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DEVELOPMENT OF AN EMAIL AND MULTI-USER CHAT SYSTEM

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ABSTRACT

The electronic mail (Email) plays an unavoidable role in human communications. With the increasingly growing reliance on electronic mail there is an increasing demand to develop a cheap and readily available effective communication process amongst people in a closed group with similar interest. This research work considered the analysis and development of an electronic mail (Email) and a multiuser chat system to enhance effective communication. The analysis and implementation of Email and the multiuser chat system is subdivided into three stages namely: programing, database management, and networking. Using Java programming language; which involves the coding of the server and the client components, MySQL; which consist of the development of the database management system, and a wireless router; to provide internet connectivity, real time electronic messages, whether online or offline, can be sent and received at zero cost amongst a group of people who share the same area of communicative commonality.

Keywords: *Database management, Java programming, MySQL*

INTRODUCTION

Communication is the process of sending or receiving information while technology is the driving force it requires a sender to send a message through a medium to a receiver (Proakis and Salehi, 2008). Communication can occur across vast distances in time and space. Effective communication requires that the communicating parties share an area of communicative commonality. The communication process is complete once the receiver understands the sender's message. There are a range of verbal and non-verbal forms of communication, these include body language, eye contact, sign language, haptic communication, and chromatics. Other examples are media content such as pictures, graphics, sound, and writing. The Convention on the Rights of Persons with Disabilities also defines communication to include the display of text, Braille, large print, accessible multimedia, as well as written and plain language, human-reader, augmentative and alternative modes, means and formats of communication, including accessible information and communication technology (Proakis and Salehi, 2008). Electronic mail (Email) is the transmission of message over communications networks. The messages can be notes entered from the keyboard or electronic files stored on disk. Most mainframes, minicomputers, and computer networks have an e-mail system. Some electronic mail systems are confined to a single computer system or network, but others have gateways to other computer systems, enabling users to send electronic mail anywhere in the world. Companies that are fully computerized make extensive use of e-mail because it is fast, flexible, and reliable.

On the other hand, a multi-user chat system is a system that is used to facilitate communication between users within the corporate or scientific organization (Foster, 2015). The system allows users to converse in real time rather than posting through emails or forums which can result in a delayed response. Chat application is used to facilitate this, allowing user opportunity for private chat, group chat (conference chat), share files while chatting, store and archive communicated messages. It is also a kind of communication over a network that offers a real-time transmission of text messages from a sender to receiver. Chat messages are generally short in order to enable other participants to respond quickly. A multi-user chat system is a casual conversation. The term however, has now become associated mostly with online chat services or computer programs. Feedbacks of Emails have been studied extensively in [(Foster, 2015) and (Toorani, 2008). In contrast to existing result, as feedback is a critical component of effective communication, this work introduces an email and multi-user chat system to enhance effective communication amongst a group of people who share the same area of communicative commonality.

MATERIALS AND METHOD

An Email and multi chat system is a very common means of communication that its technology improves as the day goes by. The design of an e-mail and multi-user chat system by application of a java programming language for our source codes, also applied MySQL for the design of our data base and the use of a router to implement the network (i.e. a wireless network).
The step wise method used in the design phase of this research work are; (i) The database management system, (ii) The server, (iii) The client, (iv) The network, and are discussed extensively in the preceding subsections.

Figure 1: Block diagram of a an Email and Multi-user chat system

Database

A database is an organized collection of data. The data is typically organized to model aspects of reality in a way that supports processes requiring information. These are computer software applications that enable you to store, modify, and extract information from the data base (Mathew, Cole, and Gradecki, 2003). It also interacts with the user, other applications, and the database itself to capture and analyse data. A general-purpose data base management system (DBMS) is designed to allow the definition, creation, querying, update, and administration of databases. Well-known DBMSs include MySQL, PostgreSQL, Microsoft SQL Server, Oracle, SAP and IBM DB2. A database is not generally portable across different DBMSs, but different DBMS can interoperate by using standards such as structured queried language (SQL) and ODBC or JDBC to allow a single application to work with more than one DBMS. For the purpose of this research, we would be using a relational data base. This is a type of database that his named based on its characteristic of normalizing the data which is usually stored in tables.

The relationship model relies on normalizing data within rows and columns in tables. The data can be related to other data in the same table or other tables which must be correctly managed by joining one or more tables. Relational models may be somewhat less efficient than other models; however, this may not be a problem with the processing power and memory found in modern computers. Data in this type of model is stored in fixed predefined structures and are usually manipulated using SQL. Relational data base management systems include Oracle, Ms SQL Server, IBM DB2, MySQL, SQLite, and PostgreSQL

amongst others (Harold, 2004).

Server Client and Server Application

Server client provide an opportunity to network multiple computer. Their name implies a relationship between two programs, in which one, the client, requests a service from another that fulfills that request i.e. the server.

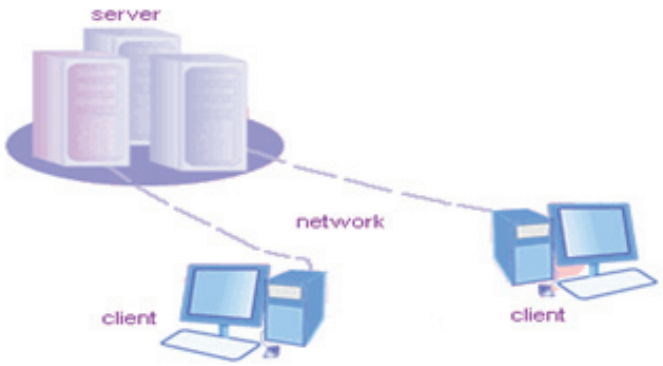

Figure 2: Showing a Server Client

Client Server Model

The client–server model of computing is a distributed application structure that partitions tasks or workloads between the providers of a resource or service, called servers, and service requesters, called clients (Deitel and Deitel, 2012). The clients and servers communicate over a computer network on separate hardware, but both client and server may reside in the same system. A server host runs one or more server programs which share their resources with clients. A client does not share any of its resources, but requests a server's content or service function. Clients therefore initiate communication sessions with servers which await incoming requests. For the purpose of this research, the server and client software would be implemented using Java SE 7 technology.

JAVA Programming Language

This is a general-purpose computer programming language that is concurrent, class-based, object-oriented, and specifically designed to have as few implementation dependencies as possible. It is intended to let application developers "write once, run anywhere" (WORA), meaning that compiled Java code can run on all platforms that support Java without the need for recompilation. Java applications are typically compiled to byte code that can run on any Java virtual machine (JVM) regardless of computer architecture (Deitel and Deitel, 2012).

Server Component Software

A server is a running instance of an application (software) capable of accepting requests from the client and giving responses accordingly. Servers can run on any computer including dedicated computers, which individually are also often referred to as "the server". In many cases, a computer can provide several services and have several servers running. The advantage of running servers on a dedicated computer is security (Deitel and Deitel, 2012). For this reason, most of the servers processes are designed in that they can be run on specific computer(s).

Servers operate within a client-server architecture. Servers are computer programs running to serve the requests of other programs, the clients. Thus, the server performs some tasks on behalf of clients. It facilitates the clients to share data, information or any hardware and software resources. The clients typically connect to the server through the network but may run on the same computer.

Development of the Email and Multiuser Chat Server Software

The server is developed using the Iterative development process model. With iterative development, the project is divided into small parts called module, this allows the development team to demonstrate results earlier on in the process and obtain valuable feedback from system users.

By taking advantage of Modularity which Java offers, the server was developed in modules and each module was tested independently using the iterative development process. The various modules which make up the server are explained below;

A. Connection Acceptor Module:

This module of the server is responsible for receiving connections from the clients by using an instance of the Server Socket class, and creates a new thread for handling each client by the thread handler module.

B. Client Handler Module:

This module implements the Runnable interface, also responsible for handling each connected client in a separate thread and allows the server to continue listening for other connections on the servers thread. It handles all other request from all clients.

C. Send User Status Module:

This module is responsible for sending a list of users and their connection state (offline or online) to all connected clients. It implements the runnable interface and how it is executed from each client handler object, thereby allowing it to send the list of all users to the client which executed it as long as that client remains online.

D. Database Connector Module:

This module of the Server is responsible for connecting the server to the underlying RDBMS, allowing the server to request data as necessary as well as giving the server data persistently in case the server needs to be shut down and restarted. The server user interface is implemented using the javax.swing* package (Mathew, Cole, and Gradecki, 2003).

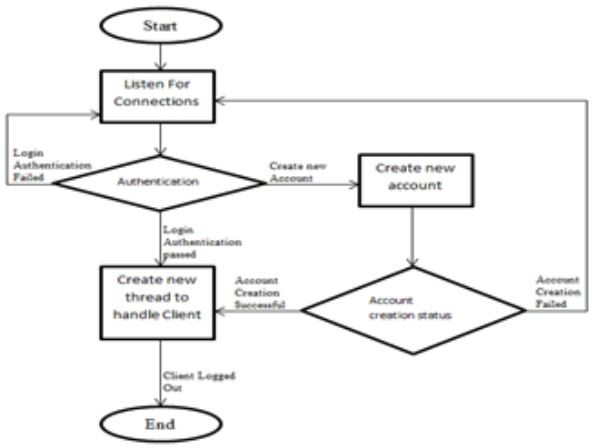

Figure 3: Sequence flow diagrams for the server application

A Server Connection Handler Module:

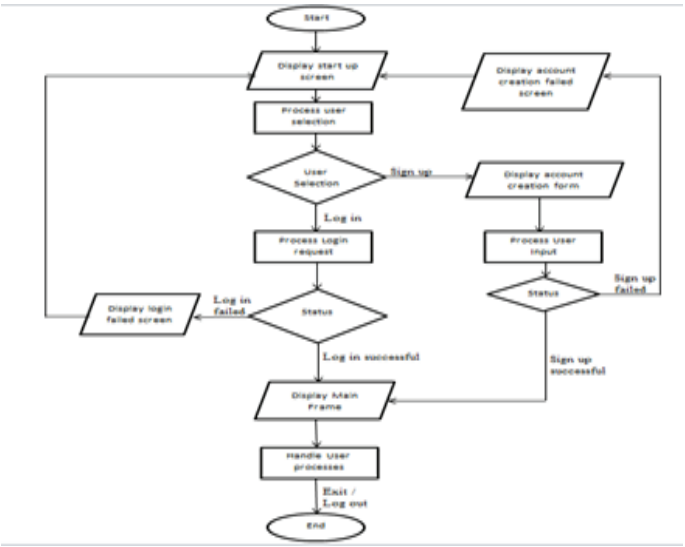

Figure 4: Sequence flow diagram of the client Application

Network

A network, data network is a telecommunications network which allows computers to exchange data. In computer networks, networked computing devices pass data to each other along data connections (network links). Data is transferred in the form of packets (Harold, 2004). The connections between nodes are established using either cable media or wireless media. However, the practice of linking two or more computing devices together for the purpose of sharing data is networking. Networks are built with a mix of computer hardware and computer software.

Types of Network

I. Wired Network
II Wireless Network

For the purpose of this project, we would be using a wireless network which is implemented by using a LINKSYS dual band N600 router E2500 (Foster, 2015).

Wireless Network

A wireless network is any of computer networks that use wireless data connection to network nodes. Wireless network is a method by which homes; telecommunicationnetworksandenterpriseinstallation avoid the costly process of introducing cables into a building, or as a connection between various equipment locations. Wireless telecommunication network are generally implemented and administered using radio communication (Foster, 2015). This implementation takes place at the physical level.
Internetworking Device

ROUTER: This is an internetworking device which operates by moving data to specific location/ or convert data into alternative formats. The implementation of a wireless network is with the aid of a wireless router.

Figure 5: The top & Front view of LINKSYS dual band N600 router E2500

Features of a LINKSYS Dual Band Router

The feature of this router which enhances its operation includes the following:

1. Superior wireless speed: The Linksys E2500 connects computers, tablets, Internet-ready TVs, game consoles and other devices at wireless transfer rates of up to 300, + 300 Mbps for an optimal home network experience (Foster, 2015).
2. Optimal wireless coverage: The enhanced Multiple Input Multiple Output (MIMO) antenna array offers increased signal strength to provide optimal coverage and reliability so that wireless connectivity from anywhere in a particular location can be enjoyed (Foster, 2015).
3. The power of Dual-Band: Double network bandwidth with Dual-Band N (2.4 and 5 GHz) designed to avoid
   interference and maximize throughput ideal for high definition media streaming, file transfers, and wireless gaming.
4. Advanced security: Advanced security features such as WPA2 wireless encryption and the integrated firewall help to keep the network protected.
   i. Optimized for entertainment: Double network bandwidth with Dual-Band N (2.4 and 5 GHz) designed to avoid interference and maximize throughput ideal for HD media streaming, file transfers, and wireless gaming.

ii. IPv6 ready: Supports the latest Internet Protocol technology to help future-proof the network.
iii. Quick to install: Cisco Linksys Connect helps set up wireless network in a few easy steps on a Windows or Mac computer.
iv. Easy to manage: Cisco Connect works with Mac and Windows computers and helps customize settings or quickly add new devices to the network.

Cisco Linksys Connect enables one to:

1. Create a separate, password protected network for guests
2. Limit access time and access to certain websites with parental controls
3. Access advanced network settings easily
4. Measure your connection speed with the Broadband Speed Meter
5. Perform regular automated update checks for firmware and software with the option to install

Configuration Of A Router

The step-by-step procedure of how the router is configured is shown below:

Step 1

Connect one end of the power cable to the router and the other end into an electrical outlet (Power source), then connect one end of the Ethernet cable to the internet port on the router and the other end of the Ethernet cable to a modem or PC for LAN access.
Once that is done click on next on the router interface configuration.

Figure 6: The top & Front view of LINKSYS dual band N600 router E2500

Step 2

The router automatically connects to the network, demand for router name (SSID) and password and the setting up is done. It is important to note that the username and password can be changed in the router setting port and the password used will be the password for accessing the router later for further configuration (Foster, 2015).

Once the setup is completed, we will be able to do the following:

(i) Wirelessly connect computers and devices to the LAN (Local area network)
(ii) Give LAN access to guest
(iii) Manage parental controls

Test the LAN connection speed

Figure 7: Showing setting up stage of the Linksys router

Step 3

The figure below shows how the basic setting up of the router is done, this includes:

(i) Select the router language which is of course English
(ii) Set the internet connection type to automatically configuration Dynamic host configuration protocol (DHCP) to automatically generate internet protocol (IP) addresses for computer devices.
(iii) Give IP address ranges to the router while leaving reservation for Static IP on the DHCP.
(iv) Set Time Zone to GMT+1

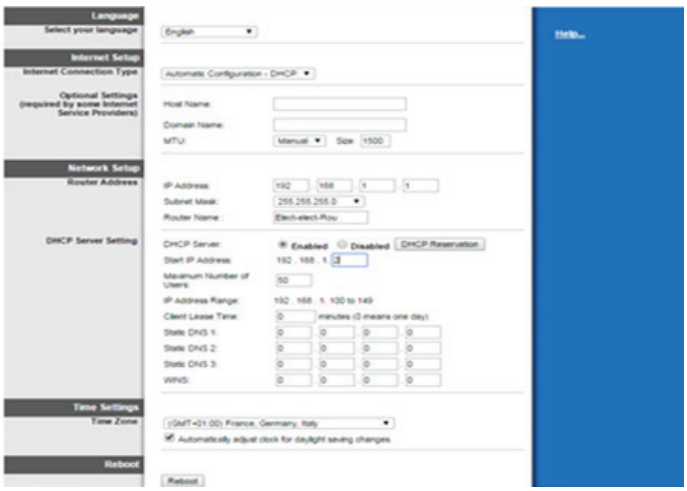

Figure 8: Basic Setup stage of the Linksys Router Step 4

The figure below show wireless connection, wireless security setup etc. Other setting up of the router can be done depending on the usage and as desired by the administrator.

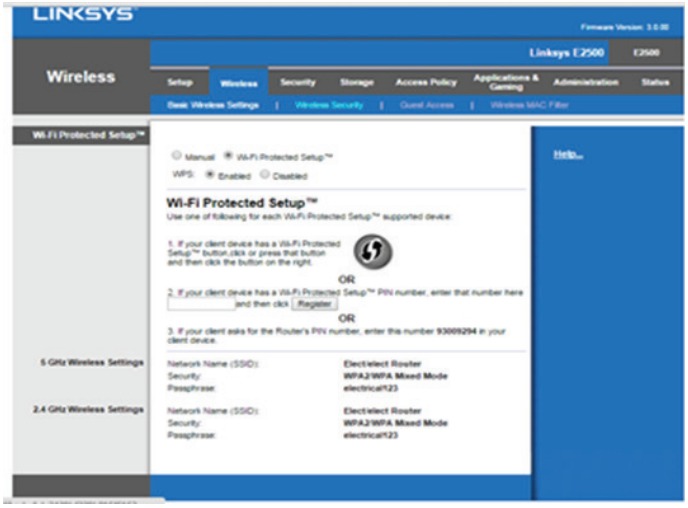

Figure 9: Wireless setup of the Linksys Router

RESULTS AND DISCUSSION

Testing and Observation

Unit Test of Software Modules

This involved the testing and verification of individual software components or modules that makes up the whole software system. The idea is that if a unit is faulty, the whole system cannot function as expected.

Client Login Module Test

A user enters his/her login details in the login display window and clicks on the send button, response is received from the server and displayed to the user via a separate window to indicate if the login is successful or not.

If the login is successful, the application proceeds to display the main interface from which the client can carry out other operations. If the login fails, the applications shows a log in failed dialog to inform the user that his or her login request was rejected by the remote server. The user can then proceed to retry to login or cancel and quit the application.

The user authentication process functioned as it was designed to.

Observations from the Login Module Test

(i) It was observed that the response of the authentication process from the server to the client depended on the speed of the network connection and the processing speed of the client computer.

(ii) Also, it was observed that whenever an already logged in client tries to login in from another system, the previously logged in client is shown a message indicating that he or she has been logged in else-where, and is forced to log out. This functionality was intentionally added to the program.

Figure 10: User authentication user interface

Client Sign-Up Module Test

The test of the sign up was carried out by launching the new user creation module of the client software as shown in figure 11 below. The user interface for creating a new user contains the different forms and drop boxes in which the user enters the necessary data required. This module functioned as expected as it checks for the correctness of the data input by the user and displays a prompt to the user in case of an error. If there is no error, the application contacts the server and sends all the necessary information of the new client. The server updates the database and responds to the user if the creation of the users account was successful or not.

If the creation of the user is successful, the client application proceeds to display the main user interface, else the user is shown a prompt to inform him that the process failed and the reason for the failure.

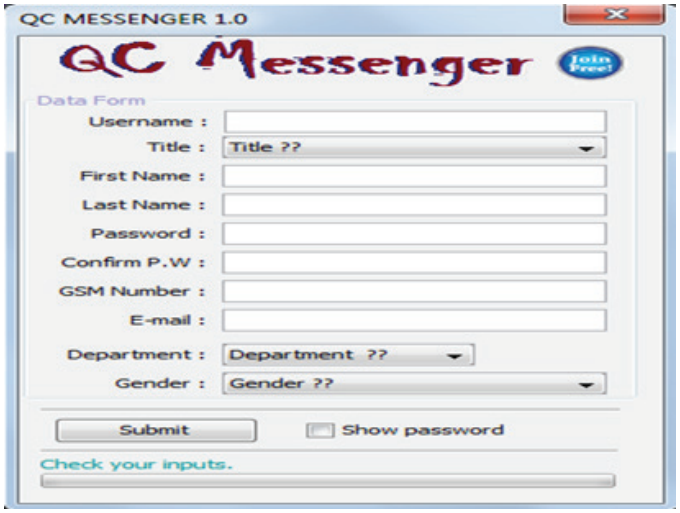

Figure 11: Diagram showing the sign-up user interface

Observations from the Sign-Up Module Test

(i) It was observed that the response time of the process varied proportionally with the speed, bandwidth, and processing speed of the client and server computers.

(ii) Also, it was observed that the system could not state exactly the reason for a failure in creating a new user if one occurs. It only displays the preprogrammed responses.

Client Private Chat Module Test

The private chat functionality test was carried out by launching the private chat dialog of a user by clicking on that users name displayed on the main frame. If the one user wishes to chat with another user currently connected to the system, the text area and send buttons were enabled else they were disabled. Then, an exchange of messages is initiated, and both users are able to exchange message. The private chat module functioned as expected.

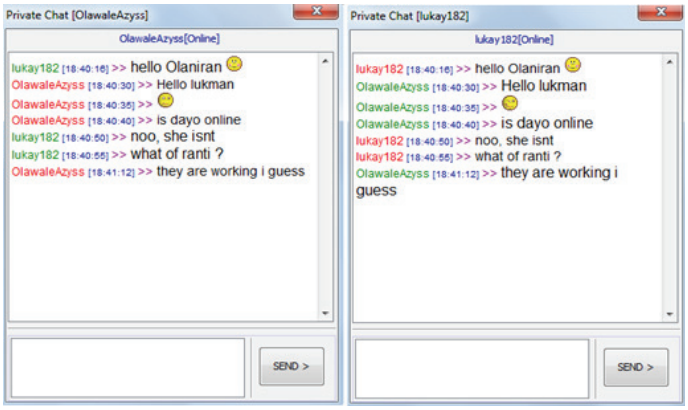

Figure 12: Diagram showing the sign-up user interface

Observation from the Private Chat Module Test

The messages are delivered almost instantly; the time difference between the sending of a message and its delivery at the other end is negligible.

Client Group Chat Module Test

This test was carried out by launching the group chat application by clicking on the groups icon. A user must belong to such group before such group icon can be displayed. After the group module is launched, a user can participate in a conference style chat where each participant can drop a message which is received by all the participants in such group. One could also view other properties of the group, such as the group administrator and the names of all participants in such group. The group chat module functioned as expected as shown in the diagram below.

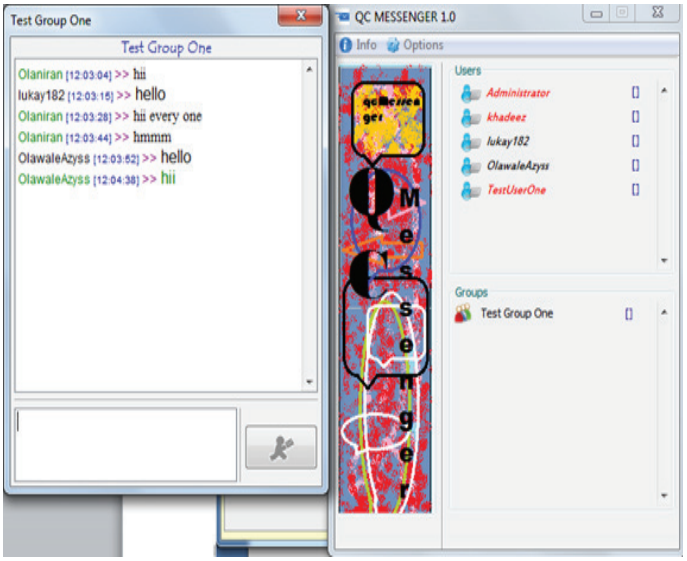

Figure: 13 Group chat graphical user interface.

Observations from the Group Chat Module Test

(i) There was negligible time difference between the sending of a message and its delivery by every member of the group.

(ii) It was observed that due to fire wall settings, some client computers were not allowed to receive multicast messages. The solution to this problem was for such user to turn off his or her fire wall or grant the JVM permission through the firewall.

Client Email Manager Module Test

This test was carried out by launching the email manager module of the application. When this module is launched, it queries the database, through the network, for the user emails, and displays them in a table. The user can click on any row of the table to view the message, as well as, mark the message as read, or unread. This module was found to function as fairly as expected.

Observation from the Email Manager Module Test

The time taken to load the users messages from the remote servers database is dependent on the network speed and processing speed of the client and server computers.

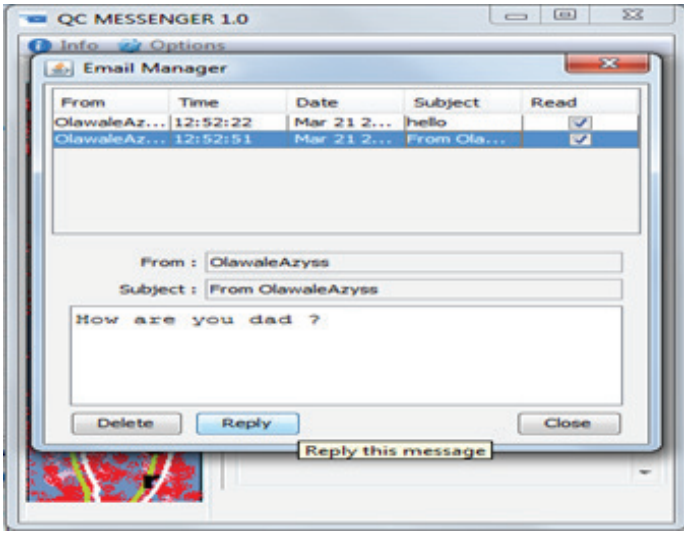

Figure 14: Email manager user interface

Server Connection Handler Module Test

The connection handler module was tested by launching the server. After the server is launched, it listens for connection from prospective clients. When a client connects, the server spawns a new thread to process such client requests and continues listening for other clients requesting to connect. This module functioned as expected, without any noticeable error. Observations from the Server Connection Handler

Module Test

The server was able to accept connections from various clients and service them on a new thread. The number of clients connected to the server impacted

the processing speed of the server. Therefore, the processing speed of the server is directly dependent on the processing speed of the computer on which the server resides.

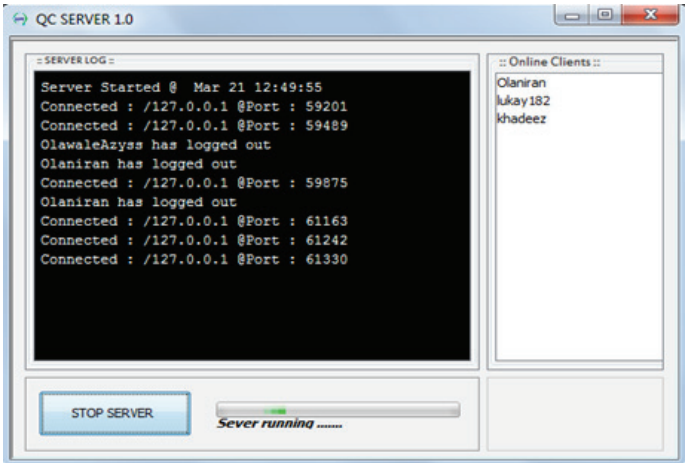

Figure 15: Server User Interface

CONCLUSION

Current findings have revealed the increase in the cost implications of sharing information amongst people who share the same commonality. As an example, the recent increase in the cost of text messages by mobile operators as a result of the increase in VAT by the Nigerian government. Thus, there is a need to develop a cheap and readily available information sharing platform that promotes effective communication. This research work thus considered the development of a cheap and real time Email and multiuser chat system to ensure effective communication between a group of people who share the same commonality.

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