

Concept Based Students Data Retrieval and Repository System

A Case Study of Kampala International University in Tanzania

Edward Onyango Orinda¹, Habiba Njeri Ngugi²

¹ICT Consultant and Software Developer & Researcher, Lecturer, School of Informatics and Innovative System, Jaramogi Oginga Odinga University of Science and Technology

²Software Engineer and Lecturer Kampala International University, School of Applied Science and Technology

Abstract—Concept based student's data retrieval and repository system is a web-based application software that helps deals with storing student's academic information and displays them when required by the legitimate user. The main purpose of the study was to develop online concept based student data retrieval and repository System. The specific objectives were to identify software requirement specifications for the System design, identify the problem of the file system and the design system techniques. The research design used was Action Research design. Data analysis was done with help of (SPSS) Statistical Package for Social Science which was used during data manipulation. The findings obtained as the system was tested in a comprehensive manner and running in friendly way, Therefore, its recommended that, concept based students data retrieval and repository System has to enable students and staffs to learn not more than 24 hours for those having low knowledge about computer skills so as meet accessibility and effectiveness of the system.

Keywords— Concept based, development, management, data, retrieval, repository, system.

I. INTRODUCTION

Data retrieval and repository systems also known as DBMS (database management system) have been researched widely at International level. In the information technology world, a repository is a central place in which an aggregation of data is kept and maintained in an organized way, usually in computer storage (secondary or primary storage). The term repository is from the Latin word repositorium, meaning a vessel or chamber in which items can be placed, and it can mean a place where things are collected. Considering on the use of the term, a repository may directly be accessible to users or may be a place from which specific databases, files, or documents are obtained for further relocation or distribution within a network. A repository may just be the aggregation of data itself into some accessible place of storage or it may also be implied to some ability to selectively extract data Davis (2013).

Connolly and Beg (2005), define a database as a collection of logically related records to allow easy sharing by multiple users. A concept based student's record and repository system is important for every school regardless of the level i.e. primary, secondary, college, and university, to better manage the students' data online.

Concept based and repository systems have globally been applied to overcome the limitations of manual record keeping, the business world depends on databases 24 hours a day/seven days a week. Inventory, order processing, payroll, accounting, shipping and transportation routing are often tracked within a main database that keeps the company functioning. From elementary schools to colleges, educational institutions have used repository to keep track of students, grades, transfers, transcripts and other student data. There are even specialized database packages geared toward schools and colleges, Davis (2013).

From the global point of view, it appears that there is tacit consent that the relationship exists between use of information and communication technologies and job enhancement of database administrators. Stephen (1995) submits that the use of information technology provides significant benefits in work measurement, cost reduction, productivity improvement and better services to customers and clients. Actually it is availability which makes use possible and it is use that makes performance attainable. So, the combined effect of availability of information and communication technologies that can enhance the job performance of the student's online record management. (Henning 2005).

Concept based student record and repository Management Systems (CBSRS) in America manages student's record and information retrieval according to Bellardo, University of California (2010) described CBSRS as web based application that present the student's information retrieval to the organization electronically. Research shows, in fact, that the university attract and keep students when they provides students services standards and policies that prevent problems from arising, and are honest, fair and responsive when things go wrong. The system also encompasses techniques, processes and systems that lessen the chance of students having problems and allow data retrieval to be done on fairly, efficiently and effectively.

Repositories and information systems in Canada, A report prepared by the Canadian Association of Research Libraries and computer departments (CARL) revealed that in the year 2000/2001, academic repositories and computer departments subscribed to 436,731 electronic journals. The same report also states that database administrators and technicians are leaders in using technology to transform traditional databases and manual based system (file) resources and services to meet the challenge of the 21st Century (Charles, 2012).

Digital records, repository and information systems in Singapore, Yusuf (2005) reported that a committee was set up

by the government and mandated to design an information technology plan for the national institutions. The National record and repository systems of Singapore on its part took an initiative in ensuring all debases especially academic libraries are ICT based.

Academic repositories and information systems in Africa do not enjoy the same information delivery methods like those in developed countries except those in Southern Africa. Charles (2011) pointed out the great disparity in the adoption and use of ICTs (Information and Communication Technologies) in student's repositories and computer departments. Chacha (2004) most universities online record and repository in Nigeria is in deplorable conditions due to inadequate funding. This manifests in repositories having low security, poor accessibility and maintenance, deterioration of technological facilities and even lack of laboratories. Such situations are not conducive environment for academic performance of these universities in this period of information explosion.

Repository managements system in Tanzania has not been on track due to Lack of well-trained instructors to handle and maintain the databases because there has been little effort specifically to train specialists in computing, there is a critical shortage of computer professionals, let alone instructors. If any meaningful training is to start immediately in the country, then expatriates will be needed, Oblinger, (2012). Kampala International University in Tanzania offers various academic programmes in the college that are well packaged to suit the times, challenges and potentials of her prospective students. The methods of storing, managing and publications of student information's like students results is Paper based Files. Some are as simple as using information technology as a delivery channel for information or services. In other cases, information technology creates unique experiences, whether in learning or student support. Perhaps most important for the future are the examples of IT use enabling alternative models that improve choice, decision making, and student success. The current way of keeping students data some of which is private threatens the confidentiality of students data, is prone to; Data Redundancy, data Inconsistency, data isolation, data Atomicity, data dependence, program maintenance, data sharing, data security, and incompatible file format.

Problem of Statement

The file based record keeping system is prone to; data redundancy, data inconsistency, data isolation, data atomicity, data dependency, reduced data sharing capability, very limited data security, and incompatibility of file formats. This has made registration of students, timely access to students' records and data backup a hard because the entire process requires a lot of time to search for students files, makes it hard to generate reports concerning the stored data, the files have become many and occupied a lot of space, the data cannot easily be backed up and it common to find a student with multiple files which reduces data integrity. Therefore, the purpose of this project is to design a concept based students' data and repository management system that reduces data redundancy, allows the administrator to stored data in an

organized and uniform format, makes data readily accessible online.

Objective

The objective of this project is to develop a concept based student data retrieval and repository system.

II. LITERATURE REVIEW

Limitation of File Based System

According to the Thomas and Carolyn (1998), the separation and isolation of data, when the data is stored in separate files it becomes difficult to access. It becomes extremely complex when the data has to be retrieved from more than two or more files as a large amount of data has to be searched among a large pile. Inconsistent Data, the data in a file system can become inconsistent if more than one person modifies the data concurrently, for example, if any student changes the residence and the change is notified to only his/her file and not to bus list. Entering wrong data is also another reason for inconsistencies.

Fixed Queries, manual based systems are very much dependent on application programs. Any query or report needed by the organization has to be developed by the application programmer. With time, the type and number of queries or reports increases. Producing different types of queries or reports is not possible in manual Based Systems. As a result, in some organizations the type of queries or reports to be produced is fixed. No new query or report of the data could be generated. (Akuegwu, 2010).

Incompatible File Formats, since the structure of the files is embedded in application programs, the structure is dependent on application programming languages. Hence the structure of a file generated by COBOL programming language may be quite different from a file generated by 'C' programming language. This incompatibility makes them difficult to process jointly. The application developer may have to develop software to convert the files to some common format for processing. However, this may be time consuming and expensive. (Stephen, 1995).

Data dependence, the physical structure and storage of data files and records are defined in the application code. This means that it is extremely difficult to make changes to the existing structure. The programmer would have to identify all the affected programs, modify them and retest them. Cohen (2001) argue that file based systems are very much dependent on application programs. Any query or report needed by the organization has to be developed by the application programmer. With time, the type and number of queries or reports increases.

Producing different types of queries or reports is not possible in File Based Systems. As a result, in some organizations the type of queries or reports to be produced is fixed. No new query or report of the data could be generated. Duplication of data, due to the decentralized approach, the file system leads to uncontrolled duplication of data. This is undesirable as the duplication leads to wastage of a lot of storage space. It also costs time and money to enter the data more than once. For example, the address information of

student may have to be duplicated in bus list file data. (Thomas and Carolyn (1998).

Requirements Needed to Support Repository System

Depending on the system being described, different categories of requirements are appropriate. System Owners, Key End Users, Developers, Engineers and Quality Assurance should all participate in the requirement gathering process, as appropriate to the system. Requirements outlined in the functional requirements are usually used during the system testing phase (Whitten et al., 2001).

According to Sommerville (2007), Software requirements specification is the process of understanding and defining what services are required from the system and identifying the constraints on the system's operation and development.

Functional requirements are the fundamental actions that must take place in the software in accepting and processing the inputs and in processing and generating the outputs (IEEE Computer Society, 2010).

According to Whitten, Bentley, and Dittman (2005), functional requirement or system requirements are functions that must be included in an information system to satisfy the business needs and be acceptable to the users. For the student record and repository system, the main functional requirements are that the system provides a means for entering student information, department information, lecturer information, class information, building information, and classroom information through graphical user interfaces.

According to Ofni systems (2012), a functional requirement document also called functional specifications or functional requirement specifications, defines the capabilities and functions that a System must be able to perform successfully.

According to Burke (2004), on line student record and repository system should search the student identity by registration id from the database, take into consideration of the generated report based of the status of the student, check whether the student is new or existing and edit the existing record.

According to Sommerville (2007), non-functional requirements of a system are constraints on the services and functions offered by the system and they include performance, security, or availability, usability and characteristics of the system as a whole.

Pfaffenberger (2003), defines non-functional requirements as descriptions of the features or characteristics or attributes of a given system as well as any constraints that may limit the boundaries of the proposed solution. Whitten et al (2005), agree with Pfaffenberger by defining non-functional requirements as "constraints placed on any software project". Non-functional requirements for the online student record and repository system include a programming language used in writing executable codes, interfaces of the system, storage compartment of processed information and finally the operating environment (platform).

According to Stellman (2010), users have implicit expectations about how well the software will work. These characteristics include how easy the software is to use, how

quickly it executes, how reliable it is, and how well it behaves when unexpected conditions arise. The nonfunctional requirements define these aspects about the system. The nonfunctional requirements should be defined as precisely as possible. Often, this is done by quantifying them. Where possible, the nonfunctional requirements should provide specific measurements that the software must meet. The maximum number of seconds it must take to perform a task, the maximum size of a database on disk, the number of hours per day a system must be available, and the number of concurrent users supported are examples of requirements that the software must implement but do not change its behavior.

System Design Techniques

According to Whitten and Bentley (2000), System development methodology is a very formal and precise system development process that defines a set of activities, methods, best practices, deliverables and automated tools for system developers and project manager to use to develop and maintain most/all information systems and software.

System development life cycle (SDLC) Turban (2001), added that traditional SDLC consists of four fundamental phases these are Planning, Analysis, Design and Implementation phases. While Whitten and Bentley (2000) argues that development life cycle methodologies have seven phases these are preliminary investigation, problem analysis, requirement analysis, decision analysis, design, construction and implementation. In general terms the proposed system will use the system development life cycle which includes the four major phases which are planning, analysis, design and implementation.

Prototyping also known as iterative design or evolutionary development aims at building a system in a series of short steps with immediate feedback from the users, to ensure that development is proceeding correctly. Prototyping is a process of building a quick and dirty version of the system (Raju, 2005). Prototyping is a technique for quickly building a functioning but incomplete model of information system using Rapid (Whitten and Bentley, 2000).

Nabil and Govardhan (2010), waterfall model is a linear process where a sequential methodology is followed and the project is monitored and measured according to the completion of each phase. The pure waterfall lifecycle consists of several non-overlapping stages. The model begins with establishing system requirements and software requirements and continues with architectural design, detailed design, coding, testing, and maintenance. The waterfall model serves as a baseline for many other lifecycle models.

According to Akuegwu (2010), the designed architecture determines the software framework of a system to meet the specific requirements. This design defines the major components and the interaction of those components, but it does not define the structure of each component. The external interfaces and tools used in the project can be determined by the designer and examines the software components defined in the architectural design stage and produces a specification for how each component is implemented, the detailed design specification determines whether the software meets the

specified requirements and finds any errors present in the code. (Whitten and Bentley (2000).

III. METHODOLOGY

Research Design

Action research design was used in this study. This design was selected because the researcher intended to solicit systems requirements from the respondents and base on the requirements specified to design a concept based student data retrieval and repository system.

Research Population

The target population consisted of data bank officer, deans, head of departments and faculty administrators. The researcher collected data from a target population of five faculty deans, five associate deans from faculties of applied science and technology, health science, law, education, business and development studies. Six faculty administrators were included in the study, one from the faculty of applied science and technology, one from the faculty of health science, one from the faculty of law, one from the faculty of education, and two from the faculty of business and development studies, data bank manager and two secretaries this made a total of 20. They were selected because they are people responsible for accessing student's information within the University.

Sample Size

Total sample of the target population was purposively sampled, that is 20 members of the university administrative committee.

Research Instruments

This study used a questionnaire as a research instrument to collect data from the respondents. The instrument was selected because it allowed the researcher to get in-depth data about the requirements specification of the concept based retrieval and repositories system.

Data Analysis

The researcher analyzed data qualitatively which ensured completeness, uniformity, accuracy and consistency of all data that was collected. This was done by creating themes of collected data basing on the research objective. The themes created enabled the researcher group together elements under one theme in a category and others also in another category. Thereafter, the categories in themes were explained in line with what respondents said.

IV. SYSTEM ANALYSIS DESIGN, TESTING AND IMPLEMENTATION

System Analysis

In this phase, the researcher studied the existing system of the concept based student data and repository if there was any and was expected to establish report document that shows what was lacking (loop wholes) by looking at the strength and weaknesses of the existing system in operations. The researcher was required also in determining the requirements (functional and non-functional requirements) of the new

system and establishes another report document. Then the researcher was supposed to set up a conceptual design of the database that shows the structure of the whole database and the stakeholders involved in the system. The costs and benefits of the new system were to be analyzed thus researcher established an analysis report.

Feasibility Study

This is a procedure that identifies, describes, and evaluates candidate systems and selects the best system for the job or process of determination of whether or not a project is worth doing. At most cases are done during the generation of a feasibility report where it guides or create a platform in which the project is supposed to be conducted on. There are key considerations involved in the feasibility analysis; these are Technical feasibility, Economic Feasibility and Specification feasibility.

Technical Feasibility

The project is technically feasible, since the needed resources can be required for the development of the system as well as maintenance. It can be run on any system that has minimum specification. It reduced data entry errors because of data entry validation, it was easily handled by the user, and it also helped in faster data alteration.

Economic Feasibility

The Cost benefit analysis was important in deciding whether the project was economically feasible or not. The cost of attaining the required resources was not high which led the researcher to be able to conduct the project. Through cost benefit analysis it was concluded that the benefits outweigh costs and thus the project was economically feasible.

Specification Feasibility

The specification which were required were of hardware and software in order for the project to be feasible. On the software's part, the tools required were Microsoft Studio, windows xp service pack (I, II, III), vista, windows 7, Microsoft office access and on the hardware part, desktop computer and a laptop were required.

System Requirement Specification

Before developing any kind of software application, the researcher visited the case study area so as to identify the needs and functionality from the working staff hence wrote down the requirements. The requirements can be categorized into functional and non-functional requirements.

Functional Requirements

- I) The system should allow the administrator to log in.
- II) The system should allow the administrator to add new members.
- III) The system should be able to retrieve information from the database.
- IV) The system should be able to receive information status of a student.
- V) The system should be able to establish student status on time.

- VI) The system should be able to generate report of all the students.
- VII) The system should be able to generate report of student details available.
- VIII) The system should be able to generate report of members.
- IX) The system should allow the administrator to log out.

Non -Functional Requirements

Non-functional requirements these are things that are not necessary for the functioning of the system but they make it efficient. The researcher collected the non-requirements also and arranged them into the same document that provided the guideline for the project. The non-functional requirements are;

- I) The system should be user friendly such that it does not become difficult for the user to utilize.
- II) The system should not take more than ten minutes for a person to understand.
- III) The system should not take more than one second when opening a form.
- IV) Documentation of codes for future use.

System Design

After the purpose and specifications of the required software to be developed are determined, designers are requested to develop a plan for the solution. A plan may be sketched by using data flow diagram, context diagram or UML diagrams so as to show the flow of data in the system.

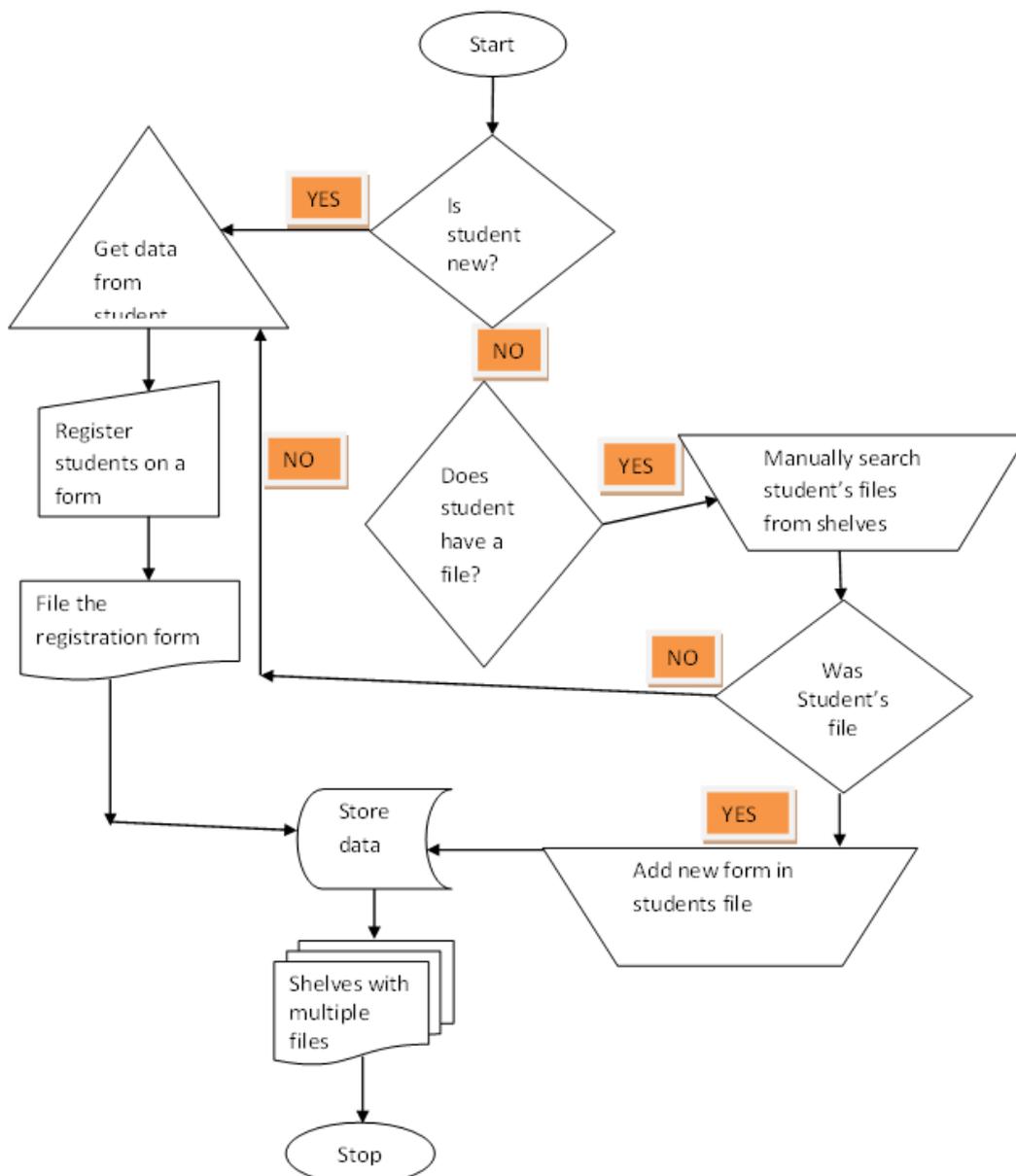


Fig. 1. Shows the conceptual system flow chart diagram for the existing file system.

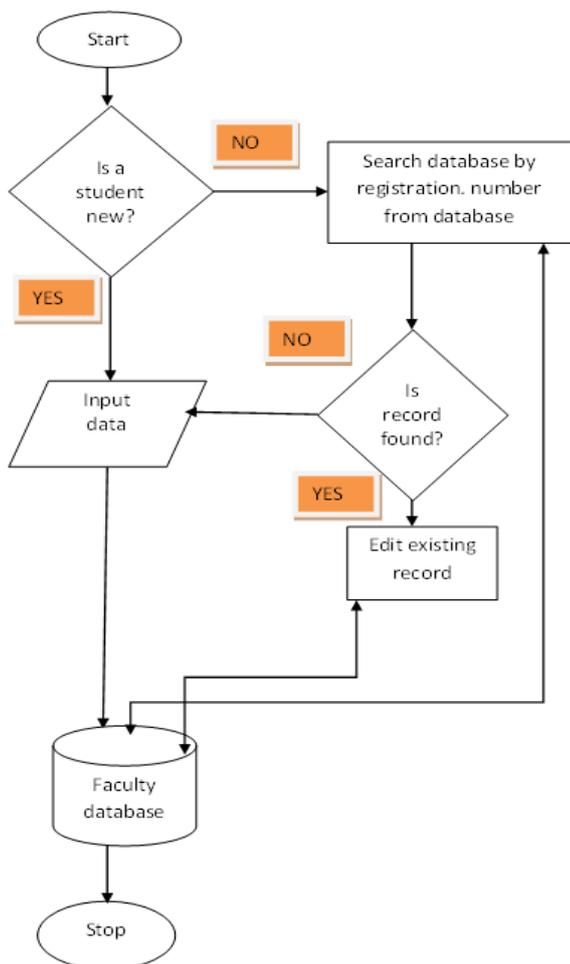


Fig. 2. Shows Flow chart diagram for the concept based students data retrieval and repository system.

Logical Database Design

The database is comprised of three relation tables one for student's details with the name student and the other for courses with the name course, and the third for lecturers and support staff called staff.

TABLE 1. Shows the tables in the database.

Table ame	Purpose
Students	To store students data
Staff	To store data about lecturers and support staff
Courses	To store data about course offered in the faculty

TABLE 2. Shows the fields of students table.

Field name	Label or description
Regno	Students registration number
Fname	First name
Oname	Other name
Lname	Surname
Year	Years of study
Sem	Semester of study
Contact	Phone or e-mail
C_code	Course code

TABLE 3. Shows the fields of the course table.

Field name	Label or description
C_code	Course code
C_name	Course name
Duration	Number of years
Sta_id	Course head or lecturer in charge

TABLE 4. Shows the fields of the staff table.

Field name	Label or description
Sta_id	Staff/lecturer identity
Fname	First name
Lname	Surname
Qualification	Qualification
Position	Any assignment in the faculty
C_code	Course taught

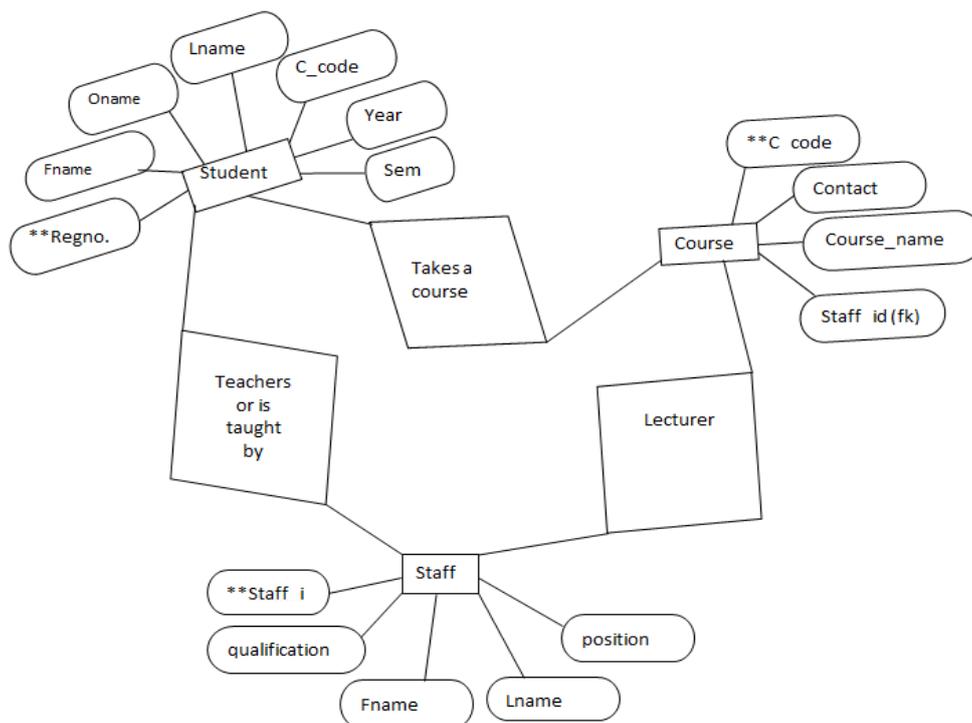


Fig. 3. Shows the entity relation diagram for a database to be designed.

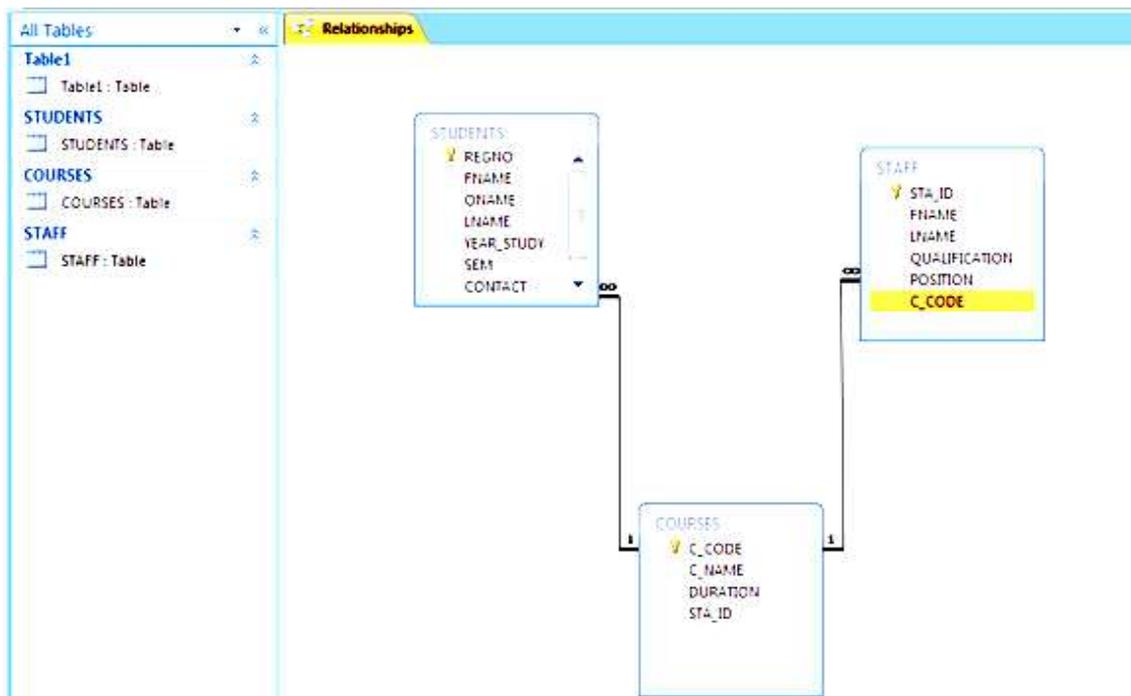


Fig. 4. Shows the relationships between the tables in the database.

Screenshot: students report

REGISTRATION FORM						Tuesday, September 5, 2017
						1:05:37 PM
REGISTRATION NUMBER	FIRST NAME	LAST NAME	YEAR OF STUDY	SEMESTER OF STUDY	COURSE CODE	
BIT/001/DT	DAVID	MAMBOLEO	3	2	CSC432	
BIT/006/DT	BUPE	ROSE	2	2	BIT982	
BSC/021/DT	BIMKUBWA	KHAMIS	2	1	CSC98	
BCE/765/DT	LINDA	KAUTA	3	2	BIT/654	
BCS/765/DT	JESSE	IKINGURA	3	2	BIT/454	

System Testing and Evaluation

System testing is termed as an investigation conducted to provide stakeholders with information about the quality of the product or service under test. The efficiency of the system was tested to ensure accuracy and easy accessibility of the system. The researcher also tested compatibility of the developed system when installed in different pc with different operating systems to see if it can perform as required. There are several categories of tests which differ from the other as much as the different in development approaches. These are;

Unit testing

The researcher started testing the small units or block of the system by going through codes line by line to check if they are correct in each form made that consists different tools such as text box, command button and others. The problem found was dealt with accordingly to prevent future error from occurring.

Integration testing

The researcher tested the linkage between forms to see if the links are well organized. Each form was linked to other

forms with which it interacts. The linkage between the form interfaces created in visual basic and the database created in Microsoft office access was tested to ensure that the connection has no problems.

Independent path testing

Independent path testing is the testing method that involves using path of the program attempt to find every possible execution path. Using this idea, the researcher was able to test each individual path in as many ways as possible in order to maximize the coverage of each test case. This gave the best possible chance of discovering all faults within a piece of code as well as the page.

Validation testing

Under validation testing, the system after being hosting in a web server, then it was accessed through different devices by sample of users and it was showing the desired output hence makes the system being valid.

System implementation and maintenance

The implementation of the application involved the fingerprint reader and the Personal computer. The fingerprint

reader acquires the fingerprint and the PC consists of the windows forms that simulate the attendance application. The functionality of the Attendance management system can be broken down into the following blocks. These are: administrative interface, attendance system and reports generation. In implementation phase developer translated the objects models into source code. This process included implementing attributes and methods of each object and integrating all the objects into unified single system. During this phase both the system interface design and database design were converted into the actual software.

The developed system by the researcher can be installed in a computer with standards and studied by the administrator. This provides a direction on how to manage a system by being able to insert, delete, update and retrieve the records by generating of a report. After the administrator has learned, the researcher was in the position to delegate all the authority to the administrator so as it could be decided when to start being fully used.

V. FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Findings of the Study

The following were identified as requirement of the concept based students data and repository management system; the system should allow users to input data via a graphical user interface, the system should allow the user to navigate through the records, The system should allow the user to store data in a database, The system should allow a search for a particular record, The system should have a login system using a username and password, The system should print out reports as demanded, the system should allow sorting of records. Other non-functional requirement include: The time required for someone with basic computer skills to learn it should not be more than 2 hrs., it should make use of forms for entering data and it should be easy to use. Prototyping was found to be the most appropriate development technique.

VI. CONCLUSIONS

System requirements are categorized into two that is functional and nonfunctional requirements. Functional requirement state what the system should do while nonfunctional requirements states qualities that make the system work better. Prototyping is a system development methodology that should be used on small projects whose requirements are dynamic. While the traditional water fall model should be used for projects whose requirements are stable and well understood. The researcher recommends that a more detailed feasibility study be carried out to define more requirements and include things like results management among others.

The researcher recommends that the mockery (prototype) that has been developed in this research project be improved to the level that can be implemented to manage student's records at the level of a university faculty. Thus more user involvement should be done so as to collect more realistic system requirements.

Areas for Further Research

Further studies should be conducted on mobile based applications to improve on the efficiency in case the institution differs from the one for which this project has been developed for. It should further be researched on for approaches that are different from prototyping that was used during this study.

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