

DEVELOPMENT OF AN INTRANET BASED STAFF MANAGEMENT SYSTEM WITH INTEGRATED INSTANT MESSAGING FRAMEWORK

Ugwuanyi E. I.¹, Nnamani V. N.², Ngene J. N.³, Mba D. L.⁴, Asogwa T. C.⁵
^{1,2,3,4,5} Enugu State University of Science and Technology, Department of Computer Science,
Enugu State, Nigeria.

¹ilaba9040@gmail.com, ²vinnyppearlz@gmail.com, ³john.ngene@esut.edu.ng,
⁴david.mbah@esut.edu.ng, ⁵tochukwu.asogwa@esut.edu.ng

Abstract

This paper presents the development of an intranet-based staff management system with integrated instant messaging framework. The methodology employed for the development of the new system is the rapid application development and object-oriented analysis design methodology. The methods used are the registration process, login, staff management and instant messaging notification. The system design was done using universal modeling language which employed modeling diagrams such as activity diagram, sequence diagram, use case diagram user interface diagram to present the instant messaging algorithm. The front end was implemented with Node.JS while the backend was implemented with MySQL. The result when tested showed that the new system allowed the admin to send message instantly to basic staff at 98.09% delivery accuracy and when cross validated, the delivery accuracy achieved is 95.79%. The reason the tolerable fraction of the staff did not receive the message was due to limitation on the service provider path such as poor coverage at the point, losses or due to the unavailability of the staff cell at the moment. The system was integrated at the computer science department for staff management and tested. The result showed that it was able to instantly notify selected staff member of the message, thus reducing cost of printing circulars, transportation, time of printing and distributing circulars, etc.

Keywords: Staff Management; Intranet; Instant Messaging; MySQL; NodeJS

1. INTRODUCTION

Pratik et al. (2019) defined the Staff Management System (SMS) as a framework that assists organizations in keeping track of employee information, including attendance, salary details, medical information, leave records, and overall performance. According to Padua (2012), an effective staff management system should encompass key features such as time and attendance management, employee service portal, instant notification, payroll structure, and biological information management system. This system enables the head of Human Resources (HR) to oversee the team of employees by providing real-time information and guidance. SMSs are particularly useful in organizations with hierarchical structures, ensuring that all employees work collectively to achieve organizational goals.

Traditionally, SMSs were simple desktop-based applications with limited memory, managing a small number of staff within an organization. However, with the advent of the Internet of Things, more robust SMSs have emerged, capable of managing larger amounts of data through cloud servers. Consequently, these SMSs not only handle employee information but also coordinate other essential organizational data such as documents. Unfortunately, existing SMSs primarily focus on employee data management and lack the necessary features for direct staff management and coordination. They lack the means to reach out to staff within the organization and convey vital information when needed. Therefore, there is a need for

SMSs that allow administrators to communicate directly with staff and provide crucial information required for effective organizational functioning. This can be achieved through the use of an Instant Messaging System (IMS). According to James et al. (2014), IMS is a text-based communication process where two individuals engage in a conversation over network-connected information technology devices. IMS offers a less intrusive means of workplace communication that has the potential to enhance business performance by improving operational speed, agility, and efficiency (Tirus, 2014). IMS can be categorized into four major types: single and multi-protocol programs, mobile agent clients, web-based messengers, and enterprise software. The first two primarily function as chat software for multi-user interactions but lack enterprise requirements. While the web-based manager offers a simple platform for online communication among users, only the enterprise software provides the necessary features for instant messaging requirements in organizations. This system ensures more uniform coordination among staff by facilitating the effective distribution of useful information, aiding everyone in improving daily tasks and achieving organizational goals. Several works have been presented on staff management by James et al. (2014), Adetoye et al. (2014), Rishabhi et al. (2020), Chioma (2013), Madya et al. (2018), and Marcus (2018) to enhance organizational structure and productivity. However, despite the successes achieved, there is still room for improvement, particularly in communication. This study aims to develop and integrate an improved communication system into the SMS for enhanced staff management and coordination within organizations.

2. METHODOLOGY

The methodology employed for the development of the new system incorporates the Rapid Application Development (RAD) and Object-Oriented Analysis and Design (OOAD) methodologies. RAD is a linear sequential software development process that enables faster development cycles and higher-quality results compared to traditional software development life cycles (Rose, 2012). It emphasizes minimal planning and utilizes a component-based construction approach for development. In the RAD model, user requirements are defined using structured techniques and prototyping to design the final product. The process begins with creating preliminary data models and process models using structured techniques, which serve as the foundation for understanding the system requirements. Prototyping is then used to evaluate and refine these models, ensuring they align with the user's needs. The iterative nature of RAD allows for multiple development cycles, enabling frequent feedback and refinement. In parallel, the Object-Oriented Analysis and Design (OOAD) methodology is employed to analyze the system requirements and design a solution using object-oriented principles. OOAD involves identifying and modeling the key entities, relationships, and behaviors of the system. Object-oriented analysis focuses on understanding the problem domain and defining the system's requirements, while object-oriented design involves designing the system architecture and defining the classes, interfaces, and interactions within the system. By combining RAD and OOAD methodologies, the development process for the new system benefits from rapid development cycles, frequent prototyping, and a focus on object-oriented analysis and design principles. This approach allows for efficient development, adaptability to changing requirements, and the creation of a high-quality software system.

The research methods employed for the development of the new system encompassed several key components. The user registration process involved collecting essential data from staff members, such as their biological information and biometric details, to create their account or profile within the staff management system. During registration, users were required to provide their phone numbers to facilitate



the integration of the instant messaging platform. User classification during registration helped guide the subsequent login process. The login functionality allowed registered users to access the system using their designated username and password. Depending on their assigned registration category, users were directed to either the basic staff platform for submitting requests or the admin platform for managing the requests made by basic staff members. The staff management component consisted of two sections. The first section provided a platform for basic staff members to submit various requests, such as loan requests, leave requests, and results submission. The second section was designed specifically for admin staff members, enabling them to receive and manage the requests and applications made by basic staff members. Addressing the limitation of existing systems, this research implemented an instant messaging and notification system. The developed framework allowed administrators to share information with basic staff members through an instant messaging platform. This platform utilized staff members' phone numbers and a communication server to deliver messages efficiently. These research methods were employed to develop a comprehensive staff management system, encompassing user registration, login functionality, staff management features, and an integrated instant messaging and notification system

3. SYSTEM DESIGN

The system design presented the modeling of the new staff management system proposed. The modeling was done using universal modeling languages which were compatible with the methodology adopted (Rapid application development and object-oriented analysis design methodology).

3.1 Database design

Database design is concerned with how data is represented and stored within the system. The data tables are the basic user registration for basic staff and admin staff information management, admin staff information system, basic staff information system, and instant massaging management as presented from table 1. These data entered to the system were all extracted and stored in MySQL database server which is an open source tool required for the development of the instant messaging framework.

Table 1: Basic staff registration table

Data	Description	Type
Full name	Full name of the staff	Varchar
Username	User name for login	Varchar
Password	This is the pass code for login	Varchar
Confirm password	Re-enter password of the staff	Varchar
Email address	Email address of the staff	Varchar

Table 2: Admin staff registration table

Data	Description	Type
Full name	Full name of the staff	Varchar
Username	User name for login	Varchar
Password	This is the pass code for login	Varchar
Confirm password	Re-enter password of the staff	Varchar
Email address	Email address of the staff	Varchar

Table 3: Basic Staff information table

Data	Description	Data type
Staff ID	The identification number of staffs	Integer

Academic Title	The highest academic qualification	String
Staff name	The full names of the staff	Varchar
Level	Hierarchy of the staff in terms of position	Varchar
Phone number	Phone number of the staff	Integer
Address	Home location of the staff	Varchar
Email address	Email address of the staff	Varchar
Local government	The local government area of the staff	String
State	State of origin	String
Country	Nationality of the staff	String
Date of birth	The staff data of birth	Date
Date of employment	Date of employment letter	Date
Department	Department employed to work	String

Table 4: Admin Staff information table

Data	Description	Data type
Staff ID	The identification number of staffs	Integer
Academic Title	The highest academic qualification	String
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Address	Home location of the staff	Varchar
Email address	Email address of the staff	Varchar
Local government	The local government area of the staff	String
State	State of origin	String
Country	Nationality of the staff	String
Date of birth	The staff data of birth	Date
Date of employment	Date of employment letter	Date
Department	Department employed to work	String

Table 5: Instant Messaging Table

Data	Description	Data type
Name of admin	This is the full name of the messenger	Varchar
Title	This is the academic title of the messenger	Varchar
Select staffs	This is where the recipients are selected	Varchar
Message	This is the message to be distributed	Varchar
Date/time	Date and time of the message	Date and time

The tables 1 to 5 were used to provide the data required for the development of the new system. The data provided were stored and used to develop the instant messaging integrated staff management system as shown in the entity relationship diagram of figure 1;



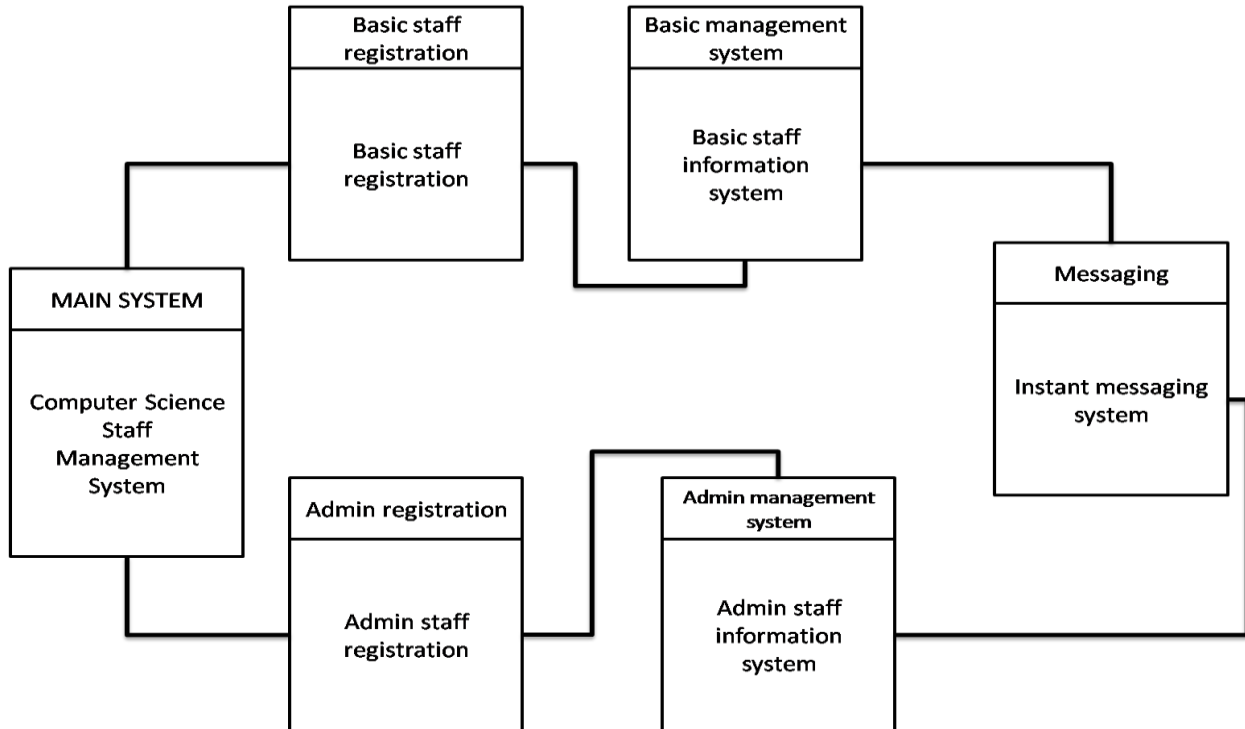


Figure 1: Class diagram

The figure 1 presented the entity relationship model of the database design which showed the relationships between the tables interaction. The model how the basic users register and then provide their biological information, the admin user follow suit to register and also provide necessary biological information. With the data provided, the admin can have access to send instant messaging to the basic staffs.

3.2 Development of the Instant Messaging Framework

The instant messaging framework was developed using a simple optimization approach that utilized a rule-based system. This approach allowed the admin to input messages, select the desired recipients, and deliver the messages to them. The process involved registration and login for both the admin and basic staff members. Upon registration, the users were required to fill in their biological information, which could only be accessed by the primary user (owner) and the admin for the purpose of instant messaging. However, the admin did not have the privilege to edit this information. The admin could then select any or all of the basic staff members based on the message's relevance and input the instant text message to be sent. The pseudocode for the instant messaging algorithm is presented below:

Instant Messaging Pseudocode

1. Start
2. Register as admin
3. Login as admin
4. Select instant messaging
5. Enter the message
6. Select recipients
 - a. If recipients are predefined:



- i. Display a list of available recipients
- ii. Select one or more recipients
- b. If recipients can be entered manually:
 - i. Prompt for recipient's phone number
 - ii. Validate the phone number
- 7. Send the message to the selected recipients
- 8. Display a confirmation message
- 9. End

3.3 The Activity Modeling of the Instant Messaging Framework

The activity diagram provides a visual representation of the process flow involving multiple objects of a class during activity processing. It is commonly used in conjunction with UML modeling methods to create workflow templates for the system under development. Activity diagrams are valuable for describing complex algorithms or use cases, detailing required actions and their timing. Figure 2 presents the activity model for the messaging framework, illustrating the steps involved when users log in, authenticate as admin staff, access the instant messaging platform, compose a message, select recipients, and send the message. Additionally, Figure 3 depicts the activity diagram for the user registration and login. Users input their information, such as username and password, and upon successful authentication, they gain login access. In the event of unsuccessful authentication, users are directed to register and create a new account.

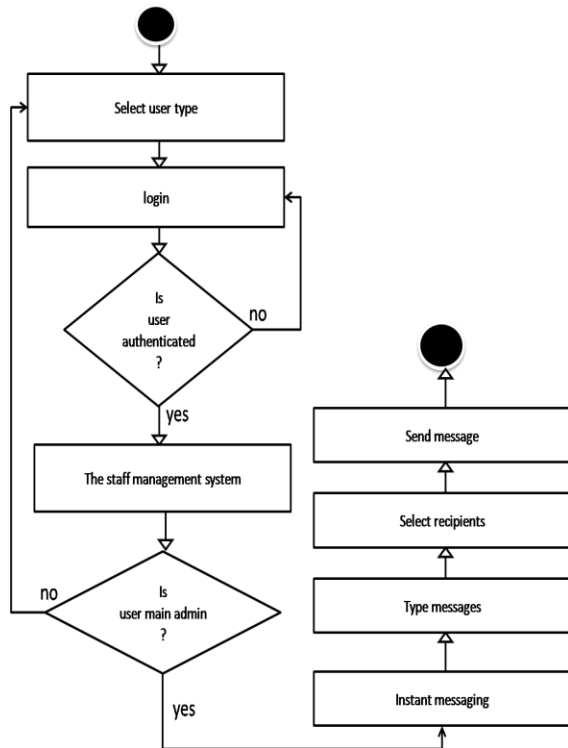


Figure 2: Activity diagram of the IMS

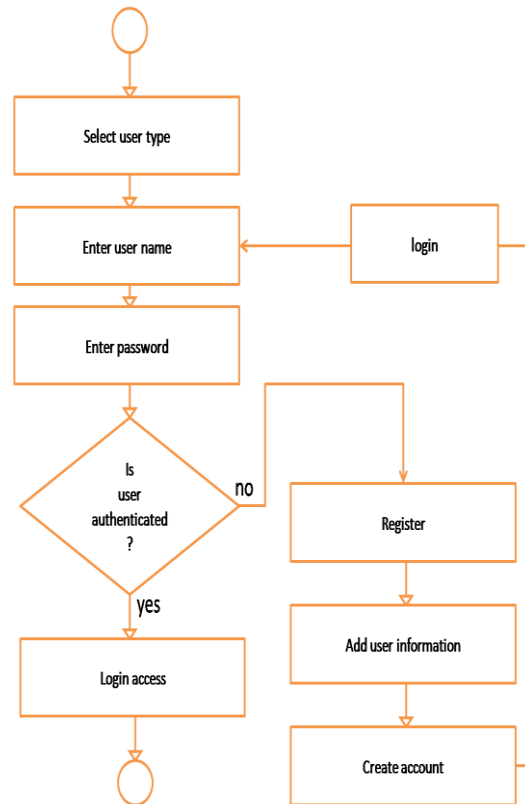


Figure 3: user registration activity diagram

3.4 Use Case and Domain Analysis

Use case diagrams give a user point of view of the system with different users referred to as the Actors. Here in the Use Case diagram below the actors include is the users which are the basic and admin while the supporting actor is the user.

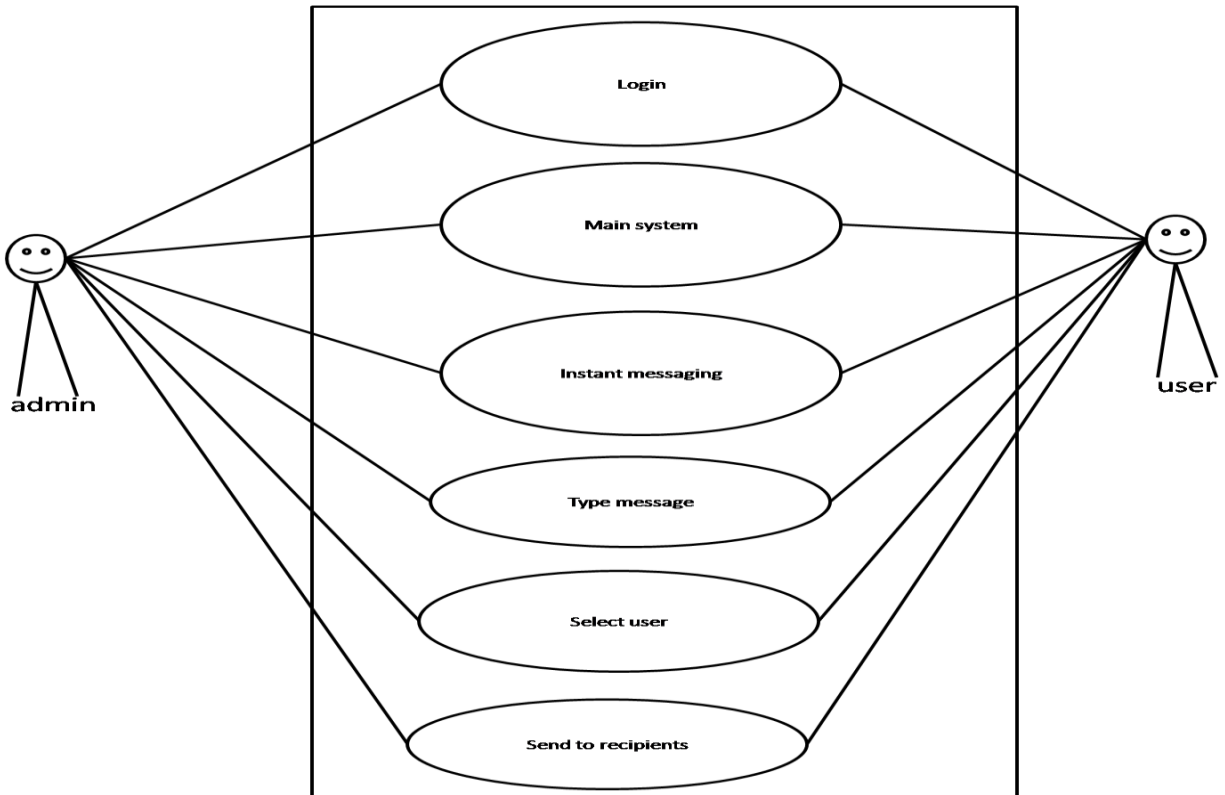


Figure 4: Use case for instant messaging

Primary actors: admin

Secondary actors: user

Brief description of event: The use case showed how the admin sends instant message to the basic staffs. The admin logged into the main system, select the instant messaging platform, type the message, select the recipients and send the message.

Pre-conditions: we assumed that user registrations have been completed.

Post-conditions: when message is send, selected recipients received it.

Main flow of events:

1. The use case diagram start login
2. Access the main system
3. Select the instant messaging framework
4. Type the message
5. Select recipients
6. Send the message



3.5 Sequence diagram for the system operation

System sequence modeling is a technique used in software engineering to model the interactions between external actors and a system. It focuses on capturing the sequence of messages or events exchanged between actors and the system in response to specific user interactions or system triggers. The purpose of system sequence modeling is to understand the behavior of the system from an external perspective and identify the main functionalities and interactions of the system.

In system sequence modeling, the interactions are represented using sequence diagrams, which illustrate the flow of messages between actors and the system. The actors can be users, external systems, or any entities that interact with the system. The messages exchanged between actors and the system represents the actions or requests made by the actors and the corresponding responses from the system.

The sequence diagram typically consists of vertical lifelines representing the actors and horizontal arrows representing the messages exchanged between them. The sequence of messages depicts the order in which they occur and the dependencies between them. By analyzing the system sequence diagrams, developers can identify the key functionalities, system behavior, and external dependencies of the system. It helps in understanding the system's requirements, designing the system architecture, and ensuring that the system meets the desired functionality and performance expectations. The figure 5 explains the sequence diagram that the objects are registration, login, main system, instant messaging. The basic staff and admin staffs register and login to the new system. The admin staffs when authenticated and logged into the system, gains access to the main system and then select the instant messaging framework to type the message and then select recipients to receive the message.

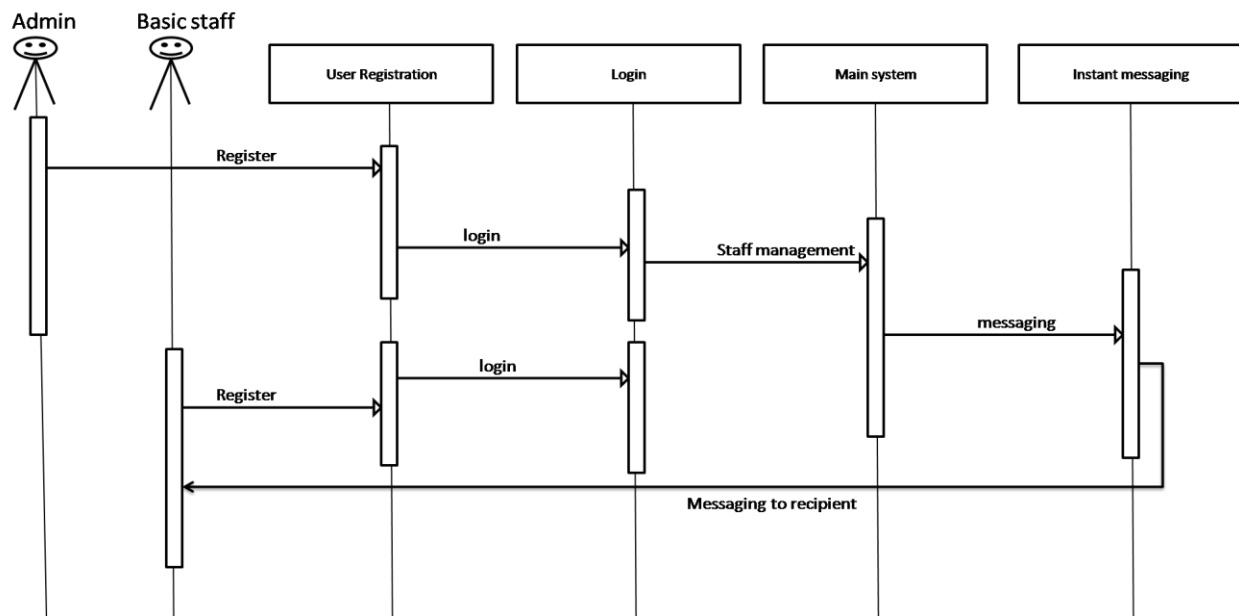
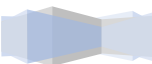


Figure 5: Sequence modeling of the new system

In the new system developed, the instant messaging application framework was integrated at the head of department dashboard to allow the admin send real time messages to the users instantaneous when the need arises as shown in the new system analysis in figure 6;



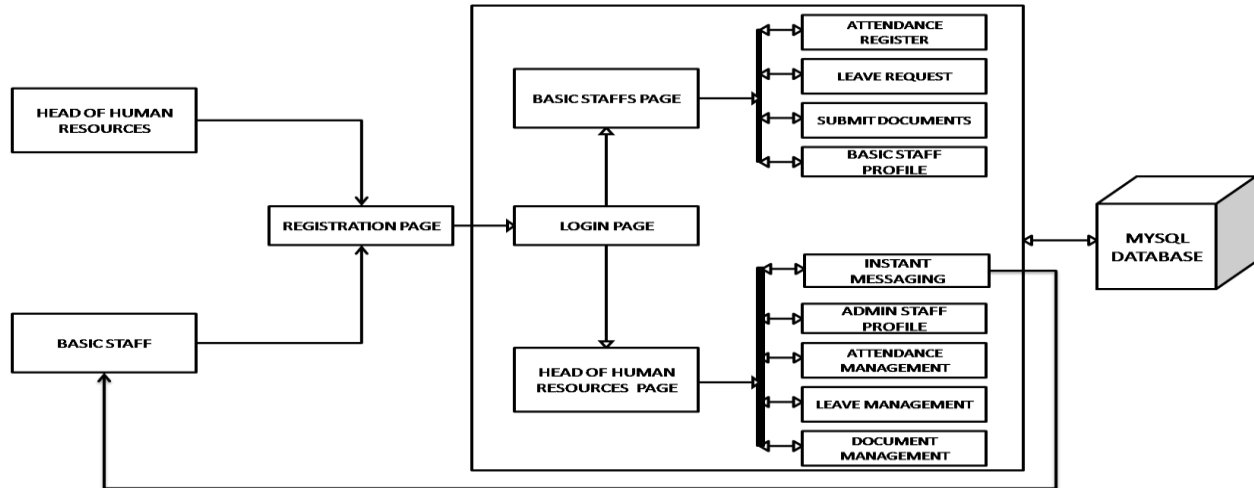


Figure 6: New system Analysis

The figure 6 showed how the existing system studied was improved via the integration of the instant messaging system to enable the admin reach out directly to all the staffs when there is need for information distribution. This process automatically sends message to the users via the phone number and notify them of the information.

4. SYSTEM IMPLEMENTATION

The system was implemented using Node.js and MySQL software. Node.js was employed for developing the front end, which involved designing the user interface using HTML scripts. To enhance the user experience, cascading style sheets (CSS) were used for interactive and user-friendly system design. The backend was responsible for managing the user registration framework, user information system, and other human resource management classes of the system using the MySQL database. Figure 7 presents the homepage of the software.

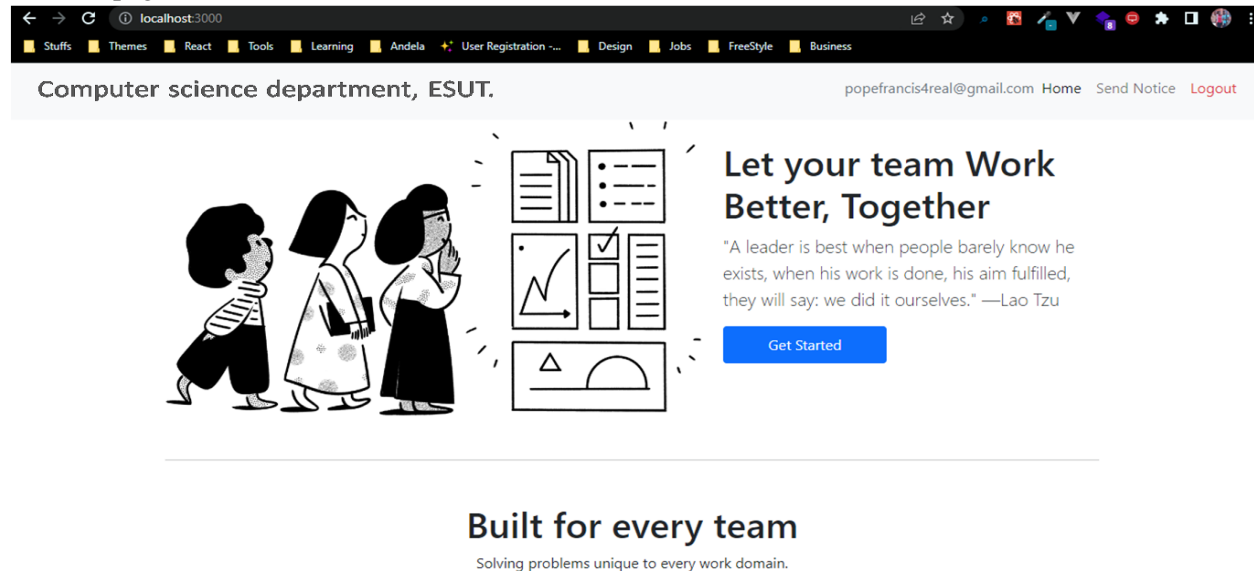


Figure 7: Homepage of the system implementation

While the figure 7 presents the homepage of the system, the figure 7 and figure 8 present the user interface of the frontend developed for the login and registration process as presented the design table 1 and 2. These information are then used to login as;

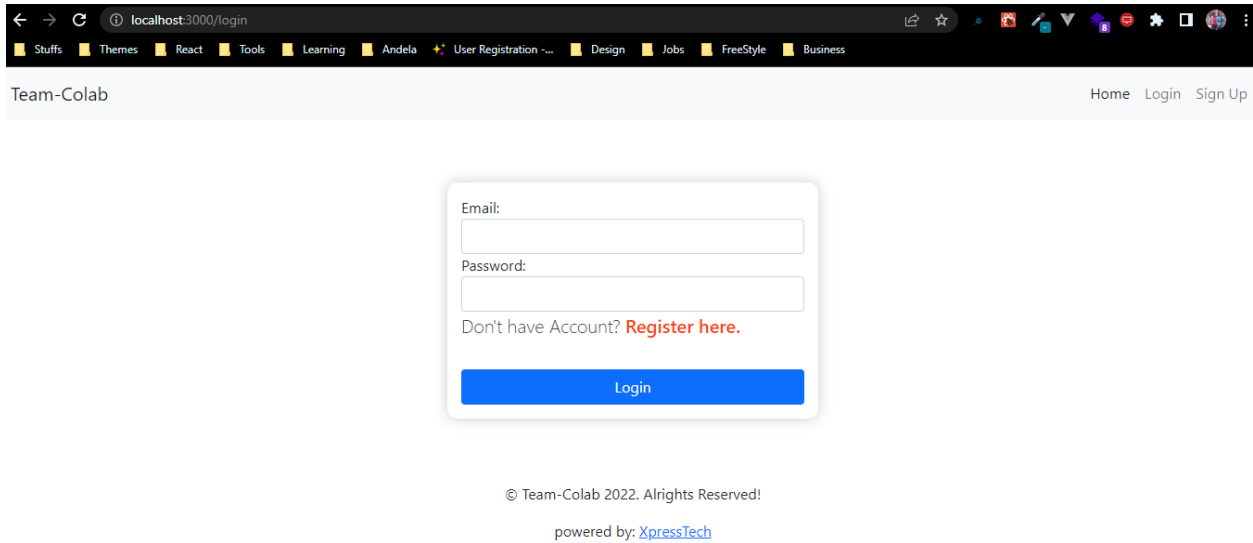


Figure 8: login framework

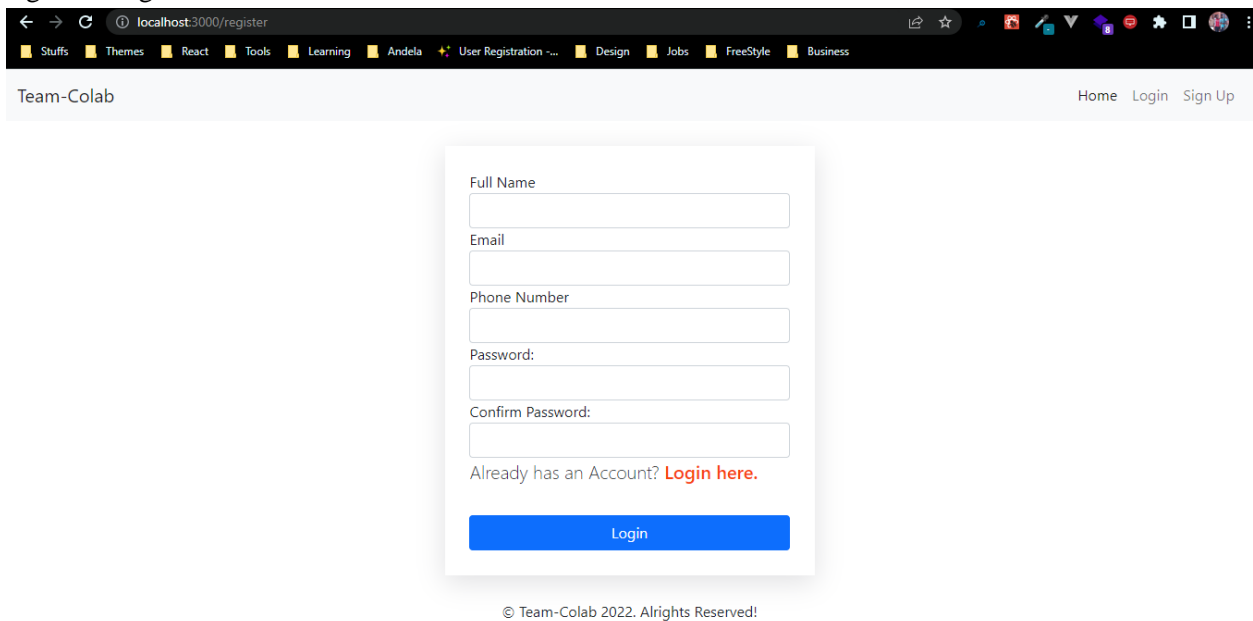


Figure 9: Registration framework

5. RESULTS AND DISCUSSION

Testing is a set of activities that can be planned in advance and conducted systematically. A program is not considered completed until it has gone through different testing procedure and passed. The new system was tested in parallel with the software that consists of its own phases of analysis, implementation, and maintenance. The figure 10 presented the performance of the login interface result.

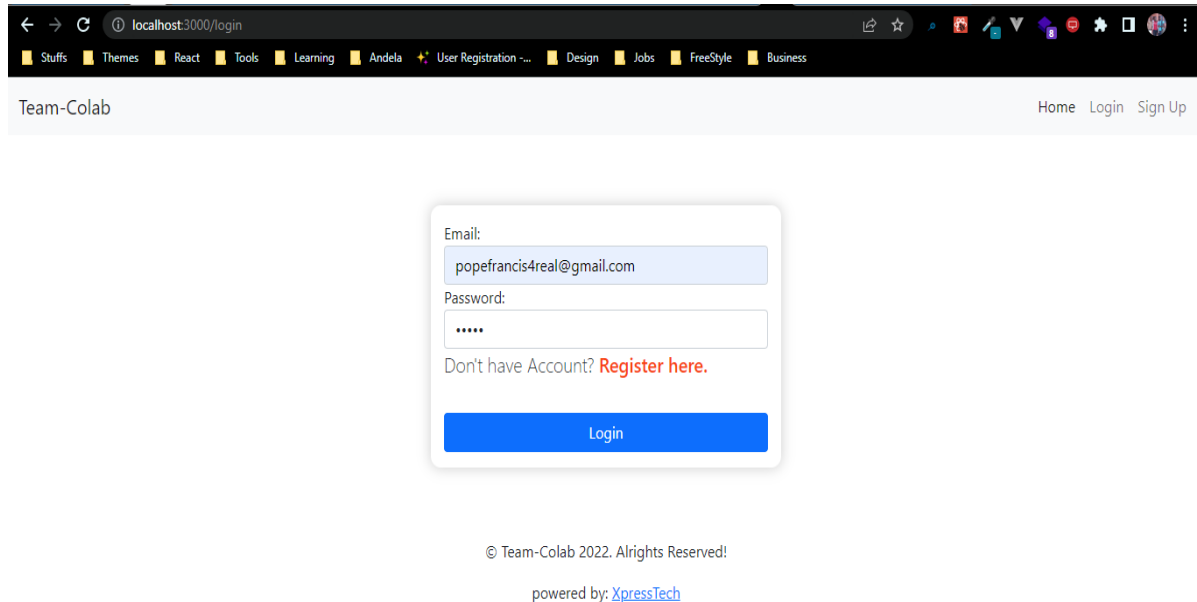


Figure 10: Result of login performance

The figure 10 presented the result of the login process where the admin logs into the system by entering user name and password for authentication and access to the main system, so as to enter the instant messaging needed to be delivered to the staff. The result of the instant messaging framework was presented in figure 11;

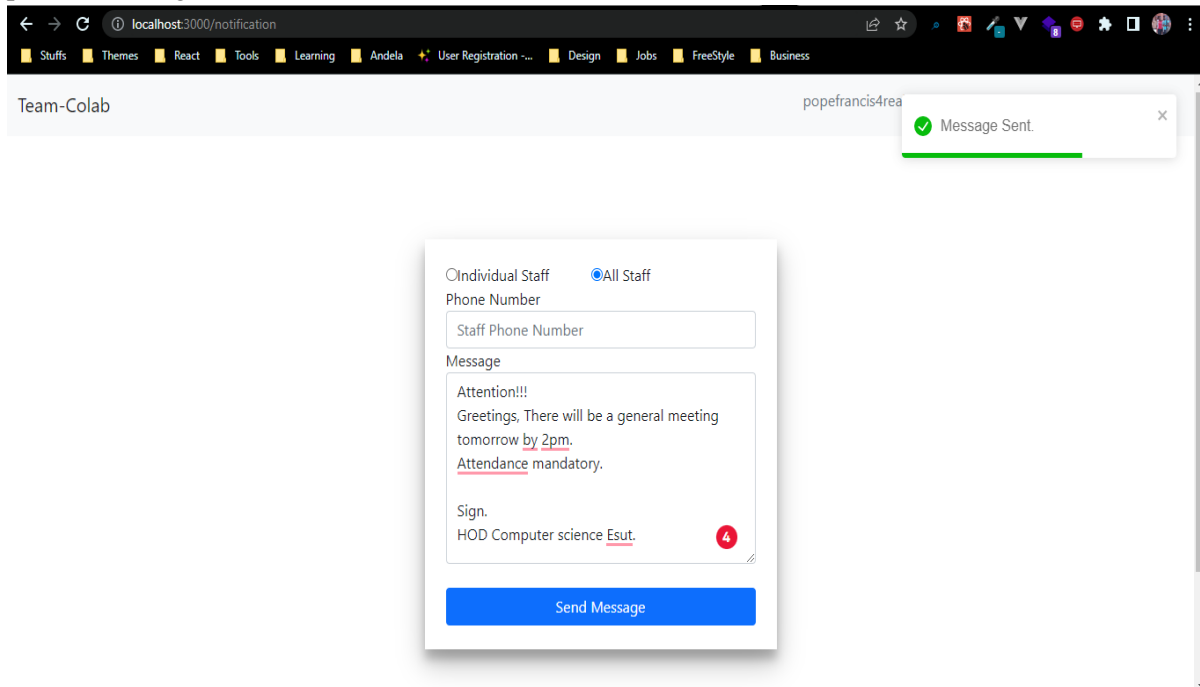


Figure 11: Instant messaging framework

The figure 11 presented the performance of the instant messaging framework showing how the admin after login, selected the instant messaging framework and entered the message needed to distribute to the basic staffs. In this case all the staffs were chosen for the testing phase to receive the messaging which is

“Attention!!! Greetings, there will be a general meeting tomorrow by 2pm. Attendance is mandatory, signed by the HOD computer science. The results of the recipients were presented in figure 12 and 13;

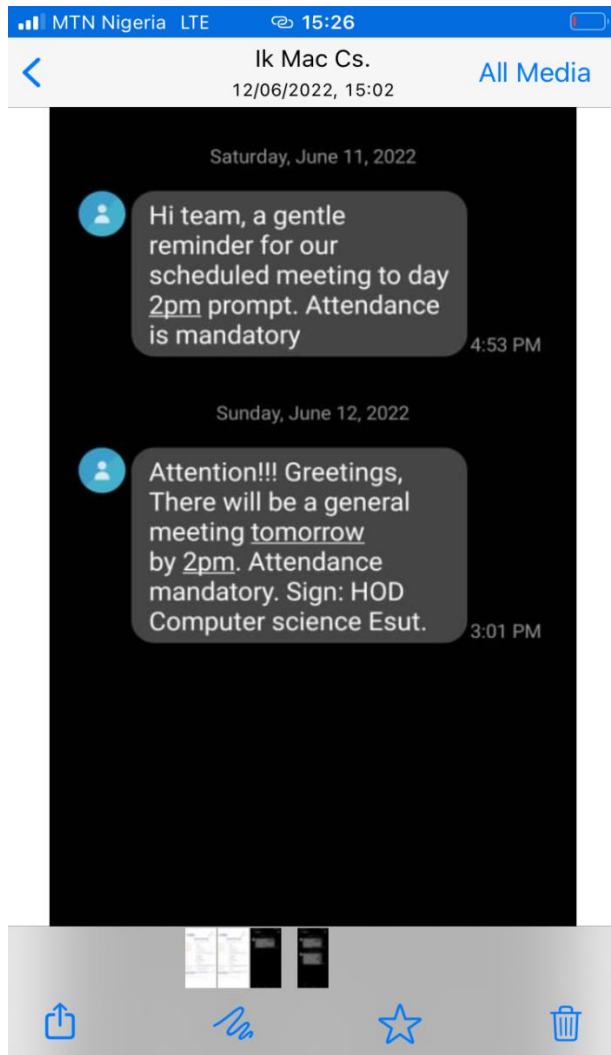


Figure 12: Inbox of recipient 1

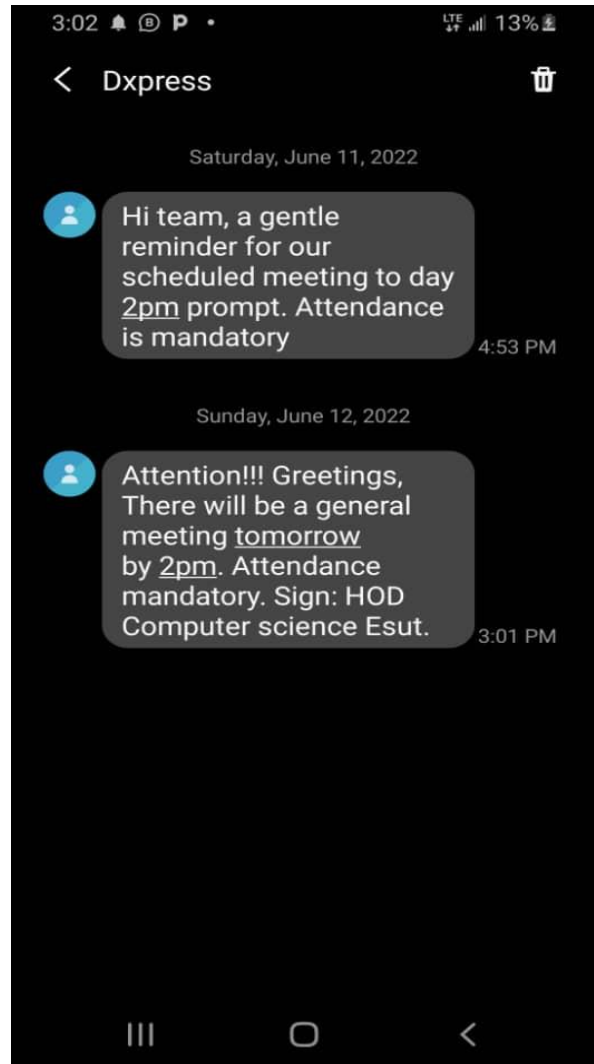


Figure 13: Inbox for recipient 2

The figure 12 presented the text message received by the recipient 1 while the figure 13 presented the result of the text message received by recipient 2. The implication of the result showed that as the text message was sent by the admin. All the staffs received the notification instantly, thus communicating them of the intention of the admin.

6. CONCLUSION

This paper presents the development of an intranet-based staff management system with integrated instant messaging framework. The methodology employed for the development of the new system is the rapid application development and object-oriented analysis design methodology. The methods used are the registration process, login, staff management and instant messaging notification. The system design was done using universal modeling language which employed modeling diagrams such as activity diagram, sequence diagram, use case diagram user interface diagram to present the instant messaging algorithm. The front end was implemented with Node.JS while the backend was implemented with MySQL. The

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