The International Journal of Multi-Disciplinary Research
ISSN: 3471-7102, ISBN: 978-9982-70-318-5

Design and Development of Electronic Record Management System at St Lawrence Parish in Kamwala South Lusaka

(Paper ID: CFP/1102/2019)

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Abstract

Nowadays most of the developing countries use traditional paper documents management system (DMS), but also the electronic form of the documentation has increased including e-mails, web pages, and database packages, which have been stored in workstations and servers. For integrated data gathering in an institution or organization, electronic document management system (EDMS) often becomes one of the most required tools for management. However, this requirement should be implemented careful1y depending on the institution or organization need. Therefore, organization should have an EDMS for creating, storing, archiving and organizing data in the organization and handle all synchronization process.[1]

[1] ***Keywords****: DMS Document management system, EDMS electronic document management system*

Introduction

For many years, records management and the physical filing and retrieval of information were what St Lawrence parish in kamwala south in Lusaka are using the paper based system. Late in the 80's when word processing sprung came into life. Suddenly, documents were appearing in hardcopy and on computer. Over the next decade, document and document image management tried to find a footing in corporate and government offices but even though they worked to a degree, they were complex, extremely expensive, and hard to manage and require a lot of effort for the users to index documents (Knowledgeone, 2005). In common language the word document usually means an information carrier containing written or drawn information for a purpose. Central to the idea of a document is usually that it can be easily transferred, stored and handled as a unit (Bjork, 2002).

Organizing large volumes of physical records are difficult and there are instances where it is difficult to extract a record or document from the large volume of them, it is almost certain that management of document is prone to human error (Akashah, Syamsul, Jusoff & Christon, 2011). Nowadays, storage systems are increasingly subject to attacks. So, the security system is quickly becoming mandatory feature of the data storage systems. For the security purpose we are always dependent on the cryptography techniques (Kahanwal, Dua & Singh, 2012). Encryption is the most effective way of computer science concerned with developing schemes and formula to achieve data and information security using codes (Das, Lanjewar & Sharma, 2013). [2]

Today the privacy is the main issue to sending information from one point to another in data transmission. Encryption is the procedure that allows messages or information to be encoded in such a way that it is extremely difficult to read or understand where decryption is the procedure to transforming encoded text into the original message and information (Das *et al.*, 2013). Why encryption? It is obvious there are developments in the field of information technology likewise have malware (a software that gives partial or full control of your computer to do whatever the malware creator wants) and Sniffer (a program or a piece of hardware that can intercept and log traffic passing over a digital network or part of a network) technology improved giving rise to unauthorized access and control of information, records and data.

Security is a critical issue any organization can't joke about. Data compression have a long history, it has been around since the beginning of electronics. Data compression can also be referred to as source coding or bit-rate reduction. It is the name for encoding information to minimize or at least reduce the number of bits used to encode information. Compression is usually used to minimize the space used on a hard disk or to minimize the amount of data transmitted through a transmitter that has limited bandwidth (Grajeda, Uribe & Parra, 2006). There are many positive effects from compressing data such as smaller size and less bandwidth usage; there are also some negative effects. The data must be decompressed to be read and this is an operation that takes recourses from the processor or hardware that needs the decompressed data. Data compression is often divided into lossy compression and lossless compression. Lossy compression is compression that is done with
some losses in the original message. It is often used in audio and video applications and other situations where some data can be lost without the message being distorted beyond recognition (Grajeda *et al*., 2006).

The compression type that will be used in this work is the lossless form of data compression. Lossless data compression keeps the entire original message during the compression. The compressed data can be decompressed at any time and the entire message is kept down to the last bit. Lossless compression is used when no data can be lost, which is the case in this work. Data compression has been playing an important role in the areas of data transmission and data storage. Many great contributions have been made in this area, such as Huffman coding, LZW algorithm, run length coding, and so on. These methods only focus on the data compression. On the other hand, it is very important for us to encrypt our data to against
malicious theft and attack during transmission (Almelkar & Gandhe, 2014). Why Compression? File compression is a process of "packaging" a file (or files) to use less disk space. Compression works by minimizing redundancy in a file's code. Compression software allows you to take many files and compress them into one file, which is smaller than the combined size of the originals. Therefore, File compression allows you to store and back up significantly more data, faster which mean the transfer time and bandwidth needed is lessened when files are compressed. File compression is often a necessity for sending large documents over the Internet as email attachments since most email systems limit the size of each email message. Often it is easier to compress multiple documents into one document to attach to an email

message rather than attaching them one-by-one. Also, Files can become corrupted when they are transferred over the Internet in an uncompressed format.

Therefore, Security file compression which for this work is taken as the improved electronic document management system will be considered by using encryption, decryption and compression algorithm to strike balance into document management systems to improve it security and space management features, it can't be predicted when an attack targeted at rendering document useless or exposing vital information may occur.

Purpose of the Study

The purpose of this research study is to design and develop a web based electronic record management system for easy storage and retrieval of information at St Lawrence parish from a manual based system.

Significance of the Study

ERMS gives you all the features you need to effectively manage your documents and that of the church member across the 20-community section from St Lawrence parish. It saves time, energy and expense on documentation to vastly improve the overall productivity of the church and include multiple levels of security and version control to allow access to sensitive documents only with the proper permissions. For this work, the researcher used St Lawrence parish as a case study as many documents needed proper documentation and secure safe for a long period of time.

Statement of the Problem

The problem definition for the system is to design and develop a web based electronic record management system for the church at St Lawrence Parish.

The researcher conducted an interview with the parish priest and Father Patrick of St Lawrence parish in kamwala south of Lusaka district who expressed concerned how difficult it is to retrieval documents especially on baptism confirmation from other parishes when a member relocates to a different town or province within the country or out of the country on the manual paper based system being used at the parish (Father Patrick, 2019).

The parish need to fully utilize ERMS or move to EDRMS, to save retrieval time, save filing space, save stationery such as toner and blank paper, pave a way to paperless offices and avoid users queuing for one file, allow maximum communication with users, low errors, low costs, and timely access to information, accurate data and high physical efficiency. They need to do that for the church processes improvement, minimize shortage of filing space, missing and misfiling, resolve damage to records. The researcher proposed the need to make available disaster backup for recovery in case it is affected by disaster like fire and water. The need to maintain the antivirus as they used Symantec endpoint protection. The administration should have procedures to indicate what types of records qualify to be kept on the system, responsibility for capturing and retrieval of records in the system, records usage, retention period and method (Tafor 2003, InterPARES Project 2001). People must have effective plans to manage electronic records. This will assist to avoid duplication, lack of security or access control to ensure that records are not deleted or accessed without authority. All the challenges can be addressed or prevented through the establishment and implementation of an effective records management policy (King1997:657). A proper records management program is guided by policies, rules and procedures.

Research Motivation

The researcher has been motivated to design and develop an electronic record management system at St Lawrence Parish in Kamwala south in Lusaka district. There are few document management systems available but ERMS has its own unique features which are ordering document retrieval, sorting of document, secure document processing (encryption and decryption) and document space management (compression, decompression and archiving) features which are not presently available in the EDMS.

This work will expose PHP compression and encryption capacity in EDMS as this is needed in organizations or institution to secure and maximize the available space of storage. In essence, the work will enhance document accountability and traceability, documents security, document storage and retrieval and ensure consistent business processes (workflows) for how documents are handled. It should be noted that the EDMS will also allow different stakeholders in the organization to view and access file from their convenience.

Aim and Objectives

The aim of this work is to design and develop an improved Electronic Document Management system while the;

specific objectives are to:

- Study existing works on DMS, encryption, decryption and compression algorithm.
- Registration of electronic records.
- Scanning of paper-based documents.
- Definition and management of file classification plans and their elements.
- Identification of document attributes and document metadata.
- Workflow management of electronic records.
- Creation of retention plans, definition of retention criteria and periods, resolution of retention plan inconsistencies (when users enter a wrong categorization value for retention plan, high level authorized users are given permission to change retention plan categorization)
- Creation and management of archival processes.
- Performing common tasks like efficiently indexing, searching, listing, viewing, editing, printing of documents and records, as well as reporting, user management, etc.
- Providing the infrastructure for secure-signature and electronic seal features.
- Secure access control mechanisms.
- Safely storing electronic documents.
- Document, data and system integrity.
- When needed, integration with existing paper-based system.
- Design a robust Laragon database to facilitate the EDMS and
- Design an Improved Electronic Document management system using the PHP

Version of AES encryption and decryption algorithm code and adding a compression module using PHP ZIP compression function.

Research Questions

i. The benefits of a Document Management System (DMS) at the parish
ii. The action plan for st Lawrence parish church to go from paper based to a web based Electronic filling.
iii. The Parish EDMS Electronic Document Management System.
iv. Make Policies and Procedures for data capturers.
v. What recommendations would be required to enhance proper implementation?

Literature Review

Document Management System (DMS) is the automated control of electronic documents page images, spreadsheets, word processing documents, and complex, compound documents through their entire life cycle within an organization or institution, from initial creation to final archiving.

It allows the institution to exert greater control over the production, storage, and distribution of documents, yielding greater efficiencies in the ability to reuse information, to control a document through a workflow process, and to reduce product cycle times (Amir, 2007).

Document Management System: A proprietary electronic system that scans stores and retrieves documents received or created by an organization. There is a distinction between this and an Electronic Records Management System (Paperwise, 2015). Document Management System: Originally, a document management system was a computer program (or set of programs) used to track and store images of paper documents. More recently, the term has been used to distinguish between imaging and records management systems that specialize in paper capture and records respectively. Document management systems commonly provide check-in, check-out, storage and retrieval of electronic documents often in the form of word processor files and the like (Keyes, 2012). Document Management System: Handles documents by electronically storing, organizing, indexing and filing. They can be retrieved when required without any loss of time. It uses imaging technology to enable access to the unstructured data, it brings all documents to your desktop and enables you to work with them, eliminating the need for paper based documents and it is a powerful document archival system, which ensures safety of documents, faster access to them and huge cost savings (Delonti, 2014).

From all the definition above, we can simplify say that a Document Management System is a process of documenting a document to a proper location and storage. Document management systems commonly provide storage, versioning, metadata, security, as well as indexing and retrieval capabilities It is done so that it will be easier for the organization or institution to retrieve and use the data efficiently and effectively. It reduces time, faster access and saves human cost. Because of this characteristic, Document Management System must also have a good security system and easy interface level so that it is safe and environment user friendly.

Records is "any recorded evidence of an activity" (Sheperd and Yeo, 2003). Records are something important for every organization or company. Their usage is that are important to conduct the current business to enable decisions to be made and to accomplish actions. The maintenance of records is necessary because it helps to use them as evidence for actions that happened in the past. Other uses of records are that help to face possible deceptions and to protect the organization. Accountability is one more serious thing that the keeping of records secures (Sheperd and Yeo, 2003). According to the definition of Uniform Electronic Transaction Act (UETA), electronic record is a record "created, generated, sent, communicated, received or stored by electronic means." (State and Consumer Services Agency Department of General Services, 2002).

Evolution of Document Management System

In the early days of document management, businesses and individuals had to keep all their files in filing cabinets. This allows for files to be stored in lockable an understandable system. However, the systems became cumbersome, due to the huge amount of space that was used. Large companies would have entire rooms or whole storage areas full of filing cabinets for all their paperwork. This was extremely inefficient; each file that came in needed to be filed, costing

the business resources and time. In addition to that, if a file ever needed to be accessed, the company would have to spend more time, energy, and resources trying to find it. Sometimes this could take hours, and often ended in futility. The physical copies of the documents were difficult to deal with. There were

many problems that companies faced regarding the files of the documents. These files could be stolen or misplaced.

Basic Aspect of Computer Security

There are three basic aspects in computer security: confidentiality, integrity and availability. Anderson (2001) argues that there are more aspects than these, but this study will use the view of Bishop (2003) on security with only three aspects.

Confidentiality

The confidentiality aspect concerns all access restrictions to information and resources. Information can be hidden or scrambled to limit the access to only concerned parties, or the information is protected by a virtual barrier enforced with for example the access control of an operating system. Existence of data may also apply to confidentiality, because the existence may reveal more than the data itself. For example, if your organization normally never encrypts email, someone monitoring the trace could conclude that something is about to happen when suddenly all emails are encrypted. Hiding resources is also an important part of confidentiality, because the notion of system configuration and what operating systems are used can help an attacker to find the weakest link in your protection. Contrary to Anderson (Anderson, 2001), secrecy and privacy is covered by the confidentiality aspect.

With secrecy, it means to limit the amount of people having access to the information and privacy is the ability to protect personal secrets. Bishop makes no distinction between secrecy, privacy and confidentiality.

Integrity

How much data can be trusted or the trustworthiness of data and resources is the aspect of integrity. It can be divided into data integrity, that is the integrity of the contents, and origin integrity, the source of the data is correct, which is also called authentication. Integrity violations can either be prevented or detected. A prevention mechanism tries to prohibit any unauthorized operations that attempts to change the data. A user can try to change data for which he or she is not authorized for or an authorized user can try to change the data in other ways than allowed, i.e. authorized user performing an unauthorized operation. Bishop gives a good example to explain this difference (Bishop, 2003). Suppose an accounting system is running

on a computer and someone hacks into the system and tries to modify the data that is an unauthorized user tries to violate the integrity of the system.

Availability

The ability to access information or a resource is referred to availability. A service can deliberately be blocked by an attacker making this aspect part of computer security. The attempts to breaking in are called denial of service attacks, or DOS-attacks for short, and can be difficult to identify and separated from increased normal usage. For example, if one is running a popular web site and suddenly one day the site hits a peak in load. Has the site become very popular and you have not enough servers to handle this increased popularity, or is it an attacker performing a denial of service attack? Manually Analyzing every request, you would be able to conclude whether it is an attack or not, but it is difficult for a mechanism to prevent and detect the attack, because it would require usage-pattern analysis.

Methodology

A Modified Waterfall model was used in this research study work has six major phases of the waterfall model;

These phases are:

- Requirement and Analysis
- System Design
- Implementation
- Testing
- Deployment of the system
- Maintenance

The Waterfall Model

Waterfall Model the Waterfall Model was first Process Model to be introduced. It is also referred to as a linear-sequential life cycle model. It is very simple to understand and use. In a waterfall model, each phase must be completed fully before the next phase can begin. This type of software development model is basically used for the for the project which is small and there are no uncertain requirements. At the end of each phase, a review takes place to determine if the project is on the right path and if to continue or discard the project. In this model software testing starts only after the development is complete. In waterfall model phases do not overlap.

The stages of "The Waterfall Model" are:

i. **Requirement Analysis & Definition:** This phase is focused on possible requirements of the system for the development are captured. Requirements are gathered after the end user consultation.

ii. **System & Software Design:** Prior to beginning the actual coding, it is inevitable to understand what actions are to be taken and what they should like. The requirement specifications are studied in detail in this phase and the design of the system is prepared. The design specifications are the base for the implementation and unit testing model phase.

iii. **Implementation & Unit Testing:** After receiving the system design documents, the work is shared into various modules and the real coding is commenced. The system is developed into small coding units. These units are later integrated in the subsequent phase. Every unit is tested for its functionality.

iv. **Integration & System Testing:** The modules that are divided into units are integrated into a complete system and tested for proper coordination among modules and system behaves as per the specifications. Once the testing is completed, the software product is delivered to the customer.

v. **Operations & Maintenance:** It is a never-ending phase. Once the system is running in production environment, problems come up. The issues that are related to the system are solved only after deployment of the system. The problems arise from time to time and need to be solved; hence this phase is referred as maintenance.

Advantages of waterfall model:

- This model is simple and easy to understand and use.

- It is easy to manage due to the rigidity of the model – each phase has specific deliverables and a review process.
- In this model phases are processed and completed one at a time. Phases do not overlap
- Waterfall model works well for smaller projects where requirements are very well understood.

Disadvantages of waterfall model:

- Once an application is in the testing stage, it is very difficult to go back and change something that was not well-thought out in the concept stage.
- No working software is produced until late during the life cycle.
- High amounts of risk and uncertainty.
- Not a good model for complex and object-oriented projects.
- Poor model for long and ongoing projects.
- Not suitable for the projects where requirements are at a moderate to high risk of changing.

When to use the waterfall model:

- This model is used only when the requirements are very well known, clear and fixed.
- Product definition is stable.
- Technology is understood.
- There are no ambiguous requirements
- Ample resources with required expertise are available freely
- The project is short.

Tools Used

Laragon Server

What is Laragon?

Laragon is a portable, isolated, fast & powerful universal development environment for PHP, Node.js, Python, Java, Go, Ruby. It is fast, lightweight, easy-to-use and easy-to-extend.

Laragon is great for building and managing modern web applications. It is focused on performance - designed around stability, simplicity, flexibility and freedom.

Laragon is very lightweight and will stay as lean as possible. The core binary itself is less than 2MB and uses less than 4MB RAM when running.

Laragon doesn't use Windows services. It has its own service orchestration which manages services asynchronously and non-blocking so you'll find things run fast & smoothly with Laragon.

Enjoy!

Features

I. Pretty URLs

Use app.test instead of localhost/app.

II. Portable

You can move Laragon folder around (to another disk, to another laptop, sync to Cloud) without any worries.

III. Isolated

Laragon has an isolated environment with your OS - it will keep your system clean.

IV. Easy Operation

Unlike others which pre-config for you, Laragon **auto-configs** all the complicated things. That why you can add another version of PHP, Python, Ruby, Java, Go, Apache, Nginx, MySQL, PostgreSQL, MongoDB, effortlessly.

V. Modern & Powerful

Laragon comes with modern architect which is suitable to build modern web apps. You can work with both Apache & Nginx as they are fully-managed.
Also, Laragon makes things a lot easier:

- have a WordPress CMS? Just 1 click.
- show your local project to customers? Just 1 click.
- Enable/disable a PHP extension? Just 1 click.

Installation of Laragon

- Laragon is very easy to install & upgrade: Just download the latest version and click Next, Next, Next...
- Laragon is very easy to use: For almost time, it will work out-of-the-box that you don't need to touch any configuration files.
- Laragon is very easy to extend: You can add other services to your current stack by just extracting them to Laragon's bin folder

System design

Context diagram

Context diagram is a view, which includes the basic inputs, general system and output. Context diagram is the highest level in a data flow diagram and contains only one process, indicating the overall system, but does not include data storage.

In this study, a context diagram describes the system in general about the Electronic Document Management System.

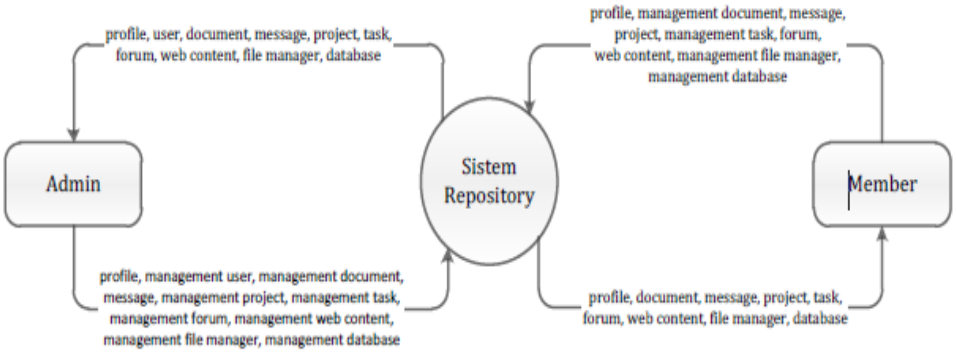


Figure: Context diagram

System data model design

System User Login Interface

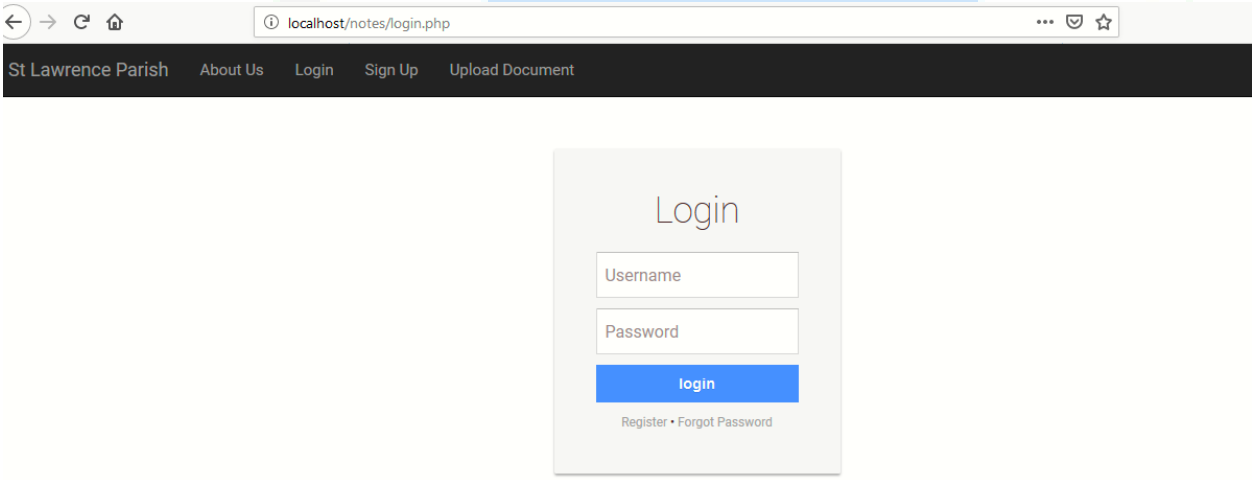


Figure: User Login

ISSN: 3471-7102, ISBN: 978-9982-70-318-5

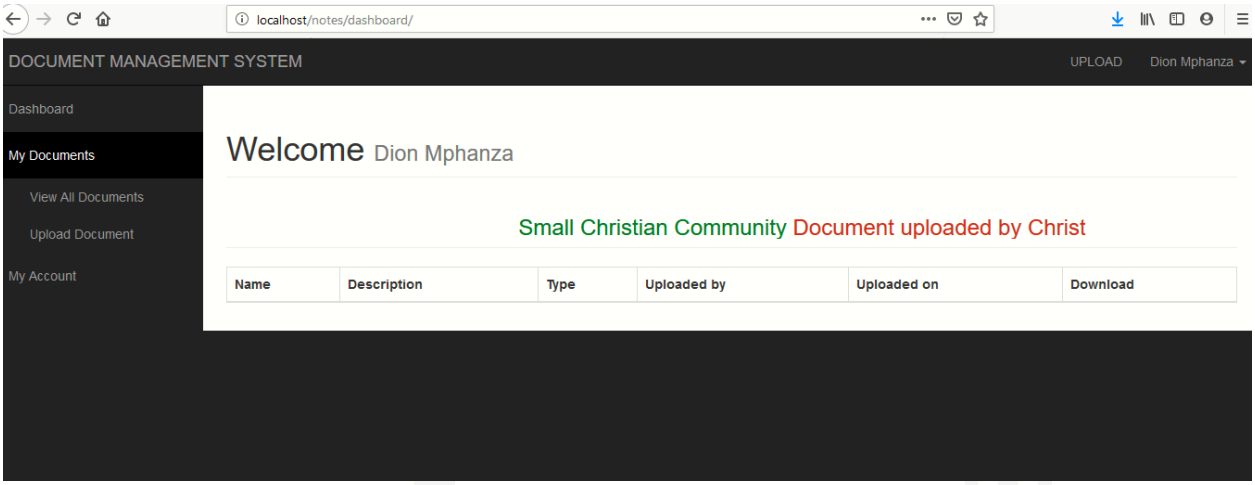
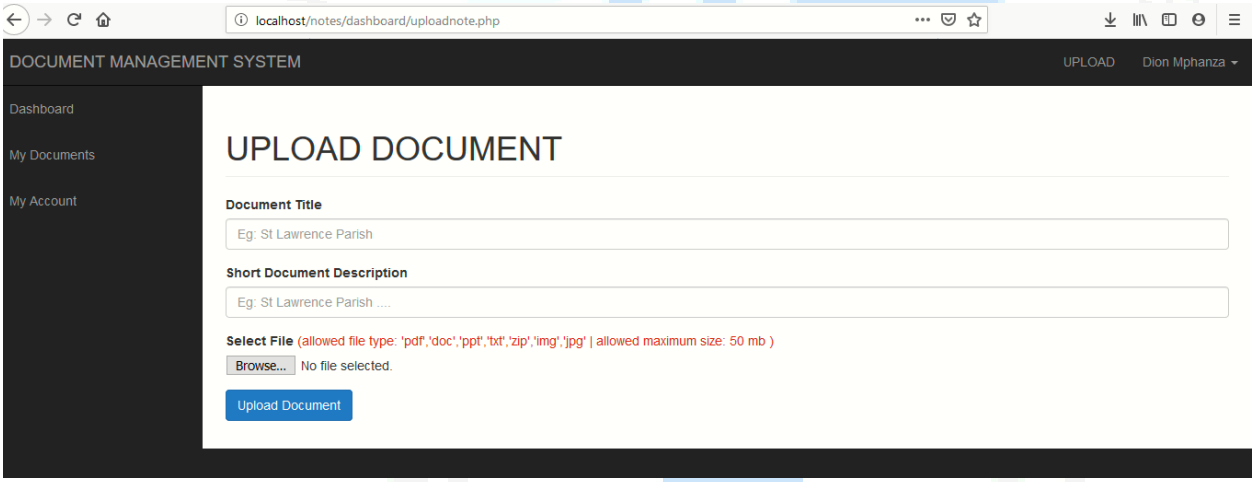
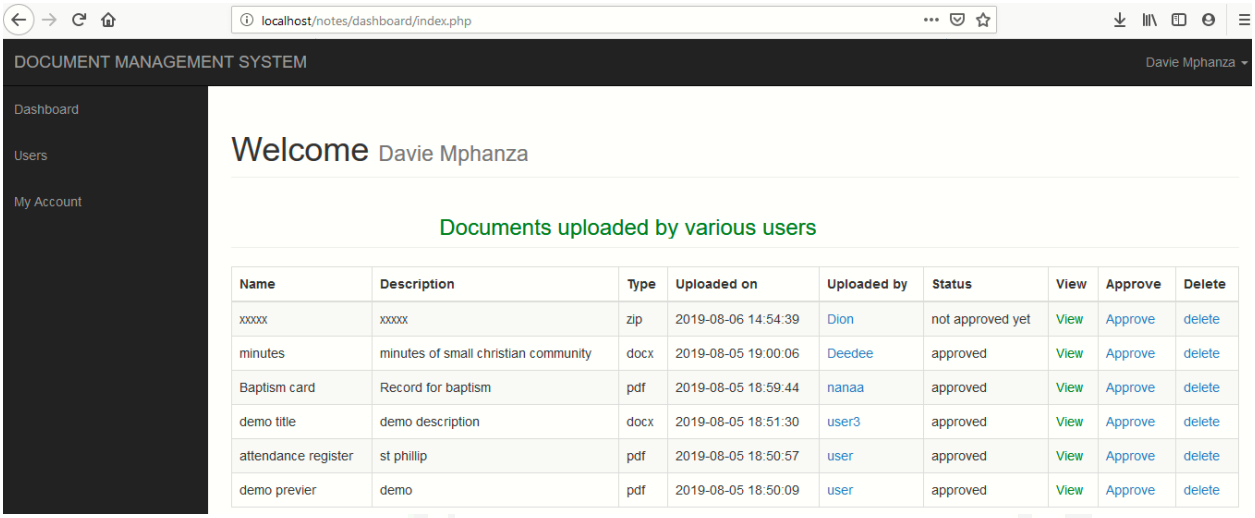


Figure: User Login





Database

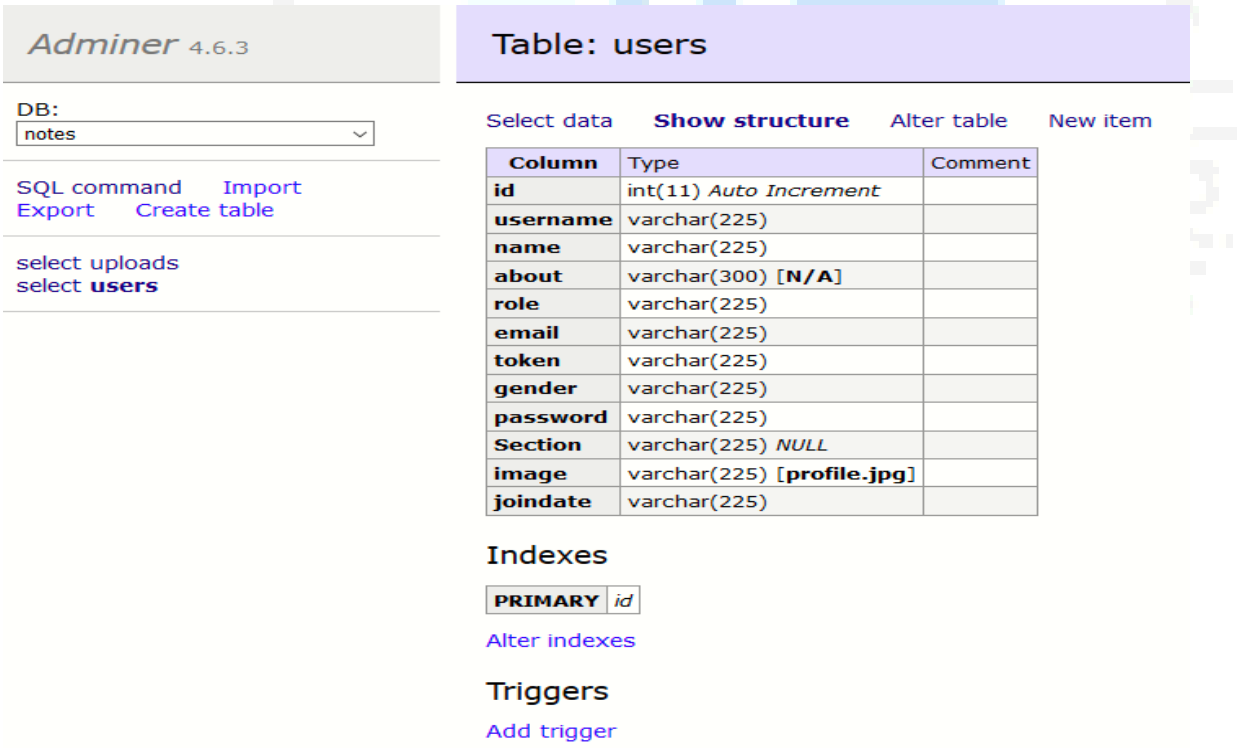


Figure: table Users

ISSN: 3471-7102, ISBN: 978-9982-70-318-5

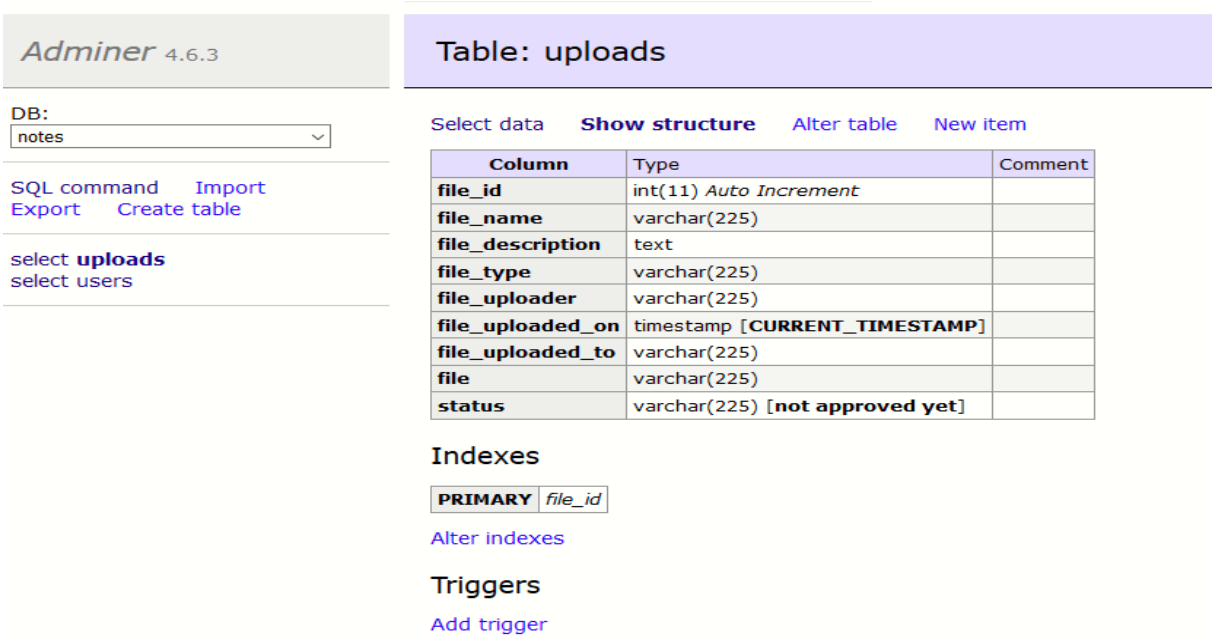


Figure: Table Upload

Product Algorithm

Step 1: start
Step 2: Sign up
Step 3: Users Sign up
Step 4: User login
Step 5: Upload Document
Step 6: View document
Step 7: Download Document
Step 8: Admin Create admin users
Step 9: Admin view all users
Step 10: Admin delete user
Step 11: Admin approve uploaded document
Step 12: Document published
Step 13: Logout
Step 14: end

Database Access Code sample

<? php

$conn = mysqli_connect ("localhost", root "," ","document") or die ("error". mysqli_error ($conn)); ?>

Conclusion

i. Electronic document management frees your staff from the drudgery of bulk paper filing and intuitive additional tools help streamline work processes even further. Powerful filing flexibility the same document can be filed under several references such as Name, Document Number and Date – not possible with paper documents or computer files unless copies are made. This lays the foundation for a very effective retrieval tool. Indexing a document is an easier and simpler task than giving it a complex filename and having to save it to a particular named Explorer folder. Integrating the filing of other electronic files as well as paper documents enables you to achieve one consistent and logical filing structure for ALL the documents.

ii. Paper and PC-generated files received from any source (Post, Email or Fax) are filed into one system. They can then be viewed or actioned by any user or users simultaneously across a network or web. The ability to share documents has several advantages:

- Inter-departmental queries are resolved more effectively by reducing the time and physical effort required to communicate and move between departments.
- The need to print or copy documents reduces dramatically, saving time and money.
- No more lost or mislaid files.
- Improved, customized access to documents Users will be able to view all the available documents and open any of them by just clicking the mouse. Read, write permissions could be set per user by the owner or administrator
- Faster document creation and update processes.

ACKNOWLEDGEMENT

Let me take this opportunity to thank all persons who in one way or the other contributed towards the success of this research project.

First of all, I wish to thank the almighty God for his sufficient grace and mercies for the gift of life and for having granted me good health in my whole life and

throughout my study.

Secondly, I would like to thank my supervisors Dr.J.C Mupala for his support, guidance, and encouragement throughout until the completion of my research project in contemporary issues in ICT.

I also extend my gratitude to:

The Information and Communication University: School of Engineering for the support rendered.

Lastly, I wish to take this opportunity to thank those people who directly or indirectly contributed to the success of this project.

May the almighty God bless them all abundantly.

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