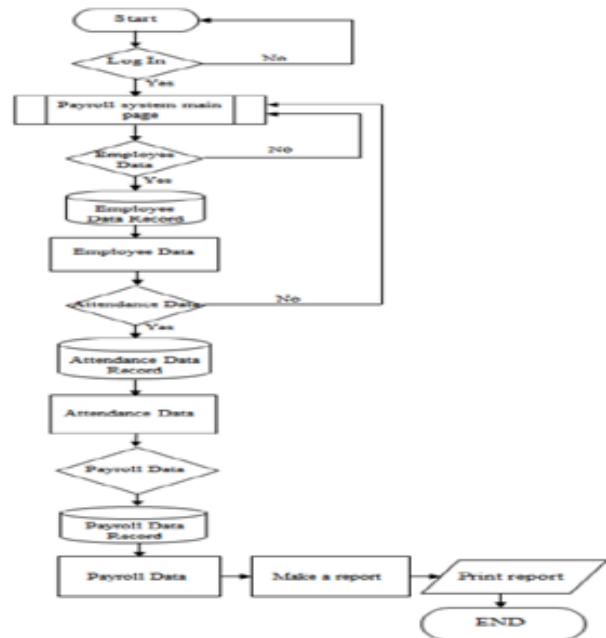

Fig.1: system flow chart

Software design: The waterfall model was adopted as a chosen model for software development. The waterfall model is an example of a plan driven process, which in principle, you must plan and schedule all of the process activities before starting the work, (Roger, 2019).
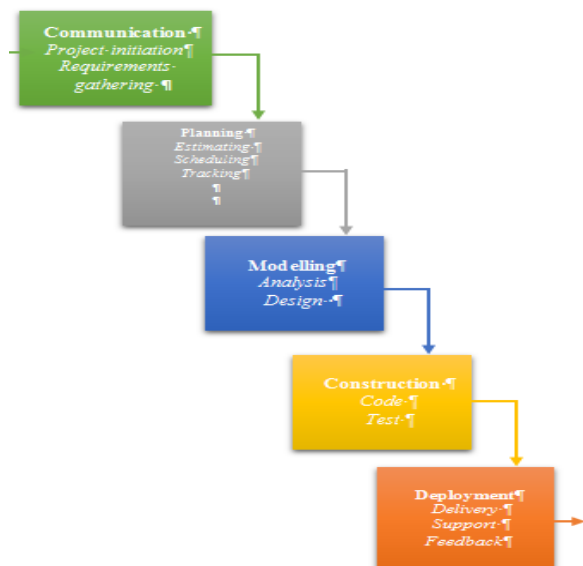

Fig. 2: waterfall model

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The waterfall model suggests a systematic, sequential approach to software development which begins with customer specification of requirement and progresses through planning, modelling, construction and deployment as shown in fig. 2. The main advantages of waterfall model are fast in develop software, simple and easy to use especially when the end user requirements are well defined and understood.

Use-case diagram: The use-case diagram (Roger, 2019) describes the typical interaction and behaviour between the users of the system and the system itself. However, it shows what the system could do. There are two actors in the proposed use-case system: the administrator and staff, as shown in fig. 3. Each actor has a level of functionalities and access to the system. The administrator is the main actor in the system and has the obligation to create, manage, and generate payslips, as well as report on individual staff accounts, database backups, etc. While staff is the second actor that has some responsibility, it includes viewing profiles, printing payslips, etc.
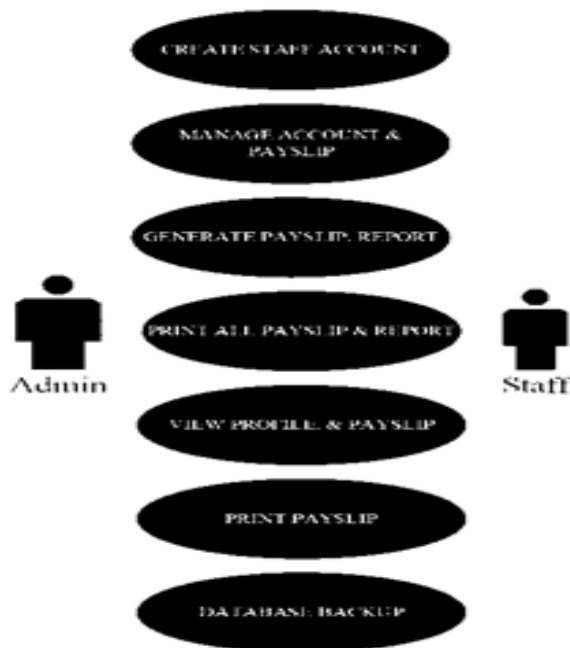

Fig. 3: proposed use-case diagram

In the case of processing payslips, the system records employee attendance lists to check whether they are appropriate. In the case of making payments, the system receives a list of employee salaries as proof of how much each employee is being paid.

However, a payroll report is processed from individual data with a date of execution, which is ready for management to make decisions and analyze the performance of staff. The reports are accessed through the menu on the main interface, were created from the most commonly sought quarries, and are limited to listing out the staff debtors' details.

Fig. 4a: screenshot of home page

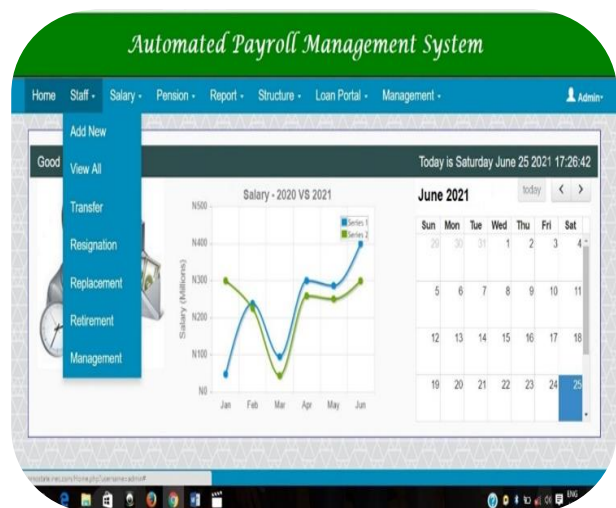

Fig. 4b: screenshot of add employee interface.

Fig. 4c: screenshot of admin submenus

Figure 4 (a, b, and c) shows the implemented interface of the system. The system is first presented with a homepage, and the homepage has two categories of users: administrator and employee. If you are an administrator or employee, click on the icon where one belongs. The administrator has to provide his credentials to access the next page, as shown in Figures 4b and 4c depicts the submenus of the administrator, and each menu has a submenu.

Following the main interface of the payroll system, which navigates other functional interfaces. Figure 4b shows the screen shot of the add new employee interface. However, figure 4c is the display of the salary sheet interface, where all salary details of every employee are viewed and can be printed.

RESULTS AND DISCUSSIONS

The results obtained from this work were presented in bar charts. The survey targeted government agencies, and all the respondents were ensured to be staff of government agencies. Table 1 shows the existing designations of the respondents, and out of the 88 respondents, 59% were senior staff, while 41% were junior staff. However, the majority of the staff surveyed were senior staff in their respective agencies (Smith, 2023).

Table 1: current designation of staff

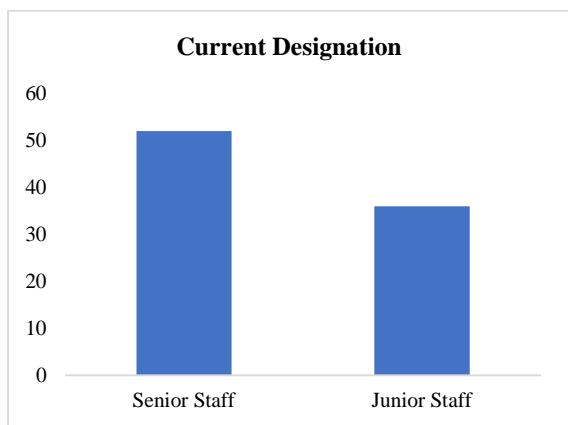| Staff	Frequency	Percentage
Senior	52	59%
Junior	36	41%
Total	**88**	**100%**

Fig. 5: staff current designation

Table 2 shows years of working experience in the agencies. The results indicate that out of the total sample, 32% of the respondents have 1–3 years of working experience with the agencies, while 68% have 4 years or more of working experience. The majority of the respondents are those who have worked with the agencies for a long period of time, and these indicate that there have been different

payrolls and implementations, which helps to improve the proposed system (Doe, 2024).

Table 2: years of working experience

Years	Frequency	Percentage
1 – 3	28	32%
4 – above	60	68%
Total	**88**	**100%**

Fig. 6: years of working experience

Table 3: challenges of payroll system

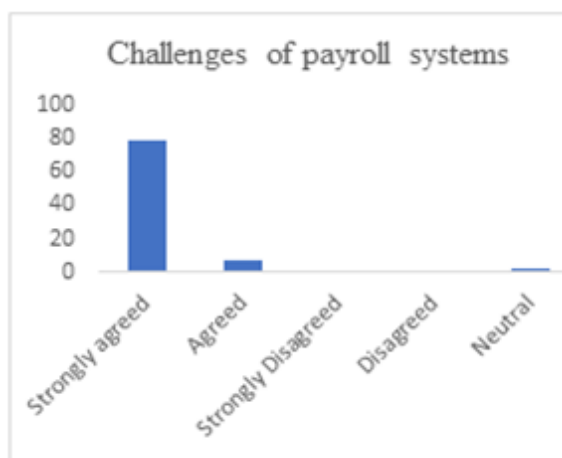| Options	Frequency	Percentage
Strongly agreed	79	90%
Agreed	7	8%
Strongly disagreed	0	0%
Disagreed	0	0%
Neutral	2	2%
Total	**88**	**100%**

Fig. 7: challenges of payroll systems

Table 3 shows the challenges of the payroll management system in government agencies. The result shows that 90% of the respondents strongly agreed that there are a lot of challenges in the payroll system (Johnston, 2022).

Conclusion: In conclusion, the aim of this paper is the development of a secured payroll management system that is capable of enhancing the existing systems in order to minimize threats and safeguard

the security of data. The purpose of this was to improve data confidentiality, integrity, and availability (CIA), as well as the complexities associated with the existing methods. Consequently, it offers an insight into the challenges of the payroll management system in government agencies and suggests ways forward to improving the system.

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