Electronic Memorandum System For Higher Institutions

LUMUMBA BECKY ABIMBOLA

17010301017

A PROJECT SUBMITTED IN THE DEPARTMENT OF COMPUTER SCIENCE

AND MATHEMATICS, COLLEGE OF BASIC AND APPLIED SCIENCES.

MOUTAIN TOP UNIVERSITY,

IBAFO OGUN STATE,

NIGERIA

2021

CERTIFCATION

This Project titled, **ELECTRONIC MEMORANDUM SYSTEM FOR HIGHER INSTITUTIONS,** prepared and submitted by **LUMUMBA BECKY ABIMBOLA** in partial fulfilment of the requirements of the degree of **BACHELOR OF SCIENCE** (Computer Science), is hereby accepted

_____ (Signature and Date)

Dr. (Mrs.) F. Kasali

Supervisor

_____ (Signature and Date)

Dr. M. O Adewole

Ag. Head,

Department of Computer

Mountain Top University

Ogun State

Accepted as partial fulfilment of the requirements for the degree of BACHELOR of SCIENCE (Computer Science)

DEDICATION

This project is dedicated to the almighty GOD.

ACKNOWLEDGEMENTS

I will be eternally thankful to my Grandmother, Mr Victoria Ayegbusi, my uncles and aunt for their love and support during my time at Mountain Top University.

I'd also want to thank my supervisor, Dr. (Mrs.) F. Kasali, for her guidance, comments, and recommendations that helped me finish my research. It is a distinct honour for me to have him oversee my project.And also a very big thank you to Dr Onifade

To all of my excellent professors, members of staff in the Department of Computer Science, and the college as a whole, you have all been the best during my four years here; may God continue to bless you in all your endeavours.

Thank you especially to all of my friends. I am appreciative for the time and knowledge provided to guarantee the completion of this project. I adore you. God bless all of you.

Above all, I want to convey my heartfelt thanks to Almighty God, the source of all life and my saviour, for everything.

ABSTRACT

Memos were sent manually within the university, the Electronic Memo System evolved from manual information transfer and including digital signatures of users. The goal of this project is to develop an electronic memo system that automates the transmission and receipt of information among members of an institution's staff. Additionally, to facilitate and accelerate office communication within the university.

To achieve this goal, it was essential to analyze the hierarchical transfer of information within the university. ASP. Net and Microsoft Visual Studio were used to create an online interface for transmitting and receiving memos, and Ms SQL server had been used to create a database for storing sent or received memos.

The electronic memo created was able to improve office communication by sending and receiving memos in a fraction of a second, and it also has the capability of storing transferred or received memos. It also enables the administrator to assign roles to users, create college and departmental users, and send or receive memos.

The electronic memo system is an excellent improvement in office communication. It is recommended that the future works incorporate an extension of this work to include users who are not university employees. Can also create a memo for other companies.

TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER ONE

1.1   BACKGROUND TO THE STUDY

Technology has reduced the burden on administrators in several institution. Information technology has also reduced the administrative cost of clerical activities and also the time processing of these activity in every organization, with the use of computers, internet, electronic memo and other IT equipment.

A memorandum was from the Latin verbal phrase memorandum est, the gerundive form of the verb memoro, "to mention, call to mind, recount, relate" which means "It must be remembered (that)..." It is therefore an important note, document or other communication that helps the memory by recording events or observations on a topic, it could also be used in an institution or even a business office. A memorandum, more commonly known as a memo, is a short message or record used for internal communication in a business (Nordquist, 2020)

The business memorandum or memo is primarily used as a formal, physical means of effective departmental communication to the employees, nearly always for internal communication and only rarely transmitted to customers or the public. The note is essentially a short letter with firm letterhead, transmitted as a file attachment online or printed for manual delivery. Fewer formal messages are normally sent only by email. Memos, depending on their function, should be distributed to a certain audience (Windermere, 2018). A memo, as compared to an email, is a message sent to a big group of people, such as your entire department or the entire firm. A memo may be required to notify employees of planned events or to communicate internal changes (Forsey, 2019).

The basic function of a memo is to solve a specific problem, pass an important message or even to make a request by making the reader aware of certain information. A memo can be written to persuade others to take action or give specific feedback on a particular matter, memos are also used to convey information, make request, provide response and to present informal report. Another function is to help everyone in an institution organised. Memo transmits information about an organization's day-to-day activity. It usually has commands, instructions, regulations, processes and so on. From the top to the bottom level of the organization. It is also used to provide comments and requests from lower to higher levels (TheBusinessCommunication)

Memos are used to convey information, we can use the memo to obtain additional information when more information is needed, memo requests typically addressed via the memo, and informal reports widely used in planning, organization, motivation, and control by managers can also be used to deliver (Buisness Communication Articles, 2013)

The purpose or intent of the communication differs depending on the sort of memo you write. For example, a notice can be written to communicate information with employees, however a notice of request must be made more convincing

While all sorts of messages have a similar pattern, the body of the message may be different (indeed, 2021).

A memorandum is a written communication that documents information to be discussed in a professional environment with a group of individuals. While a range of templates may structure memo sections it is necessary that the relevant elements of a memo be contained, mainly head, background, context (depending on what the memo should do) and conclusion (Sheahan, 2019).

Memos are of great benefits to higher institutions because it aids in effective communication and keeping of records of passed thing that have been done and communicated. Memos are also in expensive to create, even when a memo is being printed its cost the institution far less than having to create a formal meeting to pass the information. Memo information is harder to dispute than oral communication because the memo is an evidence of the writer has said, memos

Higher institution in Nigeria, types and print memos as hard copies, sometimes the memo is attached to an email, and it is being sent in hierarchy, for instance, a staff in a particular department wants to send a memo to the VICE CHANCELLOR, the memo will have to be sent to the HOD for approval, then to the dean of the college, Before it finally gets to the VICE CHANCELLOR, this whole process may take a very long time.

Electronic Memo

Switching to paperless office operations often has a positive company impact in terms of cost savings, efficiency benefits, and enhanced environmental responsibility.

Usually, the application of paperless office strategies means that employees, sellers and clients can use online technology to execute regular transactions, decreasing waste and the time needed to accomplish them (Duggan, 2012).

Electronic Memorandum is a software used to digitally create, collect, store, manipulate, and send office information needed for accomplishing basic task. E-memo also simplifies how information within an organization is transferred and managed thereby improving the accessibility and security of information sent within an organization

Electronic Memorandum is the application of computer and communications technology to improve the productivity of the office workers of an organization. The major functional components of an electronic memorandum include text processing, electronic mail, information storage and retrieval, personal assistance features, and task management. These may be implemented on various types of hardware and usually include a keyboard for input, and a hard-copy output device for "letter- quality" printing.

1.2   STATEMENT OF THE PROBLEM

Generally, memos are typed and printed as hard copies; occasionally, they are attached to an e-mail, and printing such a large number of documents is quite expensive. Hard copy memos frequently take a long time to reach their destination and even longer to receive a response.

Sending a memo via E-mails also require printing, since the sender and the recipient signature must be included in the message

In most institutions, memos are routed through the hierarchy. For example, if a memo is about to be sent from a staff member in a department to the VICE CHANCELLOR of an institution, it must first go through the HOD of the department, then to the Dean of the College, then to the Registrar, and finally to the VICE CHANCELLOR, and this process can take days.

When past memos are referred to, it can take a long time to locate them because one must search through a stack of previously received memos before accessing the referred memo.

➢ Difficulty in retrieving information; This might be a big challenge when a past written memo is required or referenced to

1.3   AIM AND OBJECTIVE

The project's goal is to create an electronic memo system that Automates the sending and receiving of information among members of an institution's staff. Also, to facilitate and speed up office communication.

1.4   OBJECTIVE

Below are the objectives of the proposed system.

i.   To understand the requirement of the system

ii.   To design the system

iii. To develop the system

iv.   To test the system

1.5   METHODOLOGY

 The proposed electronic memo system will be Developed using ASP.Net MVC for the front end development, Microsoft Visual studio will be used to develop the system, Finally MS SQL sever will be used for the implementation and management of the database

1.6   SCOPE OF STUDY

The project designs and implements electronic memo sharing. All memos sent and received by the institution are combined into a database and may be accessed via a web application,

which is supported by a well-defined database. A simple user interface was provided so that the user could simply communicate information without moving an inch. The electronic Memo system includes both a Lecturer and an Administrative user interface, the latter of which is utilized for administrative purposes.

1.7   LIMITATIONS OF STUDY

The system to be built in this study is limited to the sharing of memos among members of the institution's staff; external members are not authorized.

1.8   SIGNIFICANCE OF THE STUDY

The electronic memorandum system is crucial because it allows for quick and safe information sharing among institutional staff members. The system will establish an easy-to-use user interface for information integration among the institution's various divisions.

The technology will also automate the writing and receiving of memos, reducing paperwork inside the institution, and allowing quick access or referencing to previously written or received memos. The technology differs from email is that it can only operate within the defined institution and includes an additional digital signature.

1.9   DEFINITION OF TERMS

Memo: "According to the Collins Dictionary" A memo is a short official note issued from one individual within the same firm or organization to another.

Automation: The development and implementation of technology to monitor and control the manufacturing and delivery of goods and services (International Society of Automation, 2021).

HIGHER Institution: Higher education, often known as post-secondary education or tertiary education, refers to any degree of education studied after high school, including undergraduate and graduate diplomas. Certificates, diplomas, and academic degrees are examples of credentials (Top Hat, 2020).

Office Communication: Office Communication is the practise of communicating knowledge and ideas between one individual or group and another inside an organization, both orally and non-verbally, is known as office communication. (Chegg, 2021).

CHAPTER TWO

2.1   MEMOORANDUM TYPES AND BENEFITS

Memorandum

A memorandum is a note or record kept for future reference. According to (toppr, 2020) it is critical for an organization to have an efficient method of communication. It is a tool for use within the office. It serves several functions.

A memorandum is a written message or information sent from one person or department in the same business to another. It is not as formal as a letter.

A memo is a common abbreviation for a memorandum. Effective memos state the goal in the first sentence.

Memorandum's Purpose

A memo is written with specific goals in mind. It is used to inform, as well as to inquire:

    i.   It can be used to report.

    ii.   To make recommendations

    iii.   Just a reminder.

    iv.   It can be used to teach.

v. A memo can be used to spread goodwill.

vi. To make the thoughts known.

The Benefits of Memos

There are several advantages to using memos:

i. Memorandum is short for Memorandum is short for Memorandum is short for Memorandum is short.

ii. It is a practical mode of communication.

iii. It is reasonably priced. Memos are utilized within an organization; therefore, low-quality paper can be employed.

iv. It aids in the preservation of written records.

2.1.2 CHALLENGES AND LIMITATIONS OF MEMORANDUM

Memos are a written form of internal communication, according to (thebusinesscommunication, 2020). Although it is commonly used for information exchange within organizations, it has certain disadvantages. The following are some of the most significant downsides or limitations of using memo:

i. Memos have a limited field of application because they can only be used within the confines of the company. It cannot be used to communicate with anyone else.

ii. Office memos are a type of written communication that is not appropriate for illiterate people. As a result, it is useless to illiterate individuals.

iii.   Lace of Explanation: Memos are typically written succinctly. As a result, it offers no explanation or clarification of the message to its readers.

iv.   Problem with Modification: If a memo mistakenly spreads incorrect information, it cannot be immediately updated. Circulation of corrigendum is required for essential rectification.

v.   Time Consuming: A formal note necessitates time for formulation and distribution to the relevant stakeholders.

2.1.3 ORGANIZATIONS THAT USE MEMORANDUM

When Should You Write a Business Memo? Businesses and organizations may require their staff or members to follow specific guidelines regarding when and how to issue a memo. These recommendations may specify when a paper version is required and when email is sufficient. A memo can be used for a variety of purposes in the workplace, including the following: (Announce or confirm a meeting or event (Give instructions (Provide a project progress report (Ask for feedback or recommendations After a meeting, summarize the actions that must be taken. Clarify or modify a policy or practice (distribute meeting or event minutes or handouts) as stated by (Alam, 2021) Many, if not all, lecturers of Business/Managerial Communications Courses, as well as actual practitioners in corporate sectors and government bureaucracy, have a very muddled understanding of a memo. We mean "Office Memo" when we say "Memo." SINCE MEMOS ARE USED IN OFFICES, WE JUST CALL THEM "MEMOS." In addition, there are no further memos. Almost everyone understands that memo is a shortened version of memorandum, but not everyone understands the meaning, qualities, and rules of use of memo in a real-life work context.

Textbooks, although including hundreds of samples, do not desire to elaborate on this subject to the same level.

2.2   INFORMATION MANAGEMENT SYSTEM

Management system of information (IMS)

IMS is an overall phrase for software designed to make it easier to storage, organize and retrieve information.

IMS is also the name of the gigantic software of IBM which was built to serve NASA's Apollo Space program in the 1960s. This IMS version was the forerunner of the first hierarchical database management system in IBM (DBMS).

Information management (IM) is collected and administered from one or more sources according to (Kaur, 2004), and distributed to one or more audiences. Management is the management and control of information activities planning, structure, management, processing, evaluation, and reporting, in order to achieve the customer goals and allow company functions to supply information. "Information" means all types of value information, whether it comes from within or outside the organization, including data resources, such as production data; records and records of, for example, the personal function of information; data for market research; and competitive intelligence from a variety of sources. In the context of organizational performance, Information Management focuses on value, quality, ownership, usage, and safety of information.

2.2.1 EVOLUTION OF INFORMATION MANAGEMENT SYSTEM

According to (Zhang, 2013) Management Information Systems (MISs), the last few decades saw tremendous variety. The whole picture of the evolutionary development of MISs comes in such a large demand and problem. This study analyzes the crises and issues facing the traditional MIS by methodically reviewing the existing literature/research in MISs, by analyzing and modelling the MIS concepts. Moreover, with EBD, the design methodology, the author analyzes how crises have been addressed and, consequently, cómo transformes the classic MIS pyramid into an intelligence integration frame to understand MIS evolution that allows different information systems not only to be positioned, but also to demonstrate how these systems are still interconnected with who. The two-dimensional framework for MISs is a conceptual model based on which the general evolution of information systems can be dynamic and not "part-time" or "static" to be described as different from previous frameworks. This framework is also a paradigm that applies to MIS and IT development, and hence not only has academic meanings but also practical significances.

2.2.2 HOW MANAGEMENT INFORMATION SYSTEM IS MANAGED

Concept Management Information (MIS).

Over the course of a period the idea of MIS has grown and included numerous dimensions of organization. MIS is a must for all organizations, according to (Sarras, 2021). The primary conception of the MIS was to process and report on data from the organization. The system was able to process data from the collection to processing to a great extent. Every person had to select and select processed data and use them for his requirements. It was more impersonal. This idea was further refined when data and information were distinguished. The data is an outcome of data analyzes. This concept resembles a commodity and the finished product. Information and not a plethora of information are needed. The data can nonetheless be

examined and various colors and information specs as a produced product can be produced. The system concept was therefore required to be a person-oriented one, because every person could have a distinct orientation. For information. To the information. A conception of the past decade or two, the Management Information System (MIS). In a multitude of ways this was understood and described. The information system, the information and decision system, and the information system based on computers is also known. The MIS contains several definitions, some of which are described here.

i.   MIS is described as a system that supports decision-making information in the organization.

ii.   The MIS is defined as an integrated system that supplies information to support the organization's operations, management and decision-making functions by man and machine.

iii. The MIS is defined as an organization's database-based system developed to provide information to the organization's people.

iv.   The Computer ñ information system is defined as the MIS.

2.2.3 ROLE OF THE MANAGEMENT INFORMATION SYSTEM

The MIS position can be contrasted with the heart's role in an organization body. Blood information and MIS is the heart. Information. The heart plays in the corpse. The job of feeding all body elements including the brain with pure blood. The heart works quicker and provides more blood if necessary. It controls and regulates, processes and sends the incoming polluted blood to the destination. Necessary quantity. It meets regular blood supply needs of the human body and in crisis as well.

2.3 AUTOMATED MEMO SYSTEM (EXPLAIN BROADLY)

The Electronic Memorandum is the current trend for internal communication within an organization (E-Memo). This reflects the diverse computer and software utilized for digitally creating, collecting, storing, manipulating, and relaying office information that is necessary to perform fundamental operations. (Ramoni T. A., 2016) The electronic business composed on and sent by electronic mail technology is raw data, electronic transfer, and management. Effective internal communications are one of the major facilities for employee participation and are intended to provide firms with significant value in every parameter from productivity to customer research. The system is designed to improve the communication of information in an efficient, timely and reliable organization.

2.3.1 THE USE OF AUTOMATED MEMOMORANDUM

(favour, 2021) Electronic Memorandum is the current trends for internal communication in an enterprise (E-Memo). E-Memo is designed to automate the complete lettering process, including submission, and includes a wide range of computer and Software for digitally creating, gathering, storing, manipulating, and relaying office data that are required for basic work. The process is done online via a PC in the proposed system without the usage of a piece of paper with other characteristics that erases the manual process. When traveling

outside the workplace, by implementing e-Memo you may eliminate the paperwork. Like e-Memo, information with LAN and WLAN connections can be accessed anytime. The system is aimed at making communication of information within an organization more effective, timely and reliable. In conclusion, the processing of E-Memorandums is a very significant demand for increasing efficiency in many organizations, given the number of daily activities and also for making speedier goals in comparison to the manual procedure. Data will be saved in a digital format that will make it easier and faster to discover searches or sorting of memoranda/file services and this function is highly important to the firm or organization when it is being audited.

2.4   SDLC MODELS

SDLC is an abbreviation used to define life cycles of software or of development systems according to (Half, 2021). Although the principles between the two are the same, one pertains to the software's life cycle and one to that of a system that includes the development of software. This paper highlights the creation of software, though it may be transferred to systems on the same principles. In addition, the majority of creativity and thinking in terms of designing models and concepts comes out of software development, resulting in a strong reliance on software development.

Models are as follows:

i.   Model waterfall

Waterfall is the oldest and easiest organized SDLC methodology – complete one step, then go to the next. No return. No return. Each step has its own project plan and relies on

information from the preceding phase. It's straightforward to grasp and easy to handle the waterfall.

But the whole project schedule can be removed by early delays. And as revision time is limited, problems cannot be solved until you reach the maintenance stage. There is no room for revision. This methodology does not function if flexibility is necessary or if the project is ongoing and long-term.

ii.   Model V-Shaped

The V-shaped model, also known as the model Verification and Validation, is a Waterfall model which is defined by a corresponding test phase for each stage of development. Each stage only starts when the preceding stage ends, like the Waterfall.

This paradigm is appropriate if the needs are not unknown, as adjustments are tough to make.

iii.   Model of escape

The escape model is incarnated repetition. You implement a set of software needs and then test, assess and identify other requirements instead of starting with fully understood requirements. With each phase or iteration, a new version of the software is developed. Rinse and repeat until ready for the entire system.

This technique provides a work version early on and makes implementing changes less expensive. One advantage than other SDLC methodologies. One drawback is that resources might be used quickly through continuous iteration of the operation.

iv.   Model Spiral.

The Spiral model, one of the most flexible SDLC methods, is inspired by the Iterative model and its repeated use and is continuously completed in four phases in a "spiral," which allows for several rounds of refining.

This methodology allows a very bespoke product to be built and customer feedback may be added to the project from the outset. However, the risk is that you may create an endless spiral for a continually ongoing undertaking.

v. Model of Big Bang

The Big Bang model follows no certain process and spends very little time on planning, which is a bit of an outlier between SDLC techniques. Most resources are directed towards development and even the customer cannot understand the needs in a solid manner. This is one of the SDLC approaches often utilized with just one or two software developers in smaller projects.

Big Bang for large or difficult projects is not suggested because this is a high-risk approach; if the requirements are misinterpreted at the beginning, then the project could reach its conclusion and be reinitiated.

vi. Model Agile

The Agile model quickly delivers a work product and is a highly realistic approach to the development by splitting the product into cycles. The model delivers continuous releases with minor, gradual changes from the preceding version. The product is tested at every iteration.

This model stresses the interaction between clients, developers and testers. But because this model is strongly dependent on the contact between the customer, the project can go wrong if the consumer doesn't have a clear path.

2.4.1 SDLC PHASES

The following are the usual life cycles for software development (Everett & Mcleod, 2007) −

Stage 1: Analysis of Planning and Needs

The most critical and fundamental phase of the SDLC is requirement analysis. It is conducted by senior team members with customer information, sales department, market investigations and industry domain experts. This information is then used to create the core project approach and conduct a feasibility assessment on products in the economic, operational, and technical fields.

The planning phase also includes the planning of the quality assurance requirements and identifying the hazards linked to the project. The technical feasibility assessment results in defining the several technical approaches that can be taken to successfully perform the project with minimal risks.

Step 2: Setting Requirements

The following step is to clearly identify, document and obtain approval from the client or the market analysts when the requirement study is completed. This is done through an SRS document, containing all the product requirements to be designed and developed during the project life cycle.

Stage 3: Architecture of the Product

For product architects, SRS is the reference for developing the finest product architecture. In accordance with the standards of SRS, a DDS – Design Document Specification frequently proposes and records more than one design approach for the product architecture.

This DDS is reviewed by all major stakeholders and the optimal design strategy for the product is selected based on several characteristics such as risk assessment, product strength, modular design, budget, and time restrictions.

All product architecture modules, as well as its communication and data flow representation, are explicitly defined by a design approach with external and third-party modules. Without prejudice to the specifications in the DDS, the internal design of every modules should be well described.

Stage 4: Product construction or development

The real development begins in this stage of SDLC, and the product is constructed. During this stage, the programming code will be generated by DDS. The codes can be generated without great hassles if the design is executed in a comprehensive and orderly way.

Developers must follow organizational coding requirements and code generation tools like compilers, interpreters, debugs, etc. Coding will be employed in many high-level programs such as C, C++, Pascal, Java, and PHP. In relation to the software type being developed, the programming language is chosen.

Phase 5: Product testing

The testing activity is frequently an all-stage sub-stage process, like with the new SDLC models, mainly in all phases of the SDLC. This stage does not however refer to testing the

product till it exceeds the quality criteria stated in the SRS. In these cases, flaws of product are reported, tracked, re-tested and rectified.

Stage 6: Market and maintenance deployment

The product will be formally disclosed on the relevant market after it is tested and ready to launch. Product rollout sometimes occurs in stages, as per the company's business strategy. First, the product can be offered in a small segment and tested in real business (UAT- User acceptance testing).

Based on the input, the product can then be released in the target market group as it is or with suggested improvements. The maintenance is performed on the current client base after the product is launched on the market.

2.4.3 SUITABLE SDLC MODEL

The suitable SDLC Model for this project is Extreme programming, because its fast and testing is done after each segment.

2.5 DEVELOPMENT TOOLS

Over time, the number of web development tools has grown. Because of this, choosing the ones we must use every day is not easy. (Sousa, 2020) It is also crucial to evaluate which tools can help to build a strong answer if you can come up with what is popular with one hand.

i.   **React**

React is JavaScript's most widely used library for online and mobile UI creation. Facebook established it in 2013 with more than 149K GitHub stars at present. Reaction apps are created declaratively, making your code easier to debug and more predictable. The views are component-based, so that every component must handle its own status. React is an autonomous part of your project also, so you do not have to worry about the rest of the stack.

Today practically all companies aspire to develop mobile cross-platform apps because of the regular use of smartphones. For this, we can utilize a mobile app built on React, known as React Native. You can construct genuinely native applications; don't compromise the experience of your users and you can also reuse some code from your Web App.

ii. **MaterialUI**

You will realize there are several elements which you need to incorporate for each project if you start building front end applications on a regular basis.

UI frameworks are key tools for front-end development that seek to overcome these challenges by abstracting common aspects into reusable modules, allowing developers to scaffold the elements of new applications quickly and easily.

MaterialUI, one of the most popular frameworks, delivers a large variety of React components for faster and easier web development. All of these components are highly customizable, which can significantly reduce the amount of code (and hence time) required to develop your project. Please keep in mind that the component that we need to

design is not always easily adaptable with MaterialUI. In that case, creating our own component is the ideal approach.

When you start developing front-end applications on a regular basis, you'll discover that there are a few elements that you must include in every project.

iii. **Chrome Developer Tools**

As a developer, you're always looking for a good approach to debug your code. Chrome Dev tools are among the best for accomplishing this. It includes a suite of web development tools that allow you to perform a wide range of development tests in your browser, saving you a significant amount of development time.

The following are the most essential Chrome Dev tools:

Nowadays, we attempt to develop CSS that is easy to maintain and requires the least amount of code to achieve the purpose. It should also be DRY (Don't Repeat Yourself).

Sass is a popular front-end development tool that gives an easy method to compose CSS. It has been actively supported for over 13 years and has essentially defined the genre of modern CSS preprocessors. It supports variables, nested rules, mixing, functions, and more, all with a fully CSS-compatible syntax that aids in the organization of large stylesheets.

iv. **VSCode**

Microsoft's VSCode is a source-code editor that was published in 2016. Visual Studio Code was named the most popular development environment tool in the 2019 Stack

Overflow Developer Survey. It has several cool features that are generally only available on commercial editors. The primary characteristics are as follows:

IntelliSense: intelligent completions are provided based on variable types, function definitions, and imported modules.

Debugging is the process of debugging code directly from the editor. Debug with breakpoints, call stacks, and an interactive console by launching or attaching to your running apps.

Built-in Git commands allow you to review diffs, stage files, and commit directly from the editor. Any hosted SCM service can be used to push and pull data.

Tools for Productive Development, according to (SEBASTIAN, 2019)

i. **GitHub**

The world's most popular software development platform. GitHub is a website that hosts Git repositories. In a nutshell, it's similar to Google Drive for software projects, where you can discover code. When you upload your project, you may choose whether to make it public or private. The community is enormous, and the project base is considerably larger. GitHub is also a wonderful platform for developers to find, share, and build better software.

ii. **Git**

Git is a free and open source distributed version control system that can manage everything from tiny to extremely large projects with ease and speed. When a developer is working on anything, they must make modifications to the code on a frequent basis until they reach the final version.

A version control system preserves every change made, making it possible for others to collaborate, make modifications, and contribute. You will also discover a copy of every developer's code.

iii. **GitLab**

GitLab is the industry's most popular integrated tool for modern software development. They help teams go from planning to monitoring faster by combining issue management, version control, code review, CI, CD, and monitoring into a single, easy-to-install tool.

iv. **IntelliJ IDEA is a software development environment.**

Intellij is a software development environment. An IDE incorporates all the tools required to develop a platform, such as a code editor, a compiler, a debugger, and so on. After IntelliJ IDEA has indexed your source code, it provides a quick and intelligent experience by providing relevant suggestions in all contexts: immediate and clever code completion, code analysis, and dependable refactoring tools.

v. **Stack Exchange**

Stack Overflow is the largest online programming community, with over 50 million developers visiting each month. This is a location where they may study, share information, and progress their professions. Our developers adore this forum and visit it virtually every day because it contains answers to almost all your inquiries and concerns.

vi. **Docker**

It is possible that calling it a tool isn't entirely accurate because it's a container, but we believe it deserves to be included. Docker is a free and open platform that allows developers and system administrators to create, deploy, and execute distributed applications. Docker is a software containerization framework that allows you to bundle your applications in a file system.

vii. **Jira**

Jira is the most popular software development tool among agile teams. It aids in the planning, tracking, and management of software development projects. It also aids in the customization of workflow, collaboration, and the production of excellent software. When it comes to project management, it is really beneficial. It enables you to manage the backlog of your team, see the work in progress, and generate reports.

viii. **Jenkins**

Jenkins is an open-source automation server that specializes in continuous integration.

2.5.1 FRONT END (TOOLS)

In just a few years, web development tools have come a long way. As a result of this advancement, we can leverage the power of well-tested libraries to simplify our workflow and profit from expanded responsive design options. Not only that, but we can collaborate on projects thanks to ever-improving version control systems. According to (MOWFORTH, 2021), there have never been more possibilities for producing excellent online applications, ranging from browser add-ons and plugins to processors that streamline your code. However, with the number of web development tools expanding practically daily, it might be difficult to choose the finest software to get the task done. To assist you, we have compiled a list of crucial frontend development tools to get you started. If you want to learn more about one, please choose it from the list below.

i. **The Sublime Text editor**

Let us start with the basics: a top-tier code editor with a well-designed, super-efficient, and lightning-fast user interface. There are plenty that accomplish this effectively, but Sublime Text is perhaps the best (and most popular).

ii. **Chrome Developer Tools are available for download.**

Wouldn't it be amazing if you could change your HTML and CSS in real-time, as well as debug your JavaScript, all while receiving a comprehensive performance analysis of your website?

You can do this with Google's built-in Chrome Developer Tools. They are packaged and available in both Chrome and Safari, and they provide developers with access to the internals of their online application. A palette of network tools can also help optimize your loading flows, while a timeline provides a more in-depth insight of what the browser is doing at any given time.

iii. **jQuery**

JavaScript has long been seen as a vital front-end language by developers, but it is not without flaws: riddled with browser quirks, its relatively convoluted and impenetrable syntax meant that functionality was frequently sacrificed.

That was until 2006, when jQuery – a fast, lightweight, cross-platform JavaScript framework aimed at easing the front-end process – debuted. jQuery expanded the possibilities for creating animations, adding plug-ins, and even traversing documents by abstracting a lot of the functionality that was previously left to developers to handle on their own.

iv. **GitHub**

It's every developer's worst nightmare: you're working on a new project feature when you make a mistake. Version control systems (VCS) – notably, GitHub – come into play.

By deploying your project with the service, you may monitor any changes you've made and even revert to a previous state (making pesky mistakes a thing of the past). The repository hosting service also has a robust open-source development community (which makes team communication a breeze), as well as various other components for each project, such as bug tracking, feature requests, task management, and wikis.

Over time, the number of web development tools has grown. As a result, it is difficult to select the ones that we must use on a daily basis. If you can go with what's popular on the one hand, it's also necessary to evaluate which tools can help you produce a good answer on the other.

2.5.2 BACKEND (TOOLS)

Things can become a little more simple and easier for Backend Developers if they use the proper set of backend development tools available in the digital sector to (GeeksforGeeks., 2021) Programming languages, frameworks, database management systems, web servers, testing and deployment tools, and other tools fall under this category. When undertaking Backend Development, you can choose to use or not use these tools based on your needs.

Tools for Backend Development

i. **PHP (PHP)**

PHP, which stands for Hypertext Preprocessor, is a server-side scripting language that is one of the most popular computer languages for backend web development. We can back up this claim by pointing out that PHP is used by sites such as Wikipedia, WordPress, Facebook, and many others. This language is recommended for web

development for a variety of reasons, including cross-platform compatibility, OOPs capabilities, easy interaction with HTML, CSS, JavaScript, and others, a large community support, improved flexibility and security, and many more. Furthermore, the language is simple to learn and utilize. Furthermore, there are numerous well-known PHP frameworks available, such as Laravel, Symfony, CodeIgniter, and others, to consider.

ii. **Pythagorean**

Python is another language that is popular for backend development, particularly in recent years. It's a high-level, general-purpose programming language that supports a variety of programming paradigms, including Object-Oriented, Procedural, and Functional.

iii. **JavaScript 3.0**

To be honest, JavaScript need no introduction due to its huge significance in web development. It is, in fact, one of the core building blocks of web development, along with HTML and CSS. The language is preferred by a large number of developers for web development, and it ranks at the top of several prestigious indices for top programming languages.

iv. **Laravel is a PHP framework.**

Laravel is one of the most well-known PHP frameworks in the computer world. This open-source web framework adheres to the Model-View-Controller (MVC) architectural pattern and includes a built-in command-line tool called Artisan, pre-installed Object-Oriented and Modular libraries, Eloquent ORM (Object Relational Mapping), Template Engine, and many other useful features. Furthermore, the

framework provides you with a variety of tools for specific tasks like as dependency injection, unit testing, and so on.

v. **Django is a programming language.**

Django is a Python-based open-source web framework that makes web development easier and less time-consuming. The model-template-views (MTV) architectural pattern is followed by Django. Some of the reasons for this framework's enormous popularity and demand are its prominent qualities such as extensibility, rapid development, scalability, security, a large community, and many more.

vi. **MongoDB is a database.**

MongoDB is a popular free and open-source document-oriented database among web developers. This NoSQL database stores and retrieves data using JSON-like documents with optional schemas, providing much-needed scalability and flexibility.

vii. **MySQL 7**

MySQL is another popular open-source relational database management system for web-based applications. It is a high-performance database with improved scalability, usability, and stability.

viii. **Apache is the eighth letter in the alphabet.**

The Apache, often known as the Apache HTTP Server, is a cross-platform open-source web server developed by the Apache Software Foundation. It is one of the most popular web servers, as evidenced by the fact that Apache powers about half of all websites worldwide.

2.6 RELATED WORKS

Your literature review should be summarized in the "Related Work" section. You must cite and discuss at least three different sources of information. Technical or scholarly publications, conference papers, books, textbooks, patents, technical reports, theses/dissertations, or websites are examples.

the limitations of present approach and the necessity for new methodology It also allows you to display your expertise of the subject and assists others in relating your current work to other scientific disciplines.

This paper analyzes a revolutionary concept called Mobile Electronic Memo in a research book by (Bartolomeo, Salsano,, & Frisiello, 2011) whose objective is to overcome the limits in terms of interoperability and accessibility imposed by present technology. Mobile Electronic Memos do this by decoupling the semantics of the information from the physical and pragmatic restrictions of the media that transmits it. We evaluate relevant works and standards that could be viable candidates for implementing MEMs and describe a proof-of-concept prototype implementation.

A basis of electrical design memo must be written for each project that involves electrical components, according to a research book by (seattle.gov, 2021). It encourages the following: • Narrative description – by ensuring that designers and contractors understand the project requirements during the process of identifying and evaluating design options. It gives participants access to the original design intent and assumptions while checking project performance acceptance criteria throughout construction. Consistency is achieved by providing electrical design professionals with a form as well as methods. The form contains a summary of actual electrical design criteria. The processes are those that must be followed during the course of a project. • Continuity is achieved by orienting non-SPU and new facility

personnel to make more educated decisions about equipment operations, maintenance, and replacement while maintaining the original intent of performance requirements. The memo can keep coworkers and project managers up to date on design assumptions. It also compiles and transmits electrical design information that is required for the electrical review process. • Quality control is achieved by creating and disseminating project-specific electrical design criteria and requirements that can be easily reviewed and adjusted as needed. The note aids in the documentation and management of scope modifications. • Documentation/Completion – by consolidating and summarizing all electrical parts of the project.

In a research (Ramoni, Olaitan, & Olorunlomerue, 2016) This refers to the varied computer machinery and software used to digitally create, collect, store, manipulate, and relay office information needed for accomplishing basic tasks. Raw data storage, electronic transfer, and the management of electronic business composed on and sent with electronic mail technology. Effective internal communications is one of the key enablers of employee engagement and thought to add significant value to organizations on all metrics from productivity to customer research. The system is design to enhance effective, timely and reliable organization information communication. Macromedia Dream weaver was used for the design of the client side, Php was used for the design of server side and the DBMS used was Mysql.

CHAPTER THREE

3.1   INTRODUCTION

The methodology explains the tools, methods and techniques utilized to accomplish the electronic memo system's objectives. As a way of creating the system, the waterfall model is used**.**

In order to achieve the project goal I had, I read past work done, in order to understand the requirements of the system. To design the system I used the UML diagram, and to develop the system I used Asp.net and Ms SQL for the server and the database.

3.2   METHOD OF IDENTIFICATION OF USER SYSTEM REQUIREMENT

ASP.Net MVC

ASP.NET is a free online framework for creating websites and web applications using HTML, CSS, and JavaScript on the.NET Framework.

The ASP.NET, or Active Server Pages.NET, is a Microsoft-based technology that uses the dynamic content of the internet to utilize the.NET capacities. We imply content by dynamics which adapts to the desired circumstances. Consider a website with information about the weather. The information is current and correct when it is produced. However, the material is old over time and an update is necessary. This requires the re modelling of the website, at best a laborious procedure. ASP.NET allows the website to be updated automatically, i.e. just after the page is produced.

The ASP. Net MVC was used for front end development of the electronic memo system.

MS SQL Sever

In corporate IT environments, Microsoft SQL Server is a relational database management system (RDBMS) that supports a wide range of transaction processing, business intelligence, and analytics applications.

The MS SQL Server was used for the database implementation and management.

Microsoft visual Studio

Microsoft Visual Studio is an integrated development environment (IDE) developed by Microsoft for many forms of software development, including computer programs, websites,

web applications, online services, and mobile application. Completion tools, compilers, and other capabilities are included to make the software development process easier.

The Microsoft visual Studio is the IDE that was used for the development of the system. It comes with IIS sever so it makes it to deploy the application with the . Net framework.

3.2.1 IDENTIFICATION OF SYSTEM REQUIREMENT

FUNCTIONAL REQUIREMENT

In software and systems engineering, a functional requirement is a declaration of the intended purpose of a system and its components. The behaviour (output) that a device or software is expected to display when faced with a specific input is based on functional requirements. A system design is a functional need in an early stage of development.

The functional requirements of the electronic memo system is stated below;

➢ The system must handle user registration.

➢ The system must allow user to login.

➢ The system authorises user based on their roles.

➢ The system allows user to send and receive messages.

➢ System must allow users to add special notes to a memo such as an urgent or confidential tag.

NON-FUNCTIONAL REQUIREMENT

➢ Role Management System: System must handle the control of user functions based on their roles.

- ➤ Email Verification: The system must verify the email address of the user upon registration.
- ➤ Security: System must ensure security of user account using password encryption
- ➤ Usability: System must implement simple and easy interface that s easy for the user to navigate

HARDWARE REQUIREMENT

Processor:X86 or X64, RAM:512MB (minimum), 1GB (recommended) hard disk: up to 3GB of free space may be required.

SOFTWARE REQUIREMENT

Operating system, power shell 2.0 and either visual studio 2010 with service pack 1 or visual web developer express 2010 with service pack 1

3.2.2 IDENTIFICTION OF USER REQUIRMENT

USE CASE DIAGRAM

A use case diagram in the Unified Modelling Language (UML) summarizes the particulars of your system's users (or actors) and the various methods through which they interact with the system
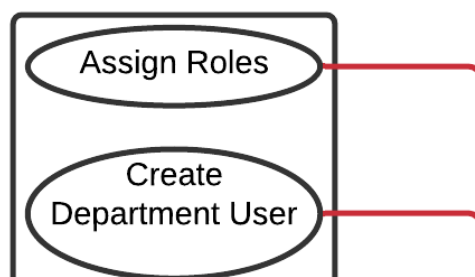
Fig 1.1 Use case diagram of an electronic memo system

The Administrative

The following are the roles the administrative user performs on the system.

i.   Assign Roles

The administrative user assigns roles to the other user. For instance, the administrative

assigns the login to the role of Dean of the College is, who the HOD to the department is and

also who the lectures are.

ii.   Create Departmental User

The administrative creates a user for important role for instance, the administrative user selects or assign the   role to the HOD to the current HOD of that department, same applies to the post of the dean of the college.

iii.   Create College User

The administrative user is the only authorized user to Create a College User for instance, the administrative is allowed to create login for the role of the Dean to the college.

iv.   Delete User

The administrative is authorized User to delete any user on the system.

v.   Receive Memo

The administrative user is authorized to receive Memo

vi.   Send Memo

The administrative user is allowed to send Memos.

The User

The following are the roles of the user on the system:

Send Memo: The user is authorized to send memo on the system within the institution

Receive Memo: The User is also authorized to receive incoming memo within the institution.

3.3   SYSTEM DESIGN METHOD

3.3.1 USE CASE DIAGRAM

A use case diagram is a behaviour diagram that illustrates how actors work together with the system to create observable behaviour. The model represents the system, along with the associated use cases and actors.
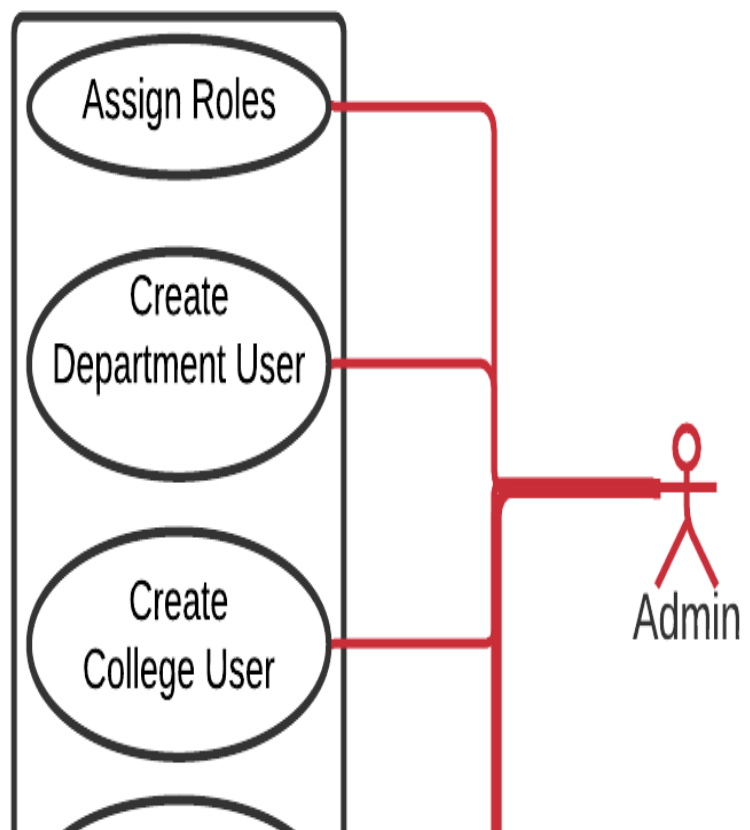
Fig 1.2 Use Case Diagram

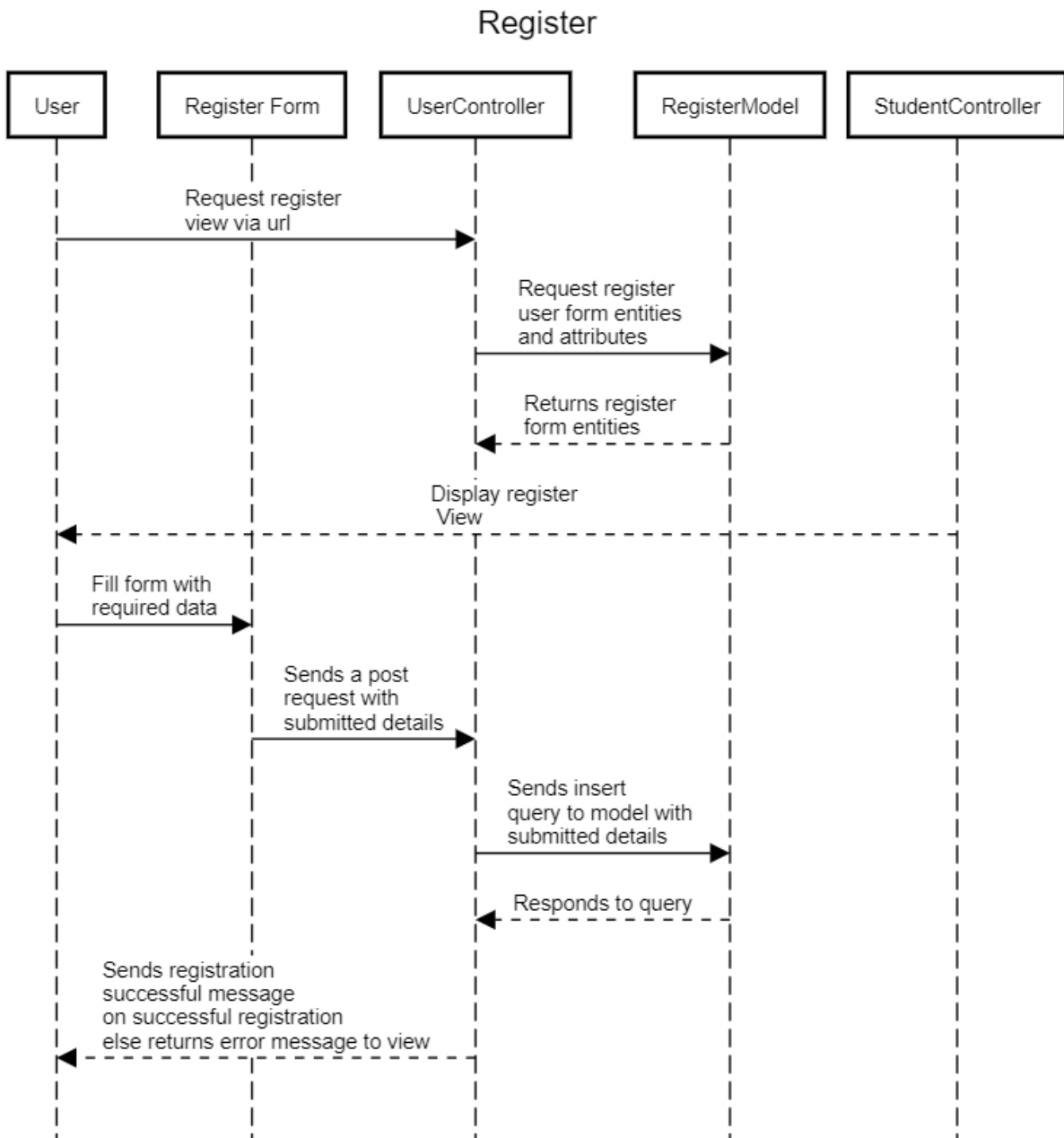## 3.3.2 SEQUENCE DIAGRAMS

REGISTER SEQUENCE DIAGRAM

Fig 1.3 Sequence Diagram for Register

The diagram above explains the system process of the register page. The user requests for a register form via the URL, then it goes to the user controller, which request register user entities and attributes from the register model, which returns register form entities. The

student controller displays the register view to the user, which the user will have to fill and send. The register form sends a post request with submitted details to the user controller. The user controller forwards it to the database of the system which is stored in a register model, the register model now responds to the user controller. The user controller sends the positive or negative response to the user

THE SEND MEMO SEQUENCE DIAGRAM
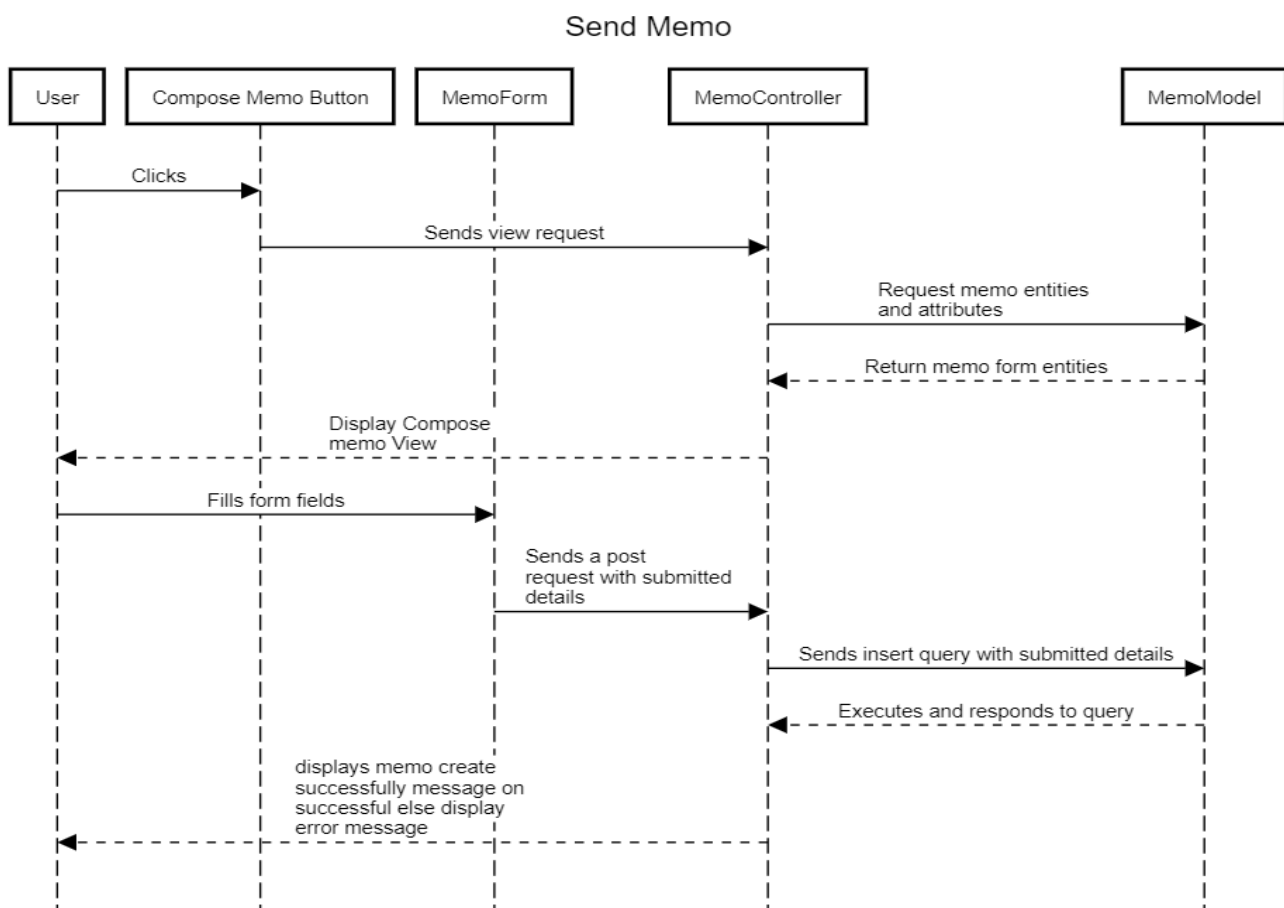
Fig 1.4 Sequence Diagram for Sending Memo

The diagram above, explains the flow of action between system component for the send memo process. The user clicks the compose memo button, then the compose memo button sends a view request to the memo controller, the memo controller requests for the memo

entities and attribute from the memo model which returns the form entities to the memo controller and

displays the compose memo view to the user. The user fills the form field and sends it to the memo form, the memo form sends a post request with submitted form detail. The memo then executes and then send a confirmation to the memo controller which takes it directly and displays a memo create successfully or successful else display error.
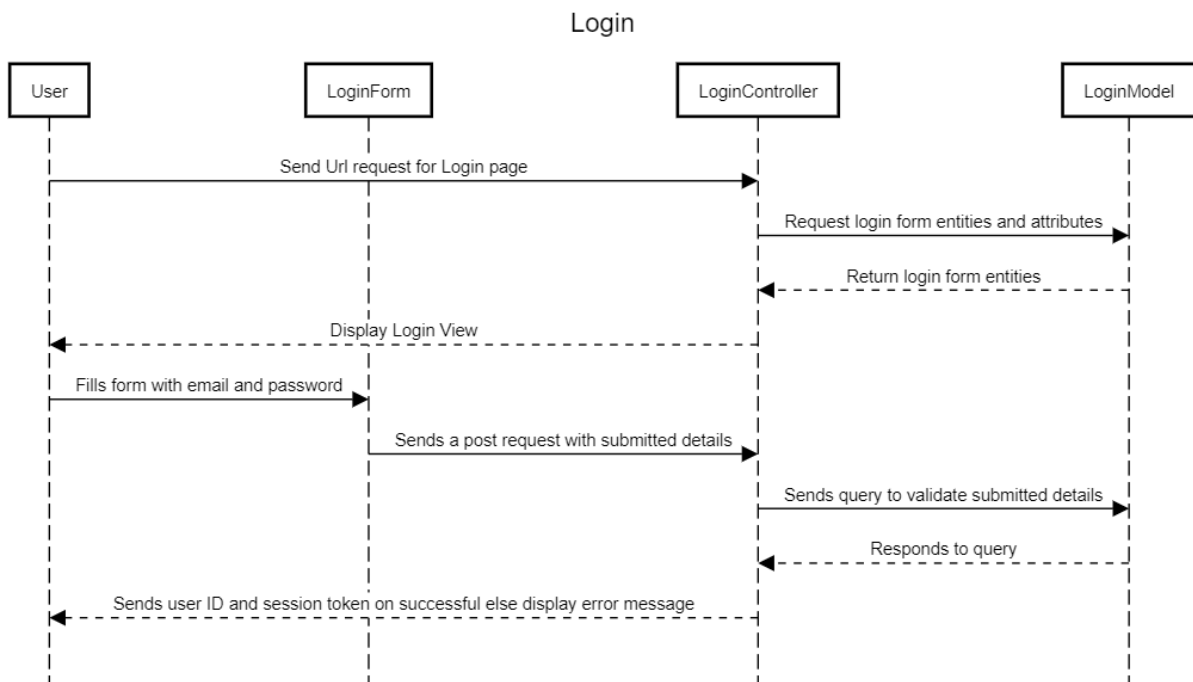
LOGIN SEQUENCE

Fig 1.5 Sequence Diagram for Login Sequence

The login sequence describes the flow of actions between system components for the login form via the system URL. The request is sent to the controller which in turn request the login

mode entities and maps it to the login view displayed to the user by the controller. The user fills the form with his or her credentials and submits it. This triggers a validation function in the controller after which the submitted credential well validated is used to generate a session token and the user ID is also sent back to the browsers.

3.3.3 ACTIVITY DIAGRAM

Activity diagram is just a flowchart to illustrate the flow from one activity to another activity. The activity can be regarded as an operation of the system. The control flow is drawn from
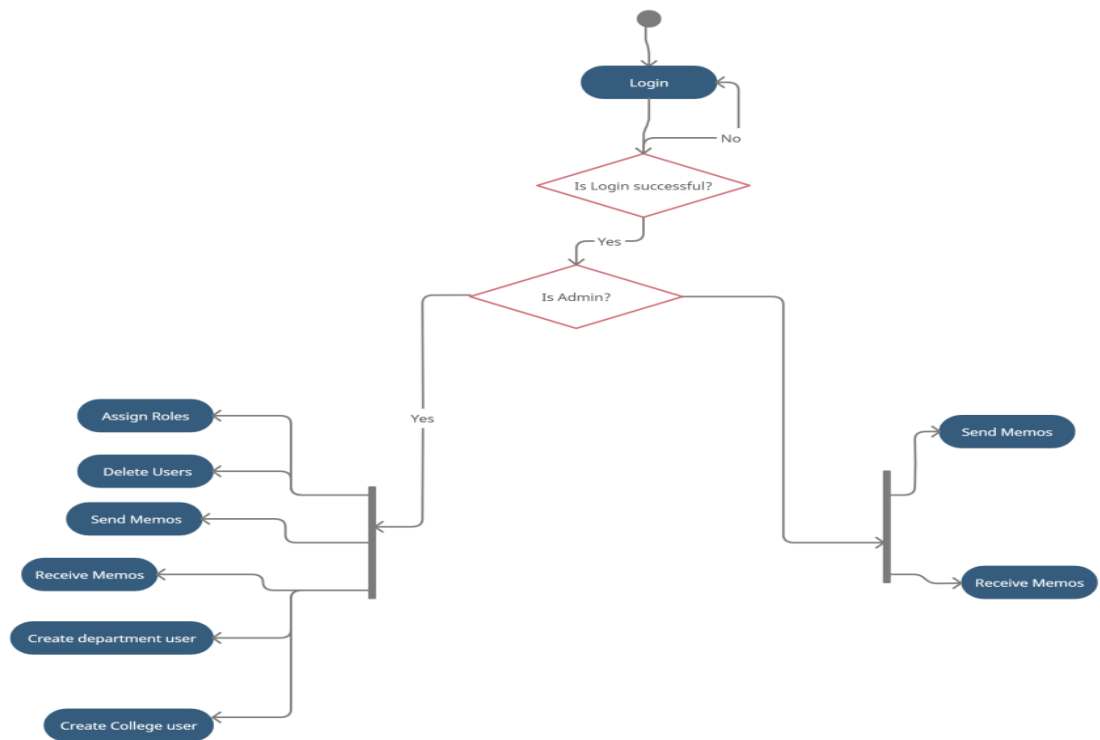
Fig 1.6 Activity diagram of an electronic memo system

According to the diagram above the first activity is to login to the system, then the system checks if the password that has been given is correct, then the system will check if the login

is successful if no, you continue to log in. If yes then the system checks if the user is an admin, If the user is an admin, then he/ she will be authorized to assign roles, create departmental user, create college user, delete user, send memo and also receive memos using the system else the user will be authorized to send and receive memos only.

There are two main users in this system first the administrative user and the lecturer. The admin is authorized to assign roles to the users i.e., the admin assigns the HOD role, Dean of college, The Vice chancellor etc.

3.3.4 CLASS DIAGRAM

Class diagrams in the Unified Modelling Language (UML) are static structure diagrams that illustrate the structure of a system by illustrating classes, their attributes, actions (or methods), and the relationships among objects.

User (Generic Class)

<<Generic Class>>
User

- StaffID: string
+ FullName: string
+ Role: string
+ Email: string
+ Password: string
- Designation: string
- College: String
- Department: string

+ Register()
+ Login(StaffID, password)
+ Update(StaffID)
+ SetRole(StaffID)
+ Delete(StaffID)

1..* ——— 1..1

Memo

Memo

- MemoID: int
- SenderID: string
- ReceiverID: string
- SenderSignature: string
- MemoSentAt: DateTime
- MemoReadAt: DateTime
- Title: string
- Content: string
- Attachment: string
- SpecialNote: string

+ createMemo( )
+ sendMemo( )
+ ReadMemo()

Fig 1.7 Class diagram of an electronic memo system

The class diagram illustrates the classes that were used to model the primary objects in the implementation of the system. It includes a user class which instantiates a user object in the e-memo system and a user in the record in the database. It has properties: Full name, Staff ID, Department, College, Signature etc, which also represents the columns of the user table in the system database. The class diagram also includes the memo class that creates a memo object for each memo sent or created on the system mapping the properties of each memo object to a column of the memo table in the system database.

3.3.5 ARCHITECTURAL DIAGRAM

An architectural diagram is a system diagram used to abstract the overall outline of a software system as well as the relationships, constraints, and boundaries between components. It is an important tool because it provides a comprehensive view of the software system's physical deployment.

The system architecture shows the physical components of the system, an IIS server used for deploying or hosting the system, the model, view, and controllers that control the system interface, logic, function, and data mode as well as MS SQL sever that is used to manage the database implementation of the system. The architectural diagram for this system is shown below:
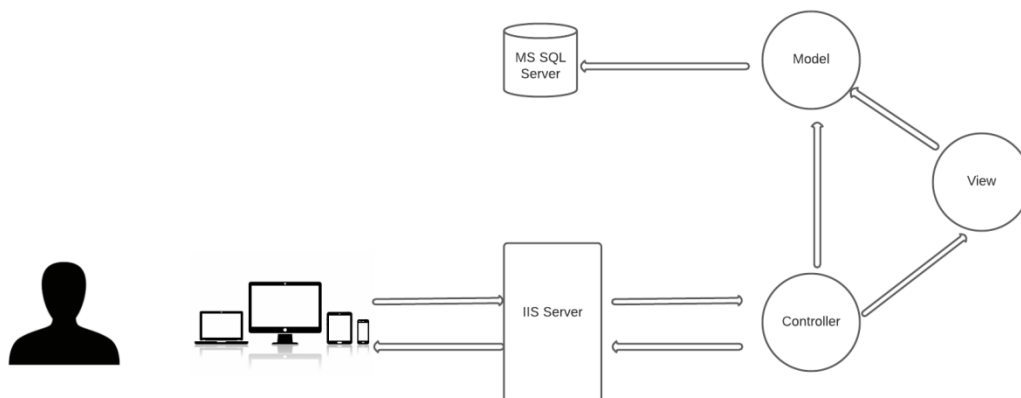
Fig 1.8 Architectural diagram of an electronic memo system

CHAPTER FOUR

1.1   INTRODUCTION

This chapter explains the whole concept of how the system operates and shows the implementation of the system. The electronic Memo system is user friendly, and the system offers easy to use, interactive, responsive, communication process.

1.2   USER'S ENVIROMENT

SIGN-IN PAGE

A sign-in page also known as a registration page allows users and organizations to independently register and gain access to the system. It is common to have multiple sign-in pages depending on the types of people and organizations that you want to register with.
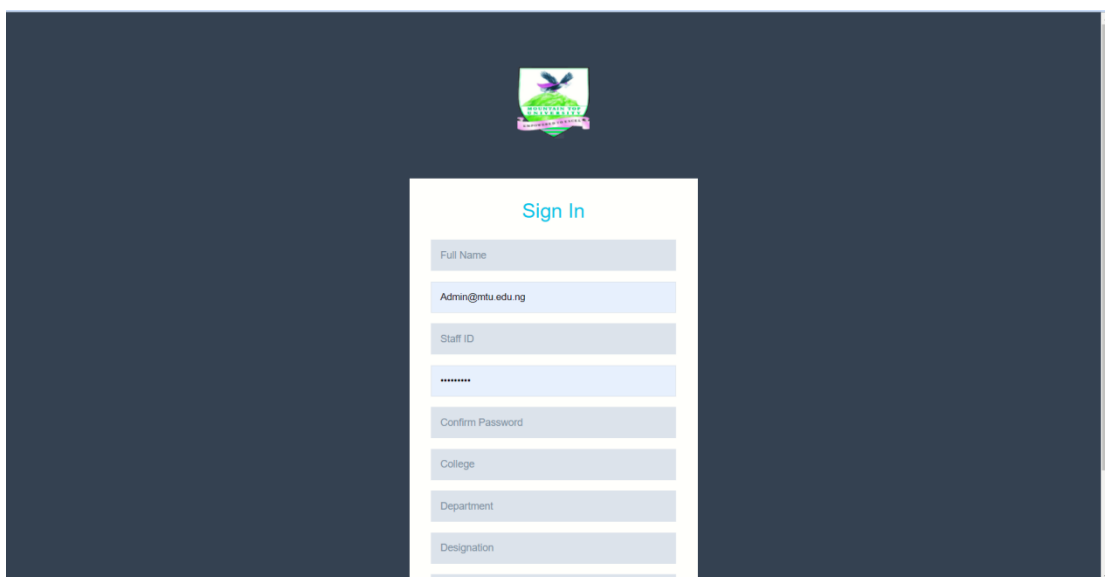
Fig 2.1 Sign- in page of the web application

LOGIN PAGE

The Login Page is used to allow users to login to the website and application. Users are identified by their username and password in applications/websites. The Login Page receives user input and sends it to a server-side software.

Login
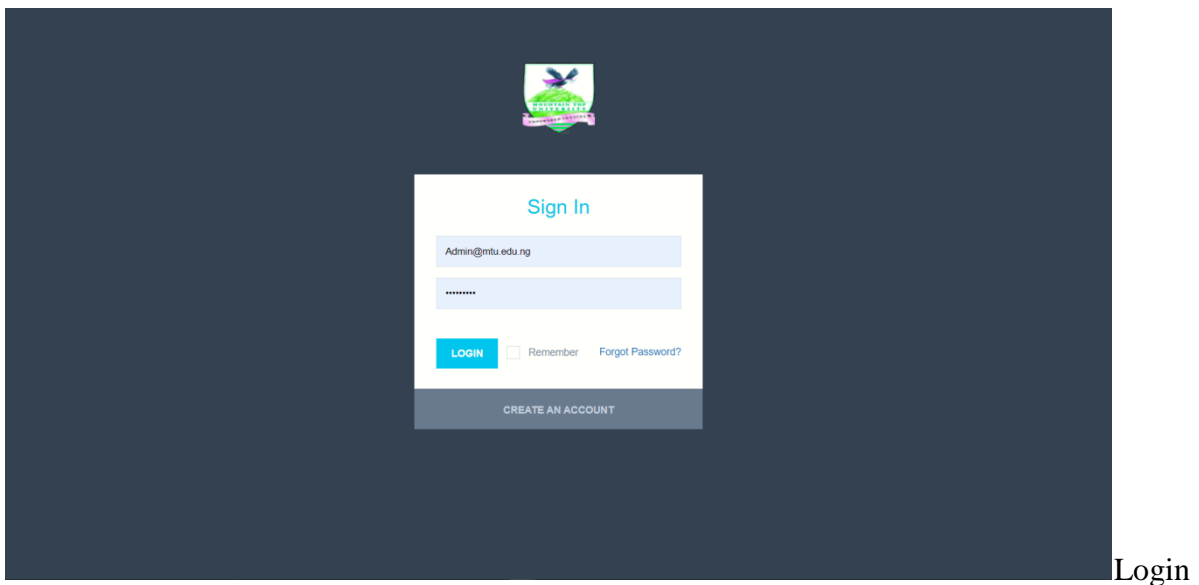
Fig 2.2 Page of the Electronic Memo system

THE INBOX PAGE

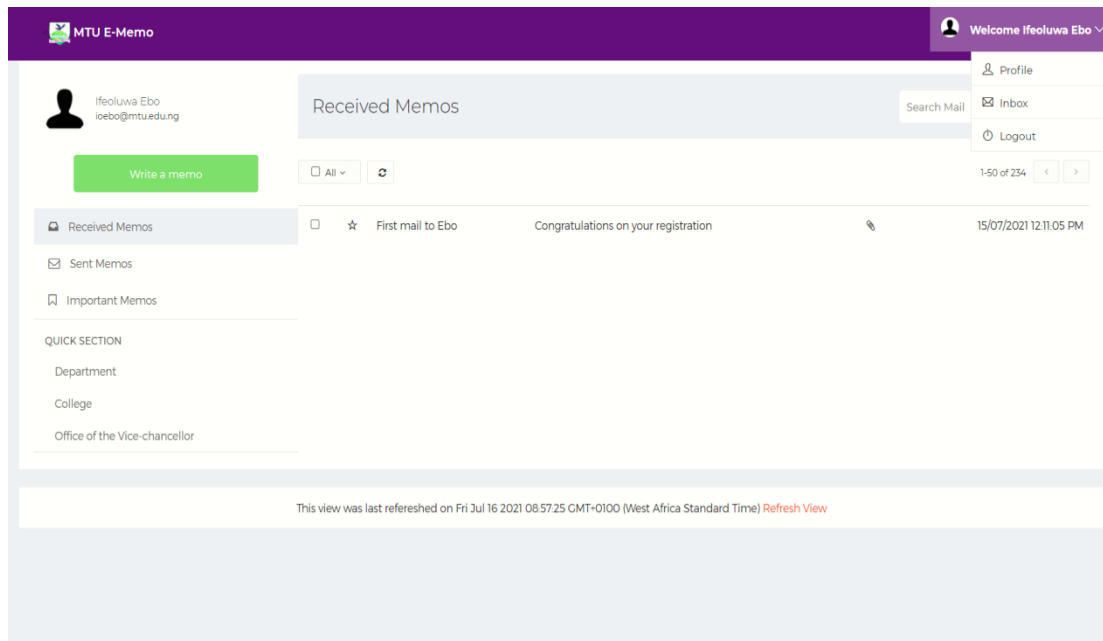This is the primary folder in which all of the users incoming messages or memos are saved, the user can also examine messages received from other users on this page.

Fig 2.3 The inbox page of the Electronic memo system

READ MEMO VIEW

The read memo page is where the user will have complete access to and can read the message received from another user.
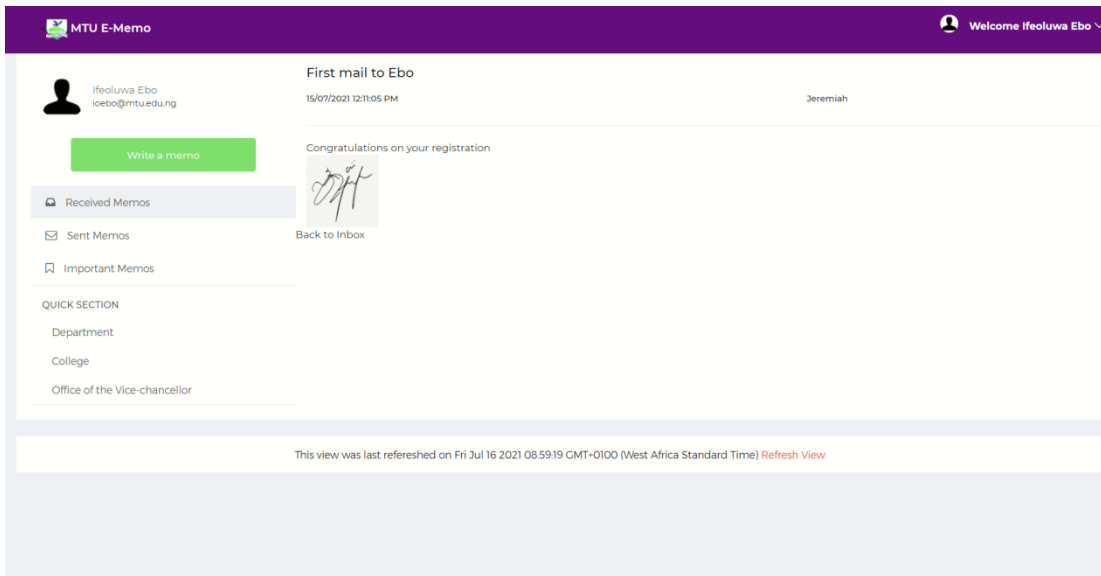
Fig 2.4 The read memo view of the electronic memo system

USER TABLE

The user table as shown in the figure below presents the table used to hold the record of each

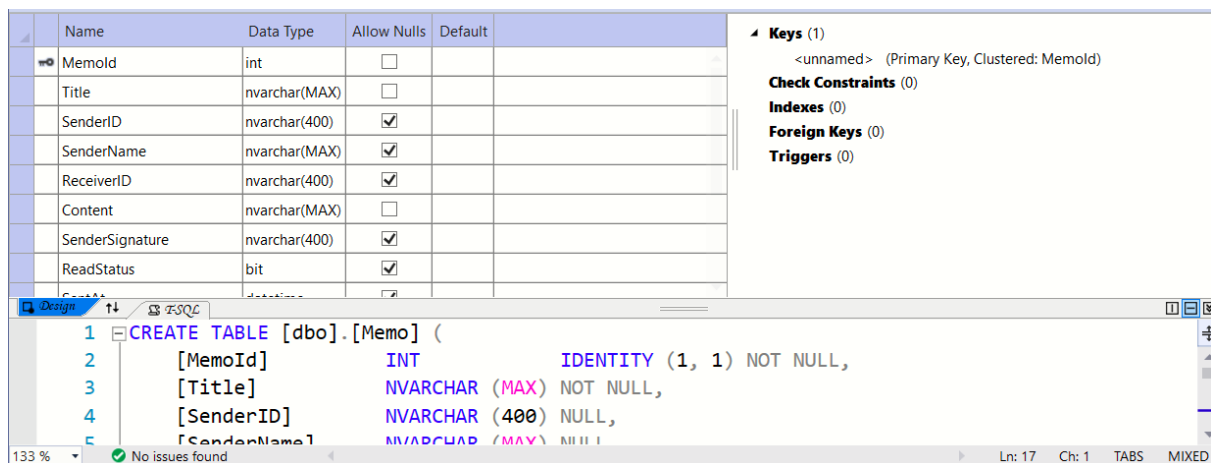user of the system in the database. It has columns, full name, staff id, department, college,
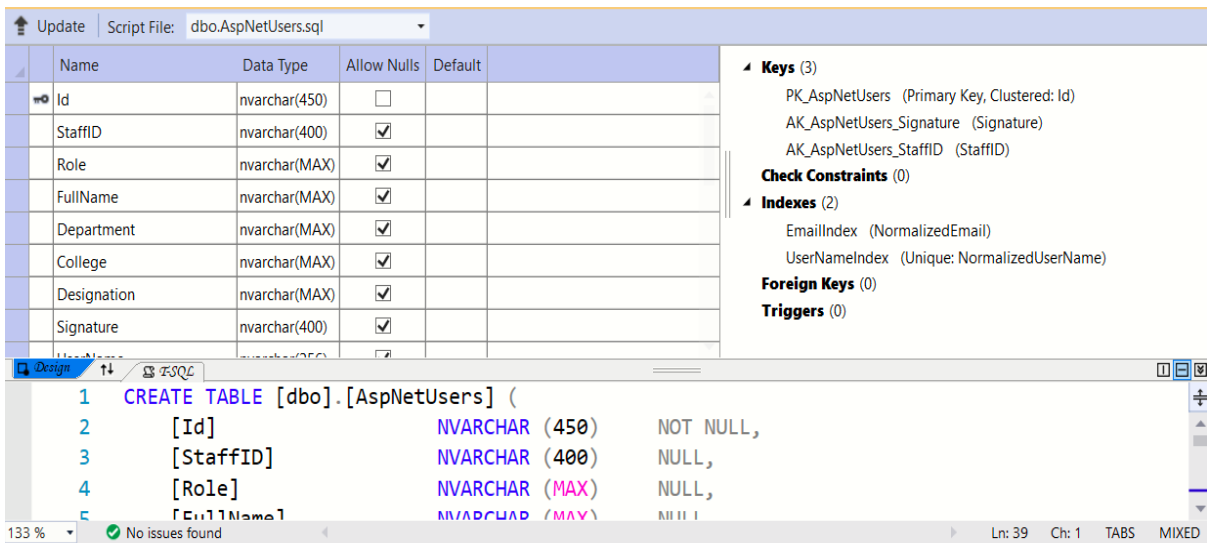
Fig 2.5 The memo showing users' table

MEMO TABLE

The memo table shows the attribute of a memo on the system represented by the columns of this table. It holds field for memo ID, which is the primary key, sender ID, receivers ID, sent At, read At, Sender signature etc.

Fig 2.6 Memo Table

ROLES TABLE

This table holds the various roles that exists in the system. It has columns: Role ID, Role Name and concurrency stamp.

CHAPTER FIVE

This chapter gives summary of the work done, recommendation and conclusion

5.1   SUMMARRY

Electronic Memorandum is a software used to digitally create, collect, store, manipulate, and send office information needed for accomplishing basic task. The major functional components of an electronic memorandum include text processing, electronic mail, information storage and retrieval, personal assistance features, and task management. Electronic memo system Automates the sending and receiving of information among members of an institution's staff. Also, to facilitate, speed up office communication and simplifies how information within an organization is transferred and managed thereby improving the accessibility and security of information sent within an organization.

5.2   RECOMMENDATION

I recommend that the school applies or adopt recent technologies in handling operations that are currently performed manually.

I also recommend that the future works should implement an extension of this work to incorporate user who are not members of staff in the university. Can also build a memo for other firms.

5.3 CONCLUSION

Office communication was done manually, which means that before the invention of modern computing, communication within the university was carried out manually, and members of staff had to wait an elongated time to receive memos.

The electronic memorandum system is vital because it allows for the quick and secure dissemination of information among institutional staff members. The software creates an easy-to-use user interface for integrating information across the institution's various divisions.

Additionally, the technology will automate the writing and receiving of memos, reducing paperwork within the institution and allowing quick access or referencing to previously written or received memos. The technology is distinct from email in that it can only be used within the specified institution and includes an additional digital signature.

REFERENCES

Alam, S. I. (2021). Understanding the Concept of Memo in Managerial Communications. *Conference: Effective Managerial Communications in a Globalized CultureAt: DhakaAffiliation: Jahangirnagar University.*

Bartolomeo, G., Salsano,, S., & Frisiello, A. (2011). Mobile Electronic Memos. *International Conference on Next Generation Wired/Wireless Networking*, (pp. 178-187).

Buisness Communication Articles. (2013, September 10). *Functions of Memo / Memorandum.* Retrieved from Buisness Communication Articles: https://www.businesscommunicationarticles.com/functions-of-memo-memorandum/

Chegg. (2021, Febuary 2). *Office Communication and Soft Skills you need to remember at work.* Retrieved from Chegg: https://www.cheggindia.com/career-guidance/office-communication-soft-skills-you-need-to-remember/#:~:text=Office%20communication%20is%20the%20process,trust%20and%20increasing%20employee%20productivity.

Duggan, T. (2012, March 15). *Business Impacts & Applications in Going Paperless.* Retrieved from CHRON: https://smallbusiness.chron.com/business-impacts-applications-going-paperless-39864.html

Everett, G., & Mcleod. (2007). *Software Testing Testing Across the Entire Software Development Life Cycle*. Retrieved from http://www.cse.hcmut.edu.vn/: http://www.cse.hcmut.edu.vn/~hiep/KiemthuPhanmem/Tailieuthamkhao/software-testing-testing-across-the-entire-software-development-life-cycle%5B1%5D.9780471793717.28214.pdf

favour, D. (2021). *Automated (Electronic) memorandum management system*. Retrieved from m.classgist.com: https://m.classgist.com/projectdetails.aspx?id=3303

Forsey, C. (2019, March 4). *How to Write a Memo.* Retrieved from HubSpot: https://blog.hubspot.com/marketing/how-write-memo

GeeksforGeeks. (2021, July 16). *12 Backend Development Tools For Web Developers*. Retrieved from GeeksforGeeks: www.geeksforgeeks.org/12-backend-development-tools-for-web-developers/

Half, R. (2021, January 11). *6 basic SDLC methodologies: Which one is best?* Retrieved from Roberthalf.com.au: https://www.roberthalf.com.au/blog/employers/6-basic-sdlc-methodologies-which-one-best

indeed. (2021, May 24). *What is Correct Memo Format.* Retrieved from Indeed: https://www.indeed.com/career-advice/career-development/memo-format

International Society of Automation. (2021). *What is Automation?* Retrieved from International Society of Automation: https://www.isa.org/about-isa/what-is-automation

Kaur, B. (2004). Information Management. *INTERNATIONAL JOURNAL OF COMPUTERS & TECHNOLOGY*, 424-427.

MOWFORTH, L. (2021, January 22). *The 7 Most Essential Frontend Web Development Tools in 2021.* Retrieved from careerfoundry.com: https://careerfoundry.com/en/blog/web-development/7-essential-tools-for-front-end-development/

Nordquist, R. (2020, Febuary 05). *ThoughtCo.* Retrieved from thoughtco.: https://www.thoughtco.com/memorandum-memo-term-1691377

Ramoni T. A., O. O. (2016). Development of E-Memo System for organizational Internal Communication. *International Conference of Science, Engineering & Environmental*, 161-171.

Ramoni, T. A., Olaitan, O. T., & Olorunlomerue, A. B. (2016). Development of E-Memo System for organizational Internal Communication. *Development of E-Memo System for organizational Internal Communication. (2016). Science, Engineering & Environmental Technology (ICONSEET)*, 161–171.

Sarras, A. (2021). *Introduction to Management Information Systems.*

seattle.gov. (2021). *Basis of Electrical Design Memorandum.* Retrieved from seattle.gov: http://www.seattle.gov/Documents/Departments/SPU/Engineering/9EBasisofElectricalDesignMemo.pdf

SEBASTIAN. (2019, June 6). *20 software development tools to improve your productivity*. Retrieved from ubiqum.com: https://ubiqum.com/blog/20-software-development-tools-that-will-make-you-more-productive/

Sheahan, K. (2019, May 17). *What Are the Parts of a Proper Memo*. Retrieved from bizfluent: https://bizfluent.com/info-8503975-parts-proper-memo.html

Sousa, B. (2020, june 18). *Top 5 Front-end Development Tools*. Retrieved from Imaginarycloud.com: https://www.imaginarycloud.com/blog/5-front-end-development-tools/

thebusinesscommunication. (2020). *Advantages and Disadvantages of Memo in Business Communication*. Retrieved from thebusinesscommunication.com: https://thebusinesscommunication.com/advantages-and-disadvantages-of-memo/

TheBusinessCommunication. (n.d.). *Functions Of Memo.* Retrieved from TheBusinessCommunication: https://thebusinesscommunication.com/functions-of-memo/

Top Hat. (2020, January 25). *Tertiary Education*. Retrieved from Top Hat: https://tophat.com/glossary/t/tertiary-education/

toppr. (2020). *Memorandum*. Retrieved from www.toppr.com: https://www.toppr.com/guides/business-communication-and-ethics/inter-departmental-communication/memorandum/

Windermere, A. (2018, june 29). *What is the purpose of issuing a memo*. Retrieved from Chron: https://work.chron.com/purpose-issuing-memo-9962.html

Zhang, J. (2013). The Evolution of Management Information Systems: A Literature Review.

Journal of Integrated Design and Process Science, 59-88.