Computer - Based Personnel Management System

Case Study: Mbarara University of Science and Technology

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DEDICATION

I dedicate this report to my immediate family especially my mum, Ms. Anna Gakibayo and to my Heavenly Father for enabling me get this far.

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I express my thanks to Eng. Stephen Yiga for his time, support and guidance given to me for the success of this assignment.

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CBPMS Computer Based Personnel Management System

CSS Cascading Style Sheet

HRIS Human Resource Information System

HTML Hyper Text Markup Language

IS Information System

MUST Mbarara University of Science and Technology

MySQL My Structured Query Language

PHP Hyper Text Preprocessor

ABSTRACT

Mbarara University of Science and Technology (MUST) is a public university located in Mbarara district. The university has many institutes and faculties with different human resource working in these facilities. MUST uses a traditional manual system to manage personnel business process like records management, overtime processing and leave processing. The manual records management system is not efficient and effective for personnel managers to access, retrieve and update employee information. The Human Resource department is also faced with the challenge of computational errors arising from the manual calculation of overtime hours. This leads to some instances that the university loses money by paying some staff more than they should be paid and in other instances the staff getting less than what they should be paid.

In order to handle the personnel business processes better, a software tool was developed and implemented. The data collection methods used, were interview and questionnaires. An evolutionary prototyping method was used for system development. Bottom-up approach was used for system design and actual realization of the Computer Based Personnel Management System was done using PHP, HTML, CSS and MySQL for the database.

It is anticipated that the computer based management system will make management of personnel information efficient and effective.

CHAPTER 1

INTRODUCTION

A computer based personnel management system falls in the domain of information systems. Laudon and Laudon (2007) define information system as a set of interrelated components that collect, process, store, and distribute information to support decision making and control in an organization. In addition to supporting decision making, coordination, and control, information systems may also help managers and workers analyze problems, visualize complex subjects and create new products. Information systems are largely used in organizations and they contain information about significant people and things within the organization or in the environment surrounding it. Three activities in an information system produce information that an organization can use to make decisions, control operations, analyze problems and create new services. These activities are input, processing and output.

Management information system (MIS) as a sub-domain of information systems is defined by Davies (2009)as a type of information system that supports the tactical decision-making of managers, and also monitors the current state of the organization. According to Valacich, George and Hoffer (2009), MIS is a computer based system that takes raw data available through a transaction processing system and converts them into meaningful aggregated form.

Personnel management is on the other side defined as part of management concerned with people at work, their positions and their relations within a particular organization (Jamie et al, John 2007). According to Unamka and Ewurum (1995), personnel management is the recruitment, selection, development and motivation of human beings who work for a firm or corporation. The main functions of the personnel manager include staff recruitment, training, and welfare. Edward (2005) asserts that the success of an organization depends on the capacities and capabilities of its

personnel. Unless an organization devotes enough resources to personnel management, it will not get the required output from its personnel.

Lengnick-Hall and Moritz (2003) suggest that aPersonnel Management Information System (PMI)needs to be implemented at three different levels: the reviewing of information, the automation of transactions and finally a change in the way personnel management is conducted in the organization by transforming personnel into a business strategic partner. In their view, Lengnick-Hall, Mark & Moritz (2003), suggestthat the evolution of human resource (HR) as promoted by Human Resource Information System (HRIS) evolves from information to automation and from automation to transformation. The same authors observed thatwhile HRIS have been widely adopted, a transformation of human resource management service delivery has occurred in relatively few organizations hence appreciation of human resource services remains a key question.

1.1 Background

Mbarara University of Science and Technology (MUST) is constituted of four institutes and two faculties with various departments under each institute and faculty. The personnel employed by the university comprises of administrators, academic staff, librarians, technicians, laboratory attendants and support staff. MUST uses a manual system of paper and pen to process personnel information which makes management of personnel difficult since record management, overtime payment processing, leave processing and evaluation of employees is not easily done. The personnel managers are also faced with a challenge of keeping track of employees since employee information cannot easily be accessed.

1.1.1 Record Management

After the appointments committee has recruited a staff, all the necessary details of the individual are captured, recorded and stored in a paper file for that staff and kept in the records office and it is the responsibility of the record officers to secure, update and retrieve staff files whenever they are needed. The current record management system requires much time for the responsible officer to retrieve and update data. The manual records management system presents a challenge of records security in that in case of a crisis like fire, all the records can be lost. Analysis of data cannot easily be carried out since assess of this data is not fast as well as retrieving, updating and compiling. All the above mentioned challenges affect personnel management hence making it inefficient.

1.1.2Overtime Processing

The process of getting overtime payment involves employees picking overtime forms from the records office and filling them. The forms are then sent to the head of department for approval. Department heads use a traditional manual system to calculate over overtime hours. The overtime forms from all departments are then sent to the assistant university secretary who gives the final authorization for the overtime allowances to be paid. The manual process of calculating leads to occurrence of computational errors in overtime hours and payment allowances which frustrates employees and at time leads the university losing money.

1.1.3 Leave Processing

The process of leave application by employees is done manually. The employees pick leave forms from the records office and fill them. The forms are then sent to the head of department for approval. After approval from the department head, the leave forms from all departments are then sent to the assistant university secretary who gives the final authorization for leave to be taken. The

manual process used makes employee leave tracking a bit difficult in terms of knowing how many days one is entitled to incase leave was taken in parts. Also knowing when one last took leave is quite impossible due to inability to follow the paper trail fast. The other challenge with this manual process is the respective people supposed to be signing usually have a lot of the paper work and this leads to these forms being put under the pile of other document hence delay in granting leave to a particular employee which later leads to collision in during employee leave schedule.

All the above mentioned forms are sent to the university secretary who has the final say in all the matters. The university secretary has to verify all the forms and this takes over a month due to the volume of the forms. This manual verification process frustrates employees. The manual system has problems including; delays in processing leaves. With the current manual system which is mainly paper related, managers find it hard to keep employee information; ranging from personal information, departments of work, qualifications, number of hours worked and leave information.

1.2 Statement of the Problem

The manual system that is used at MUST to manage staff records is not efficient and effective. Storage, retrieving and processing of data is not done in minimal time. In addition the necessary computations are not always error free.

Therefore, there was a need to develop a software tool to manage the data efficiently and effectively and also ensure that output information is always accurate.

1.3 Main objective

The main objective was to develop a Computer-Based personnel management system in order to reduce time and cost spent on managing and tracking personnel data.

1.3.1 Specific objectives

The specific objectives of the project were;

(i) to review the existing personnel management system in order to identify requirements of the CBPMS,

(ii) to design a computer-based personnel management system,

(iii) to implement the system and

(iv) to test the system.

1.4 Scope

The project was developed for Mbarara University of Science and Technology (MUST) basing on the institution's personnel management processes. The system's functionalities are;

a) to maintain complete records of employees,

b) to process overtime payment and

c) to process leave.

1.5 Significance of the Study

The benefit of the system will be as follows:

a) The personnel manager will be able to find the best solution to the various personnel problems as the computerized personnel management information system software will play a very big role in removing the stress in record keeping.

b) The university secretary will be able to process timely and accurate reports, hence increasing the university productivity levels since they are able to track the different employees in the different departments and their overtime hours.

c) The university employees will be motivated to work harder due to the factor that their pay is equivalent to their work and comes in time. The system will enable the relevant managers be able to process all the relevant data in time.

CHAPTER 2

LITERATURE REVIEW

This chapter presents and explores the literature related to system design, testing, implementation and databases.

2.1 The Method of System Development

Welke (1981) and Lyytinen (1987) define method of system development as a change process taken with respect to object systems in a set of environments by a development group using tools and an organized collection of techniques collectively referred to as a method to achieve or maintain some objectives.

A system development methodology can also be defined as a framework that is used to structure, plan, and control the process of developing an information system (Beynon-Davies, 2008).There are many stages involved in the successful creation and application of information systems. Successful development of ISs is not guaranteed, as failure can occur at various stages of ISs development

2.1.1 System Development Methodologies

There are several system development methodologies, however because of the limitation of time for this project, only two are discussed from where an appropriate one was selected. The two discussed are the water fall and prototyping system development methodologies.

a) Water fall

A project using water fall method is divided into sequential phases, with some overlap and splash back acceptable between phases. With the water fall model emphasis is on planning, time schedules,

target dates, budgets and implementation of an entire system at one time. Tight control is maintained over the life of the project through the use of extensive written documentation, as well as through formal reviews and approval by the user and information technology management occurring at the end of most phases before beginning the next phase.

b) Strengths of waterfall model

1. Ideal for supporting less experienced project teams and project managers, or project teams whose composition fluctuates.
2. The orderly sequence of development steps and strict controls for ensuring the adequacy of documentation and design reviews helps ensure the quality, reliability, and maintainability of the developed software.
3. Progress of system development is measurable.
4. Conserves resources.

c) Weaknesses of waterfall model

1. Inflexible, slow, costly and cumbersome due to significant structure and tight controls.
2. Project progresses forward, with only slight movement backward.
3. Little room for use of iteration, which can reduce manageability if used.
4. depends upon early identification and specification of requirements, yet users may not be able to clearly define what they need early in the project.
5. Requirements inconsistencies, missing system components, and unexpected development needs are often discovered during design and coding.
6. Problems are often not discovered until system testing.
7. System performance cannot be tested until the system is almost fully coded, and under-capacity may be difficult to correct.

d) Prototyping.

Prototyping is not a standalone complete development methodology but rather an approach to handling selected portions of a larger, more traditional development methodology that is to Incremental, Spiral, or Rapid Application Development (Grimm, 1998). User is involved throughout the process, which increases the like acceptance of the final implementation. Small-scale mock-ups of the system are process until the prototype evolves to meet the users' requirements. A basic understanding of the fundamental business problem is necessary in order not to solve the wrong problem.

e) Weighing prototyping methodology against water fall methodology

1. Prototyping addresses the inability of many users to specify their information needs and the difficulty of systems analysts to understand the user's environment, by providing them with a tentative system for experimental purposes at the earliest possible time. (Janson and Smith, 1985) while the water fall model does not fully support user involvement.
2. Can be used to realistically model important aspects of a system during each phase of the traditional life cycle (Huffaker, 1986).
3. Prototyping improves both user participation in system development and communication among project stakeholders which leads to ready acceptance of the system by the users and addressing requirement inconsistencies as opposed to the waterfall model.
4. Especially useful for resolving unclear objectives; developing and validating user requirements; experimenting with or comparing various design solutions or investigating both performance and the human computer interface.
5. Potential exists for exploiting knowledge gained in an early iteration as later iterations are developed while waterfall model leaves little room for use of iteration.

6. Helps to easily identify confusing or difficult functions and missing functionality as opposed to waterfall model where missing functionalities are discovered at system testing.
7. May generate specifications for a production application.

Prototyping like any another model has a few weaknesses. And the following are the weaknesses according to Janson and Smith, 1985.

Weaknesses of prototyping

1. Approval process and control is not strict.

2. Requirements may frequently change significantly.

3. Identification of non-functional elements is difficult to document

4. Designers may prototype too quickly, without sufficient up front user requirements analysis resulting in an inflexible design with narrow focus that limits future

5. Designers may neglect documentation, resulting in insufficient justification for the final product and inadequate records for the future.

2.1.2 The Evolutionary Prototyping Technique Phases

This technique includes four phases:

1. The identification of the basic requirements. Though we may not be able to know all the requirements since it is a continuous process, we should be able to identify the basic things needed for this project to work.
2. Creating the prototype. There will be several prototypes to be made in this project, with each one better than the one before it to ensure its success.

3. Verification of prototype. This will be done through surveys and experimentation using participants taken from the target users. The users are the best people to get feedback from to find out whether the system is good or not.
4. Changes for the prototypes. When found that the prototype is seen as insufficient or unsatisfactory, the project team will again make further iterations until such time it becomes perfect, as per feedback from users.

The advantages of evolutionary prototyping technique

Since it is a series of repetitive iterations, it will be easy for users to see some developments. If this is the case, gaining a positive impression from the target market is attainable because they can see how well you have been looking out towards improving systems to better handle personnel management processes. Additionally, when the current systems are complicated and ineffective, the Evolutionary Prototyping Model will become invaluable since it can pave the way for better systems through a series of iterations. The project is only considered complete once there is already the creation of the perfect system.

The disadvantages of the evolutionary prototyping Model

With this particular model, it may be very difficult to forecast the completion date of the project. It is a continuous development, set up by as many iterations or prototyping as possible that it becomes hard to tell when it will be complete. For as long as there are still significant errors in the system, it will undergo further iterations. This can cost time and money for the company. It is also important to note that since it is a trial-and-error process, it would require a good project management team in terms of knowledge and skills so as to make them capable of countering surprises along the way. Moreover, as an ever-changing process, getting dynamic and flexible people to join would be a very good advice. The Evolutionary Prototyping technique is a high-risk type of technique because simply put, it is a venture into the unknown. There is no way of anticipating what is going to happen

and for how long this project is going to last. It is necessary, therefore, that you put only the best people in the team. Additionally, this technique would work well for projects that do not have a clear set of systems and processes as it aims to find workable solutions to this problem, and is also great for those projects with very changeable and dynamic requirements. But as a series of experimentation processes, it is likely for anyone who to discover or create the best systems through the Evolutionary Prototyping Model, but this cannot happen without determination and focus on the part of each member. CBPMS was developed using evolutionary prototyping because it is fast, better, more reliable in building better quality systems.

2.2 System Design

Levin (2014) states that, systems design is the process of defining the architecture, components, modules, interfaces, and data for a system to satisfy specified requirements. Systems design could be seen as the application of systems theory to product development. The physical design relates to the actual input and output processes of the system. This is laid down in terms of how data is input into a system, how it is authenticated, how it is processed, and how it is displayed as. In Physical design, the following requirements about the system are decided: Input requirement, output requirements, storage requirements, processing Requirements, system control and backup or recovery. Put another way, the physical portion of systems design can generally be broken down into three sub-tasks: User Interface Design, data Design, and process design (Levin 2014). User Interface Design is concerned with how users add information to the system and with how the system presents information back to them. Data Design is concerned with how the data is represented and stored within the system. Finally, Process Design is concerned with how data moves through the system, and with how and where it is validated, secured and/or transformed as it flows into, through and out of the

system. At the end of the systems design phase, documentation describing the three sub-tasks is produced and made available for use in the next phase.

Physical design, in this context, does not refer to the tangible physical design of an information system. To use an analogy, a personal computer's physical design involves input via a keyboard, processing within the CPU, and output via a monitor, printer, etc. It would not concern the actual layout of the tangible hardware, which for a PC would be a monitor, CPU, motherboard, hard drive, modems, video/graphics cards, USB slots, etc. It involves a detailed design of a user and a product database structure processor and a control processor. The personal specification is developed for the proposed system (Ulrich et al 2006).

2.3 System Testing

Testing ensures that the system still meets the client needs (functional requirements). The intent of System Test is to find defects and correct them before go-live. There is no approach or method to guarantee a system completely free of defects. However, following a System Test approach will assist in mitigating risks and ensuring a successful project. System testing is an investigation conducted to provide stakeholders with information about the quality of the product or service under test (Cem 2006). Software testing can also provide an objective, independent view of the software to allow the business to appreciate and understand the risks of software implementation. Test techniques include, but are not limited to the process of executing a program or application with the intent of finding software bugs (errors or other defects).

System testing can be stated as the process of validating and verifying that a computer program:

a) meets the requirements that guided its design and development,

b) works as expected,

c) can be implemented with the same characteristics,

d) And satisfies the needs of stakeholders.

Methods of Testing

Test cases are developed using various test techniques to achieve more effective testing. By this, software completeness is provided and conditions of testing which get the greatest probability of finding errors are chosen. So, testers do not guess which test cases to choose, and test techniques enable them to design testing conditions in a systematic way. Also, if one combines all sorts of existing test techniques, one will obtain better results rather if one uses just one test technique. Software can be tested in two ways, in another words, one can distinguish two different methods:

1. Black box testing, and
2. White box testing.

White box testing is highly effective in detecting and resolving problems, because bugs can often be found before they cause trouble. Jovanović (2009) defines this method as testing software with the knowledge of the internal structure and coding inside the program. White box testing is also called white box analysis, clear box testing or clear box analysis. It is a strategy for software debugging in which the tester has excellent knowledge of how the program components interact. This method can be used for Web services applications, and is rarely practical for debugging in large systems and networks. Besides, white box testing is considered as a security testing method that can be used to validate whether code implementation follows intended design, to validate implemented security functionality, and to uncover exploitable vulnerabilities.

Black box testing is testing software based on output requirements and without any knowledge of the internal structure or coding in the program Jovanović (2009). In another words, a black box is any device whose workings are not understood by or accessible to its user. For example, in

telecommunications, it is a resistor connected to a phone line that makes it impossible for the telephone company's equipment to detect when a call has been answered. In data mining, a black box is an algorithm that doesn't provide an explanation of how it works. In film–making, a black box is a dedicated hardware device: equipment that is specifically used for a particular function, but in the financial world, it is a computerized trading system that doesn't make its rules easily available.

The main characteristics and comparison between white box testing and black box testing are follows: Black Box Testing Versus White Box Testing

Black Box Testing:

Pros

a) performing the tests which exercise all functional requirements of a program;
b) Finding the following errors: incorrect or missing functions; interface errors; errors in data structures or external database access and performance errors

Cons

a) Higher maintenance cost with automated testing. Application changes tend to break black-box tests, because of their reliance on the constancy of the interface.
b) Redundancy of tests. Without insight into the implementation, the same code paths can get tested repeatedly, while others are not tested at all.

White box testing:

Pros

a) More efficient automated testing. Unit tests can be defined that isolate particular areas of the code, and they can be tested independently. This enables faster test suite processing
b) More efficient debugging of problems. When a regression error is introduced during development, the source of the error can be more efficiently found – the tests that identify an error are closely related (or directly tied) to the troublesome code. This reduces the effort required to find the bug.

Cons

a) Harder to use to validate requirements. White box tests incorporate (and often focus on) *how* something is implemented, not why it is implemented. Since product requirements express "full system" outputs, black box tests are better suited to validating requirements. Careful white box tests can be designed to test requirements.
b) Hard to catch misinterpretation of requirements. Developers read the requirements. They also design the tests. If they implement the wrong idea in the code because the requirement is ambiguous, the white box test will also check for the wrong thing. Specifically, the developers risk testing that the wrong requirement is properly implemented.
c) Hard to test unpredictable behavior. Users will do the strangest things. If they aren't anticipated, a white box test won't catch them.

Testing can never completely identify all the defects within software (Leitner 2007). Instead, it furnishes a criticism or comparison that compares the state and behavior of the product against oracles—principles or mechanisms by which someone might recognize a problem. These oracles may

include specifications, contracts comparable products, past versions of the same product, inferences about intended or expected purpose, user or customer expectations, relevant standards, applicable laws, or other criteria. A primary purpose of testing is to detect software failures so that defects may be discovered and corrected. Testing cannot establish that a product functions properly under all conditions but can only establish that it does not function properly under specific conditions (Kaner 1999). The scope of software testing often includes examination of code as well as execution of that code in various environments and conditions as well as examining the aspects of code: does it do what it is supposed to do and do what it needs to do. In the current culture of software development, a testing organization may be separate from the development team. There are various roles for testing team members. Information derived from software testing may be used to correct the process by which software is developed (Kolawa, 2007).

2.4 MIS Implementation Process

Implementation is the final critical stage, although if not properly managed the entire efforts of ISs development may fail and the system will not be delivered. According to Bocij (2003) information systems implementation involves the changeover from an old system to new system. Implementation begins with development of a cutover proposal by the project implementation team to the management informing them that it's time to implement the new system. Before implementation a few tasks need to be performed these may include the development of manuals and providing training. Manuals will contain information on how to use the new system and should be distributed to all the people who will be using the new system. These manuals should be written in consultation with a sample of users of the new system to ensure that the directions contained in the manuals are easily understood. The people who will be using the new system should be trained. Training should take place very close to the time of actual cutover. It is usually a waste of time to train people on new

system more than a week or two before the new system is implemented because most people simply forget what they learned in the training season after some time has passed.

During IS implementation, management can follow one of the four basic cutover approaches; pilot, immediate, phased and parallel. A pilot cutover is a trial system that is usually implemented in a single location like an office or geographical area. The pilot allows developers to see how the users react to the new system and possibly change some features of the new system if necessary or feasible. If changing of the new system is not feasible pilot will reveal some of the things that might be included in the training sessions and user manuals development. However pilot may take considerable time. Obviously an immediate cutover over will be a lot simpler (Bocij, 2003). The implementation of new information systems is a significant investment for organizations. Implementation of the computer based personnel management system was done using parallel running because of its ability to show errors that can be corrected by the developer.

2.5 MIS Implementation Success Factors

The key factor to successfully achieve MIS implementation can be defined in the same meaning as success factors. Most concepts of success factors in the IS literature are described as critical success factors (CSFs). CSFs in the information system (IS) literature is well established for numerous contexts such as requirement analysis, IS planning, and project management (Somers & Nelson, 2001). These CSFs are investigated by many researchers such as Nah, Lau and Kuang (2001).

There are many investigations of IS project implementation success factors. Tan (1996) presented a set of success factors including technical characteristics, user involvement, communications,

management support, project team characteristics, difference between technology provider and receiver, incentives, infrastructure support and obstacles, to identify their effects on external technology transfer project. The success factors can be grouped in four categories as follows:

a) The first category integrates factors which influence goal congruency.
b) The second category contains the components that relate to project team in order to improve the motivation and cooperation of the team.
c) The third category concentrates on the acceptance of the project and the result. .
d) Finally, the fourth category is concerned with the implementation process which deals with implementation politics and planning.

The list of success factors is presented based on the literature, and categorized along with its key factors. As mentioned before, this summary of success key factors in this study is not only obtained from the systems implementation literature, but also from Information System (IS) project implementation. The success key factors were considered before the development of the computer based personnel management system.

2.6 Challenges of Implementing an Information System

Information System implementation has various problems regarding the implementation process and it is not easy to succeed. There are several problems which occur during the implementation of IS. These problems can be observed in a series corresponding to each stage of the overall process. It appears that every layer is comprised of multiple issues that create or worsen the challenges (Beaumaster, 2002). MIS or IS have to provide an approach to deal with the ever-changing problems and be situated surrounding all aspects of the management of information (Theiruf, 1994). Moreover, the success of IS implementation in the organisation also depends on a multitude of

important and interrelated factors (Beaumaster, 2002). Hence it is a of great significance to take into account this and observe the obstacles when implementing a new information system.

Further studies indicate that the challenges of ISs implementation vary from one organization to another. These include political and socio-economic issues, the top management support and the influence of the group leaders. According to Flynn (1995), project teams require a powerful champion to support the technologically weak organization and to ensure that communication process function as planned. Further, the inadequate resource allocation and the relevance of IT projects to parastatals rank highly on information systems challenges, Information System projects are very expensive, the determination of the optimum level of automation and computerization in order for the organization to achieve maximum business value from IS investment is one of the common concerns in state parastatals (Pant et al 2001). Jit (2003) observed that the challenge of appropriate software for automation, human resources aspects, on time and within budget maintenance of ISs facilities are key technical challenges in IS implementation.

The challenges identified are split into four categories. These include; human issues, operational issues, technical issues; and financial issues. Human issues relate to the interpersonal skills of the individuals involved with the project and come into play starting with the pre-planning stage, the approval process, project planning and project implementation through the transition to production status. Burke et al (2001) suggest that human issues have the biggest impact on the processes as they argue that when implementation is successful, it is because a focused attention was paid to the human issues. The following human issues have been identified.

a) **Poor Project Management**: Very few organizations have the experience in house to run such a complex project as implementing a large-scale integrated solution. Many parastatals usually

engage outside contractors to come and manage the implementation process. Implementation of projects needs involvement of senior executive to ensure that the right participation mix of Business and IT is done and to resolve conflicts (Turbit, 2005). This will not affect the computer based personnel management system because the project is being well handled and managed.

b) **Lack of user skills and awareness***:* Burke et al (2001) identified poor skill sets among users as an issue. This view is supported by research by META Group (2004) that indicated that more than 75% of organizations identified lack user awareness as a challenging factor. Furthermore, in the same study, 66% of organizations identified lack of executive awareness as having a similar affect. Martin Harvey, the director of IT user skills at e-skills UK, states that lack of user skills is "a major problem" which is supported by a recent study showing that 7.6 million employees needed improved IT skills out of the 21.5 million IT-using work forces (Murray, 2007). It is also suggested by Turbit (2005) that when upgrading from old technology, the skills of staff need to be upgraded as well. The upgrade will place significant demands on a team who are geared to maintain an old but stable environment, usually this effort is underestimated. Most of the users fear ISs due to lack of skills and awareness, they view ISs as a challenge to their profession or career. ICT is an area which keeps on changing therefore staff need to upgrade skills with respect to the new software that comes into use, in order to keep in line with changing environment. With the pilot running, the users were trained on how to effectively use the system.

c) **Resistance to change:** This is a refusal to see benefits of a new system because of what is known works for an individual (Burke et al, 2001). A case study based on Hayward Gordon Ltd. (HGL) in 2004 revealed that one of their major human issues was that people can become

lazy and copy electronic records. A study by Gupta (2000) revealed that the main hurdle faced by most companies was the resistance to change. He expanded on this by explaining that the resistance was due to employees being reluctant to learn new techniques or the IT department was reluctant to change due to its attachment to the product. Employees play an important role as Maguire (2000) identifies that the "vast majority of ISs are used by staff within organizations". Maguire (2000) also notes that there are still too many examples of ISs projects that have failed due to increasing problems of rising costs and the misuse of IS rather than acceptance and use of the system. Even with significant effort to ensure that system implementation is successful, many systems encounter resistance from potential users and others within the organization. CBPMS will be readily accepted since employees are already frustrated with the manual processes.

d) **Benign Neglect***:* Ignoring the situation and refusing to stay on track or fulfill responsibilities (Burke et al, 2001) means there is a lack of focus on the project which indicates that the organization is not very determined to make the ISs successful. Benign neglect is mostly displayed by the users as if they are against the implementation of the ISs. They may refuse to take part in making the system successful. This is also linked with resistance to change. Employee may refuse to stay on track due to a number of reasons these include if they were not consulted at the initial stages. User involvement in the system development process helped keep the users on track.

e) **Inadequate Staffing***:* Organizations do not always have enough staff available for the successful of implementation of ISs (Burke et al, 2001). Lack of staff will mean that the

organization may be unable to perform necessary activities such as testing and may significantly affect the time scale of the project. This will not affect the CBPMS.

f) **Scope Creep:** Implementing features outside the original scope and adding features unsystematically ultimately makes ISs harder to use (Burke et al, 2001). Organizations that have specific plans or requirements are most likely to deter from it as they keep adding changes in order to cater to everyone's needs. Most users keep on raising new requirements as they get used to the ISs. The more enhancements to be made into ISs the more the challenges. Managing the scope is very difficult in many parastatals. Preliminary study was carried out in order to fully determine the boundaries of the scope.

g) **Battles and perfectionism Political***:* Who is responsible for what? Who owns what information? Can cause rifts between departments which ultimately will affect the implementation of a system as communication may break down along with lack of departmental cooperation. In public organizations power struggles' and employee relations often occur leading to implementation challenges (Burke et al, 2001). Perfectionism occurs when users refuse to use the ISs because it is not working exactly as specified. In information systems projects implementation, a huge amount of work requires the analysis of data and input from many people, which could have significant consequences later on in the project, causing even something dramatic as redesign and reimplementation (Burke et al, 2001). This is not affecting the implementation of CBPMS since there are no battles in the university or the area surrounding it.

h) **Lack of Experience**: A case study based on Mascot Truck Parts cited in Maguire (2002) revealed that they had problems implementing a new IS because they did not have enough

experience with regards to the processes involved and incidentally the system was not setup properly. In any business the use of personnel with specialized skills enhances the ability of a parastatal to be successful in implementing large, complex, or difficult tasks. It allows for both deeper and stronger skills and the contribution of differing perspectives. Technical people who can be highly effective in approach task from different perspectives are rare, that is why sooner or later organizations bring in specialists. Operational factors are those that affect the flow of information transactions within the business. The following operational factors have been identified.

i) **Changing Business Processes:** It is difficult to draw the line between changing business processes to suit the system or retaining Business Processes and paying the cost, in money and time. Time and cost squeeze the implementation, so the usual path is not to modify the system, but to change the way people work (Turbit, 2005). Poor Planning is also a critical challenge to successful system implementation. Planning covers several areas such as having a strong Business Case, to the availability of users to make decisions on configuration, to investing in a plan that captures all the issues associated with implementation. A case study based on Pestell Group in cited in Maguire (2002) revealed that they had problems with getting their information system up and running on time due to inefficient planning. This challenge didn't affect the system because the processes did not change.

2.7 Implementation Effects of Information Systems

Information system (IS) implementation creates both positive and negative effects for an organization that use it. Most of the literature has underpinned the design and use of a modern MIS which is mainly based on technology (or IT; Lucey, 2005; Davies, 2009). The technology, which

influences organizations in many ways (Lucey, 2005), begins to have effects on an organization in which IS is introduced and implemented. Therefore the effects for the organization are critical to consider by applying MIS. The designed IT based information systems can affect the business processes of an organization (Lucey, 2005). Consequently, managers of the organization have to understand these effects in order to design and run systems that provide only benefits for the organization, and to avoid the risks that occur from IS tools (Davies, 2009).

IT systems have significant potential as vehicles for learning in organizations. Various benefits are provided from introducing Information systems into an organization. The Information system typically causes amendments in forms of collaboration and coordination between groups in an organization. An electronic mail (e-mail) can be an example of using IS in an organization. It is nowadays extensively used as a means of scheduling meetings which reduces time for face-to-face contact. The Information system can also change the patterns of power and influence in and between groups (Davies, 2009).

On the other hand, it is not only IS that can impact an organization, but IT also causes an effect on the companies that use this tool. This is because IT is represented as a facilitator, an initiator, or an enabler for the business. This is based on the situation and how the technology will be applied (Chan, 2000). According to Lucey (2005), technology alters the skills requirements for individuals, jobs, and working protocols. IT systems have significant potential as vehicles for learning in organisations. Various benefits are provided from introducing IT systems into an organisaiton. The IT system typically causes amendments in forms of collaboration and coordination between groups in an organisation. An electronic mail (e-mail) can be an example of using IT in an organisation. It is nowadays extensively used as a means of scheduling meetings which reduces time for face-to-face

contact. The IT system can also change the patterns of power and influence in and between groups (Davies, 2009).

2.8 Databases

Loudon and Loudon (2007) define a database as a collection of data organized to serve many applications efficiently by centralizing the data and controlling redundant data. Rather than storing data in separate files for each application, data are stored so as to appear to users as being stored in only one location. A single database services multiple applications.

2.8.1 Database Management Systems.

Loudon and Loudon (2007) define a database management system (DBMS) as software that permits an organization to centralize data, manage them efficiently, and provide access to the stored data by application programs. The DBMS acts as an interface between application programs and the physical data files. A DBMS reduces data redundancy and inconsistency by minimizing isolated files in which the same data are repeated.

2.8.2 DBMS Models

Contemporary DBMS use different database models to keep track of entities, attributes and relationships and these models are;

1. Relational DBMS

   They represent data as two-dimensional tables called relations. Tables may be referred to as files.

2. Object-Oriented DBMS

   An Object-Oriented DBMS stores the data and procedures that can act on those data as objects that can be automatically retrieved and stored.

2.9 Data Collection Methods.

Sapsford and Jupp (2012) define data collection asthe process of gathering and measuring information on variables of interest, in an established systematic fashion that enables one to answer stated research questions, test hypotheses, and evaluate outcomes. Data collection is carried out using different methods as shown below;

2.9.1Questionnaires

Stokes (2014) refers to questionnaires as forms filled in by respondents alone. Questionnaires can be handed out or sent by mail and later collected or returned by stamped addressed envelope. This method can be adopted for the entire population or sampled sectors. Questionnaires may be used to collect regular or infrequent routine data, and data for specialized studies. While the information in this section applies to questionnaires for all these uses, examples will concern only routine data, whether regular or infrequent. In order to maximize return rates, questionnaires should be designed to be as simple and clear as possible, with targeted sections and questions.

2.9.2 Interviews

Stokes (2014) states that interview information is obtained through inquiry and recorded by enumerators. Structured interviews are performed by using survey forms, whereas open interviews are notes taken while talking with respondents. The notes are subsequently interpreted for further analysis. Open-ended interviews, which need to be interpreted and analyzed even during the interview, have to be carried out by well-trained enumerators. It is important to pilot test forms designed for the interviews. The best attempt to clarify and focus by the designer cannot anticipate all

possible respondent interpretations. A small-scale test prior to actual use for data collection will assure better data and avoid wasting time and money.

Open-ended interviews cover a variety of data-gathering activities while structured interviews are conducted with a well-designed form already established. Forms are filled in by researchers, instead of respondent. Development of the personnel management system used both methods for data collection since they both capture all the needed information.

CHAPTER 3

METHODOLOGY

This chapter provides the description of how the project was conducted. It explains the methods and techniques applied in the developing of the computer based personnel management system.

3.1 Preliminary Study

A preliminary study was carried out before the main study. Preliminary study was used to identify key features to be addressed in order to develop a quality system. Eva (2004) refers to preliminary study is an initial exploration of issues related to a proposed quality review or development. The preliminary study enabled the project developer to evaluate time, cost and the appropriate sample size.

3.2 Sample Size

A total sample of sixty eight respondents was used in this project. A non-probability sampling technique is adopted as only managers and employees with the required information are selected for the study. The study population comprised of four personnel managers, and sixty four employees from Mbarara University of Science and Technology. Purposive sampling was used to select the personnel managers. Purposive sampling is a sampling technique that is non-probabilistic and enables the systems analyst to interview persons in their reach that they are sure will inform the design of the system.

3.3Data Sources

The project mainly used primary data which was obtained using questionnaires and interview guides. Some secondary data was also obtained from organizational human resource reports documents such as annual reports, strategic plans and financial reports available.

3.4 Data Collection Instruments

Primary data was collected using a structured questionnaire and an interview guide as shown in appendices one, two and three respectively. The questionnaires were delivered physically to the respondents participating in the project so as to ensure an acceptable response rate for the project. The questionnaires were administered at the workplace setting to diminish the effect of bias among the respondents.

3.5ProjectDevelopment Methodology

The project used evolutionary Prototyping project technique because the technique allows the developer to build the software with continuous refinements based on feedback from users. Therefore it is likely that less time will be needed at the end for the various tests. Evolutionary software prototyping is an information system development methodology based on building and using a model of a system for designing and implementing, testing the system.

3.5.1 System Design

A bottom-up design approach was used, that is progressing from small units to larger units of the system. The system requirements were modeled into diagrams. The outcomes of the system design were the Use case diagram, Data flow diagrams and the Entity relationship diagram,

which were developed using the UML technique and work bench. The diagrams elaborate the system's functional requirements. System code was developed using PHP, HTML, CSS and MYSQL were used to develop the database

3.5.2 Method of Testing

White box testing was the method used for testing because it is highly effective in detecting and resolving problems, because bugs can often be found before they cause trouble. The system was tested with users to ensure that the system worked according to the desired performance requirements earlier specified. Both functional and non-functional test were carried out.

CHAPTER FOUR

SYSTEM ANALYSIS, DESIGN AND IMPLEMENTATION

This chapter describes the analysis, design and implementation of the computer based personnel management system.

4.1 System Analysis

System analysis includes description of the system, user requirements, system specifications that is to say functional and non-functional requirements and system constraints.

4.1.1 Description of the CBPMS

The CBPMS is a software tool designed based on the personnel management processes of MUST. The system's functionalities are employee registration, records management, overtime processing, leave processing, employee evaluation, and will also act as communication channel. The system will enable the personnel managers to better handle and deal with the university human resource. The CBPMS will reduce the amount of time taken by the human resource managers to carry out the personnel management business processes and this will enable employees to receive their overtime payment in and on time and leave processing will be made quick. Use of the software tool will reduce on the time and cost of sharing information about employee status, enhancing the efficiency and effectiveness of the personnel management at MUST.

4.1.2 Questionnaire and interview results analysis

Data collection was done using questionnaires and interview guide and these helped to streamline the personnel management processes at MUST and through these research tools, the researcher was able to under the personnel management process and the challenges faced by the current system. The current manual system is faced with challenges like inefficient records management, computational errors and collision of leave schedules. Data collection also helped in determining the user requirements and prospective users of the system.

4.1.3 User requirements.

Users are both technical and non-technical users. The technical users of the university include:-

Database Administrator who is responsible for the maintenance and repair of system database;

Network Administrator who is responsible for the maintenance of computer hardware and software that comprises a computer network. The particular duties will include the deployment, configuring, maintenance and monitoring active network equipment to ensure there are functional.

The non-technical users include:-

a) The Managers, who are part of the employees, but ensure the smooth running of the system. .
b) The records manager who are part who registers and updates employee information.

The system has the following specified user requirements:

1. Process overtime worked and payment
2. Leave processing
3. Update of personnel records
4. Controlled and secure access to the system
5. User friendly interface

4.1.4 Functional Requirements

The system's functional requirements as derived from the questionnaires and interviews are;

1) Employee registration,
2) Records management,
3) Overtime processing and
4) Leave processing.
5) Maintenance of employee records.

4.1.5 Non-functional requirements

1) The system should easily be maintained by trained person.
2) User validation should be done during login to ensure that the user is valid and that the user only has access to their permission levels.

4.1.6 System Constraints

a) **Accessibility:** university employees who are not computer literate will find it hard to access and use the system.

b) **Usability:** systems cater for English speakers which might prove a challenge to those not well conversant with the language.

4.2 System Design

The System design deals with how the system functionalities are provided by the different components of the system (Sommervile, 2001). System design tools such as data flow diagrams, entity relationship diagrams and relationship schemas were used to represent the different aspects of the system. It is subdivided into the conceptual data model using DFD, the logic data model defining the entities and describing their attributes and the physical data model that uses the ER diagrams and the relation schema to describe the relationship between the tables.

4.2.1 Use case diagram

The use case diagram elaborates the functional requirements of the system from an external point of view.

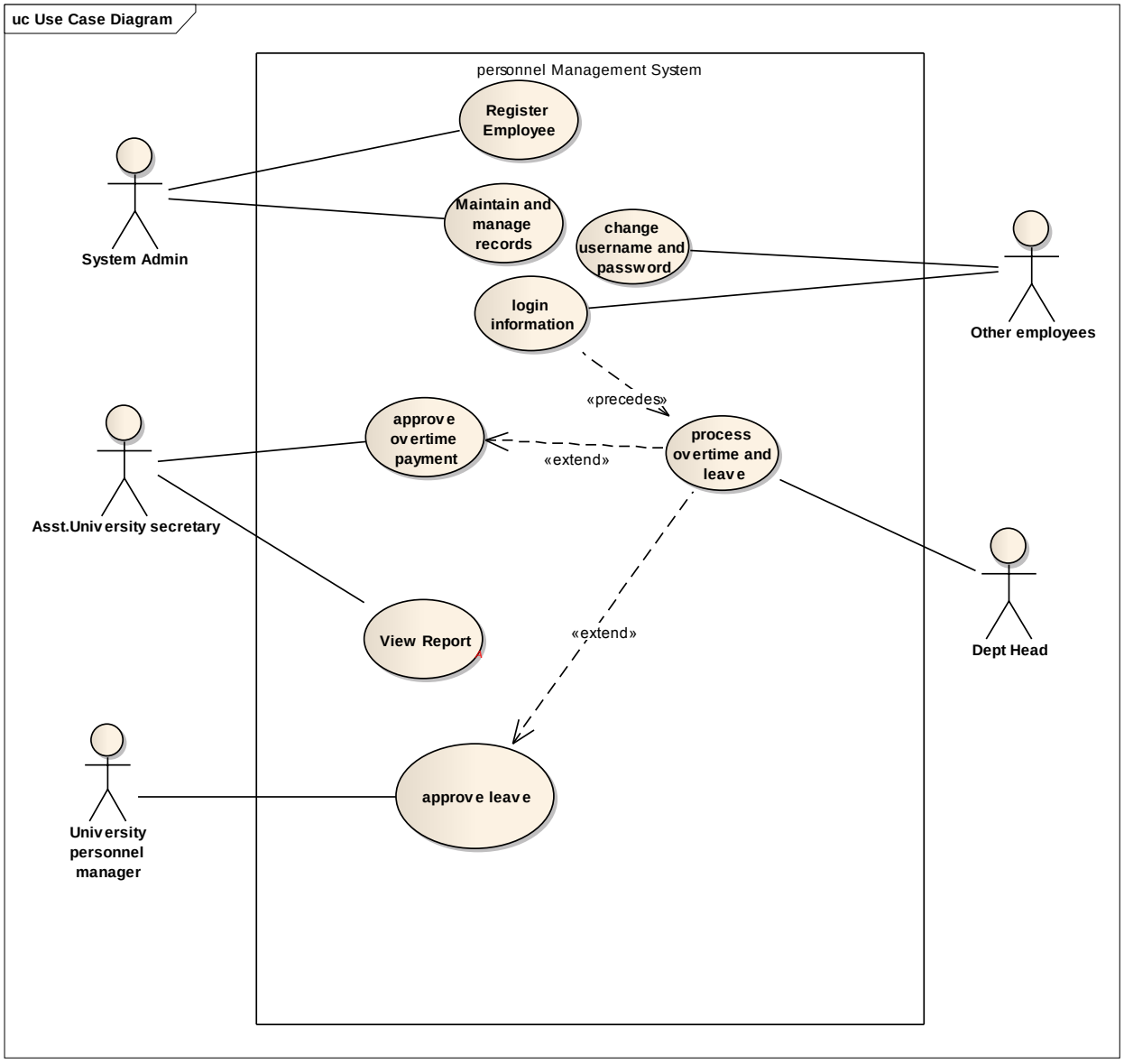


Figure 4.1: Use Case diagram

4.2.2User Description

The users in the new system were derived by analyzing the users in the old system. To avoid administrative structural changes, all users in the old system will retain the same roles in the new system.

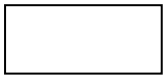
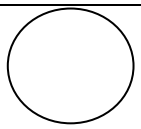
The Table 4.1 below describes users and their respective roles in the Computer-based Personnel Management System;

Table 4.1: User description table

USERS	**DESCRIPTION**
Personnel Manager	Manage information regarding employees' leave
University Secretary	Manages information concerning employees' overtime processing and leave.
Records Manager	To maintain the employee records or details in the computer based personnel management system.
Department heads	Maintain employee records like work schedules at department level.
University employees	login in and make applications

4.2.3 The DFD elements comprise a combination of 3 symbols as described in the table below.

Table 4.2: Data Flow Diagram Elements

NAME	SYMBOL	DESCRIPTION
External entity		It is outside the context of the system and can be any class of people, organization or another system. Its function is to supply or receive data. It is the originator or receiver of information outside the scope of the system portrayed in the data flowing.
Data flow		It shows the movement of data and is a pipeline carrying data through the system. These show the movement of data between processes, external entities.
Process		This portrays the computer-based personnelmanagement system.

Context Diagram

This diagram was used to represent of the personnel Management System processes. A context diagram elaborates the user interactions with the system and the system boundaries. The records manger is the first to interact with the system by registering employees, then the other users can interact with the system to carry out different tasks like apply for leave or process overtime. All these users have different access levels with the employee personnel managers having access to all the system levels.

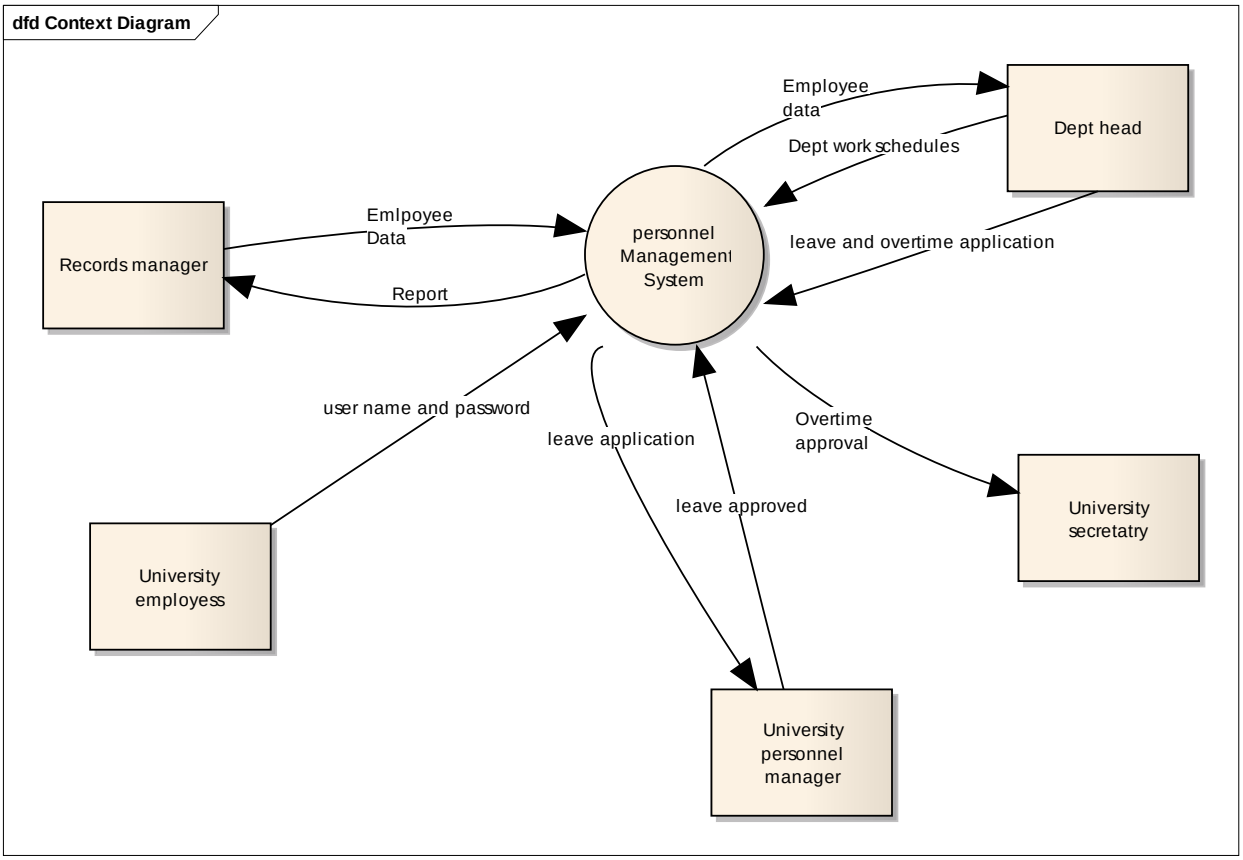


Figure 4.2: Concept diagram

4.2.4 Activity flowchart.

The activity flowchart was used to show how the personnel management activities are coordinated at MUST.

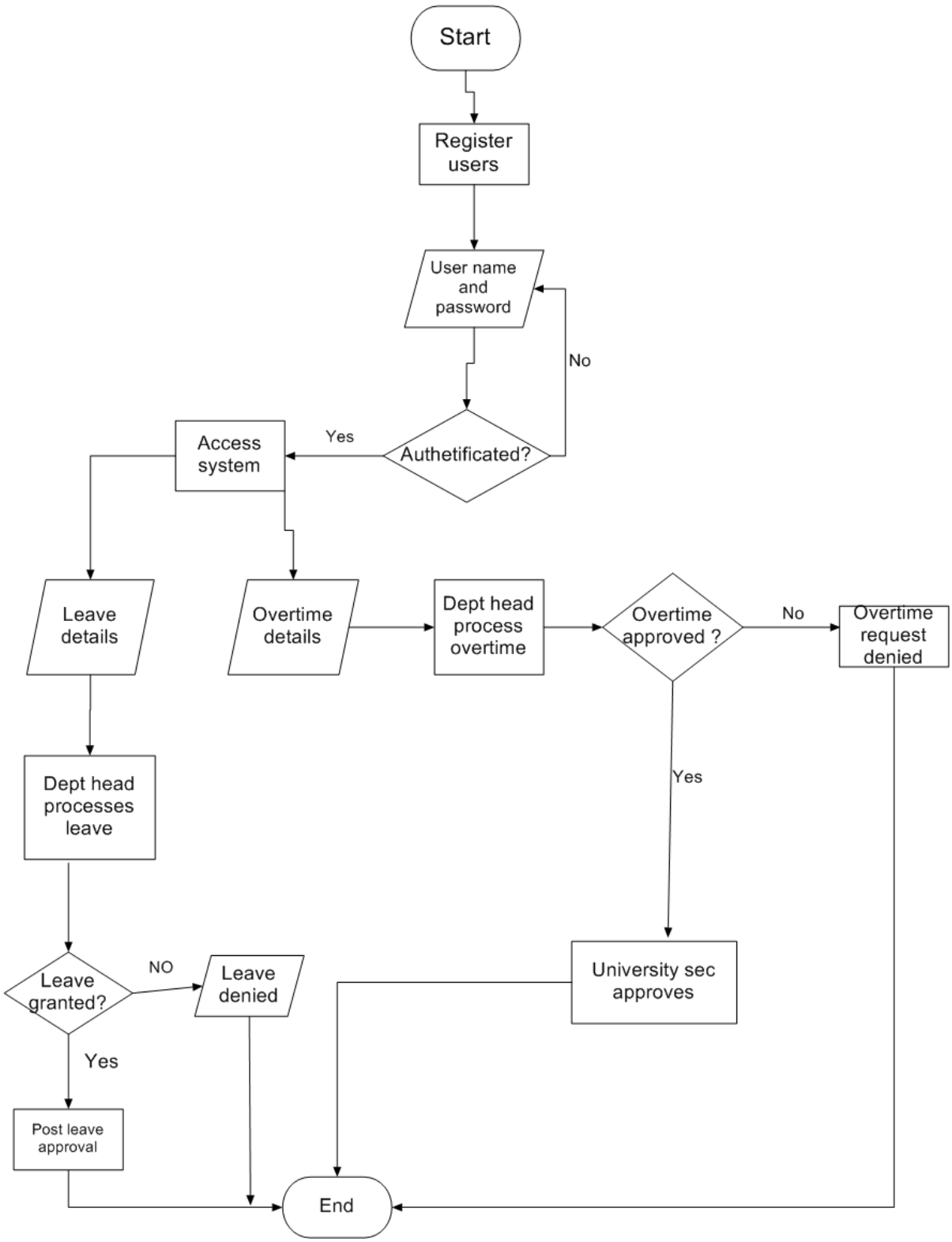


Figure 4.3: Activity Flowchart

4.2.5 Network and Hardware Requirements

A network requirement for the computer based personnel Management System is of devices that connect to each other through a Local Area Network.

The network components for this system include;

1. The Server
2. Client Computers: All the university computers are connected to the network
3. Router and switch.

Specifications for the client computers

1. Pentium IV processors with 128MB RAM
2. Hard-drive space: 5 GB

4.2.6 Software Requirements

The software requirements includes:-

- A window 98 or higher version for fast processing.
- DB- MySQL

4.3 System Architecture

The architecture used for the system is a 3 tier Client/Server Architecture composed of database tier, application tier and the client tier. The system architecture uses the local area network of the university.

Database tier: Houses database servers where information is stored and retrieved. Data in this tier is kept independent of application servers.

Application Tier: This tier acts as the server for client requests from workstations. In turn, it determines what data is needed and where it is located. It controls application functionality by performing detailed processing.

Client Tier: This tier contains the programming that provides the graphical user interface and application-specific entry forms or interactive windows. This tier communicates with other tiers by sending results to the browser and other tiers in the network.

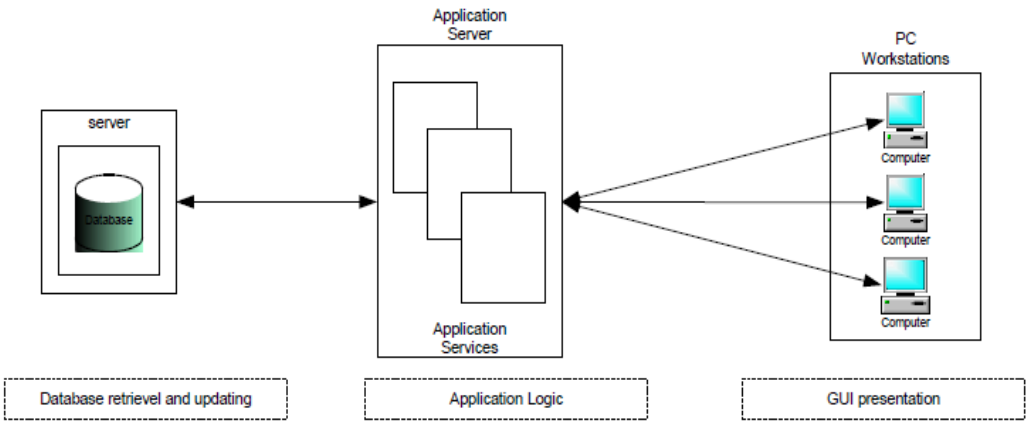


Figure 4.4: System architecture

4.4 Functional Design

The functional design comes from the functional and non-functional requirements. It elaborates the user and system interaction.

4.5 Database Design

4.5.1 Logical Database Design

The personnel Management System database represents data for 7 entities. Below are details of the entities and attributes with the primary key in bold and fully underlined while the foreign key is with dotted underlining.

Employee {userId, emplFName, empLName, deptId, emplRole, uId}

Overtimepays {payId,empId, amounttopay, numberofhours,status}

Otschedule {scheduleId, empid, dayofweek, typeofot, datetowork, timetowork}

Overtimechangereq{reqid, empid,propdate,proptime,justifications,otnumber,statusreq}

Workedot{workid, employeeid,dateworked,starttime,statuss}

Leavereg{leaveid, reason, startdate,enddate,employeeid,leavestatus}

Roles {roleid, roletype, otp}

4.5.2 Entity Relationship Diagram

The Entity Relation Diagram (ERD) shows the relationship between entities in the system. The ERD shows the major entities, Primary keys, Foreign Keys of the personnel Management System.

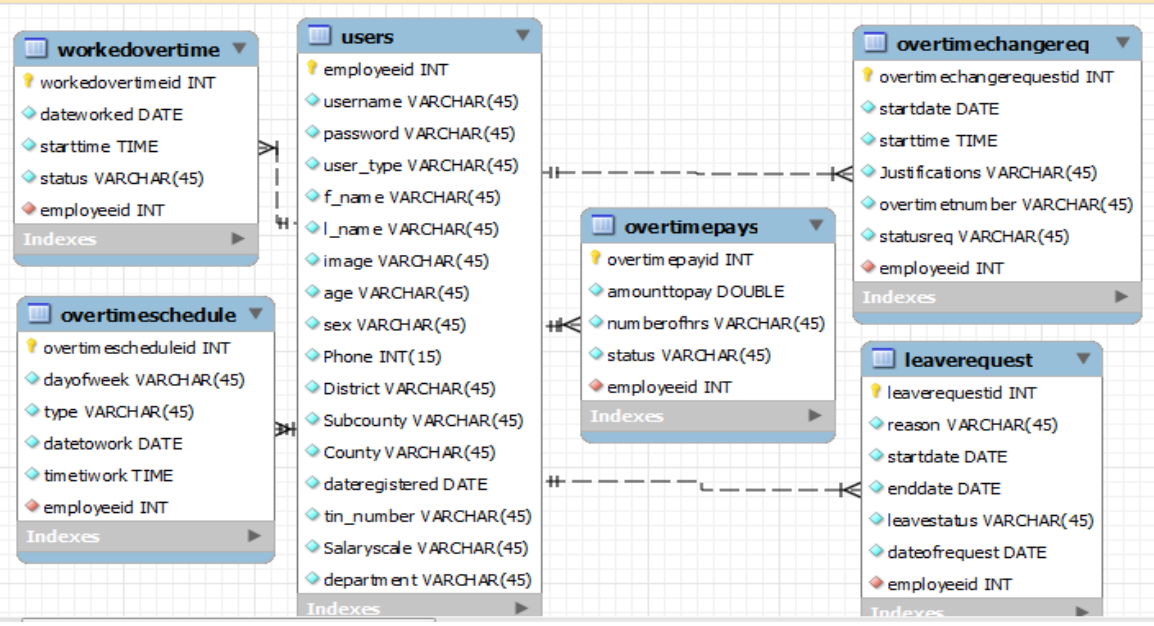


Figure 4.6 Entity Relationship Diagram

4.5.3 Physical Database Design

The physical database design translates the logical data model into a set of MySQL statements that define the database. The physical design of the database specifies the physical configuration of the database on the storage media.

Table 4.3: Physical database description

Table	Column	Data type	Notes
Users	User_id	INT(11)	Primary key
	roleid	INT	Foreign key
	username	VARCHAR(45)	
	password	VARCHAR(45)	
	user_type	VARCHAR(45)	
	f_name	VARCHAR(45)	

	l_name image age sex phone salaryscale department	VARCHAR(45) VARCHAR(45) VARCHAR(11) TEXT INT(20) VARCHAR(15) INT	
Overtime schedule	scheduleid empid dayofwk typeofot datetowork timetowork	INT INT(11) VARCHAR(45) VARCHAR(45) DATE TIME	Primary key Foreign key
Roles	roleid roletype otp	INT VARCHAR(45) DOUBLE	Primary key
leave request	Leaveid employee id reason startdate enddate leavestatus	INT INT(11) VARCHAR(45) DATE DATE DATE	Primary key Foreign key

workedovertime	worked employeeid dateworked starttime statuss	INT(11) INT(11) DATE TIME VARCHAR(25)	Primary key Foreign key

4.6 System Implementation

Implementation of the computer based personnel management system involved use of various technologies which included WAMP for Windows, MYSQL to create the relational database, PHP and HTML to create the website. System Architecture Design was also set up to describe the layout of the technical environment in which the CBPMS was implemented. The implementation of CBPMS was realized after designs were coded and the database designed.

4.6.1 User Interface Design

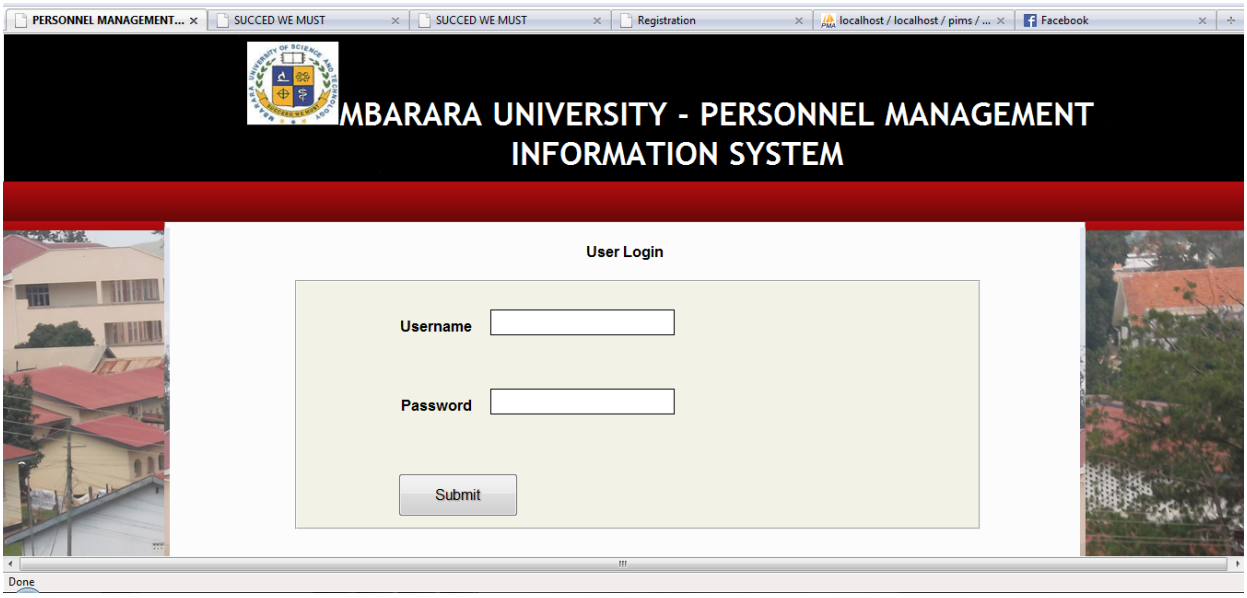
The user interfaces help the users access the system. It provides a user-friendly format, from which the user can interact with the database. The user interfaces were developed basing on the university colors and in uniformity with the existing university systems.

4.6.2 Input Design

The main objective for the input design was to ensure accuracy and also to ensure that the input is acceptable and understood by the user. The interface also enables consistence, simplicity and attractiveness.

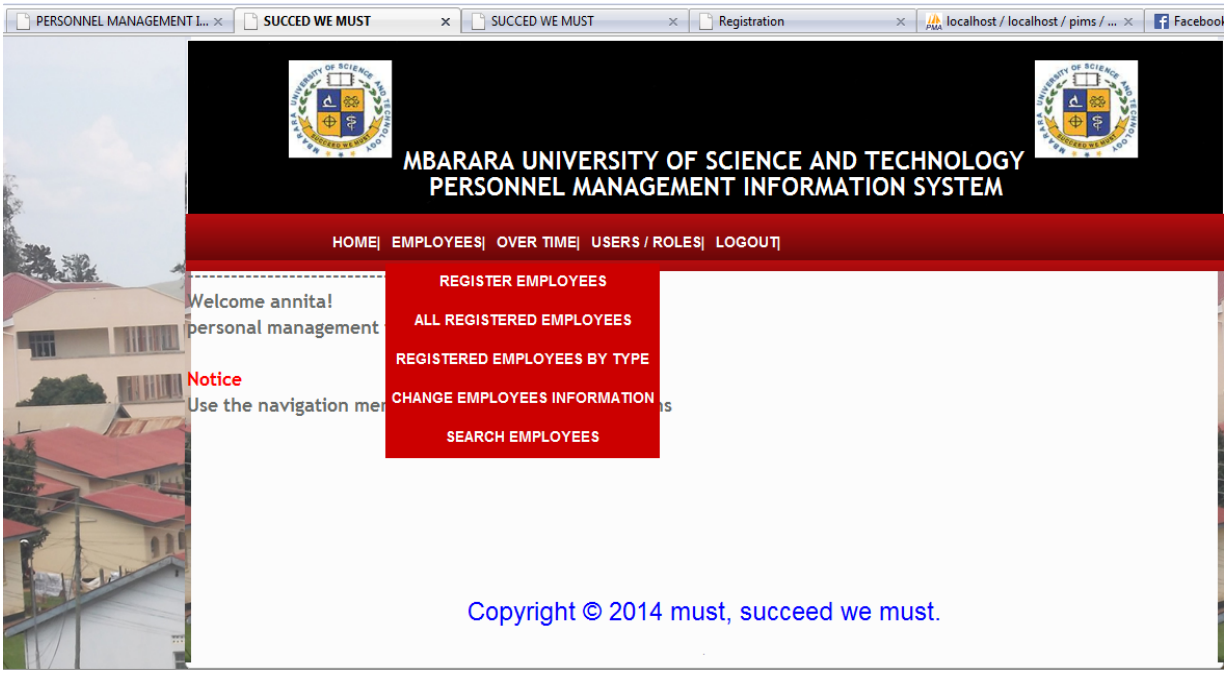
Login Form

All users login using the same login form, which queries for the username and password of the user. Below is a sample design of the login form.



Data Entry Forms

These will be used to add, modify, delete and save data. Care was taken to ensure simplicity during data entry by keeping the interface simple. Drop-down buttons were used to ensure that the data is consistent and also default values were availed to reduce the burden of typing by the system users. In addition, the data entry forms were designed in a way that is easy to read and understand.



4.7 Security Design

Security is essential for any kind of system, more so web systems which reside in networks which are prone to hackers. Therefore a variety of security measures are to be put in place, these include encryption techniques, Physical and software firewalls and other measures.

The security to be put in place can be broken down into two kinds namely Physical and logical security.

Under physical security, hardware like servers are kept in a control room in which only authorized personnel is allowed. And office computers are to be accessed strictly by authorized personnel only.

Under logical security the crucial system that is the System and the internal network are too protected by a firewall, and use of strong passwords and username by authorized personnel.

Backup copies are created and continuously updated to ensure that the system can restored in case of a critical error or data loss from risks like fires, theft of hardware, crashes to mention but a few.

Antivirus programs were installed on every computer that is to be used; these will provide protection from threats like viruses, Trojans, worms and spyware.

4.8 Testing Plan

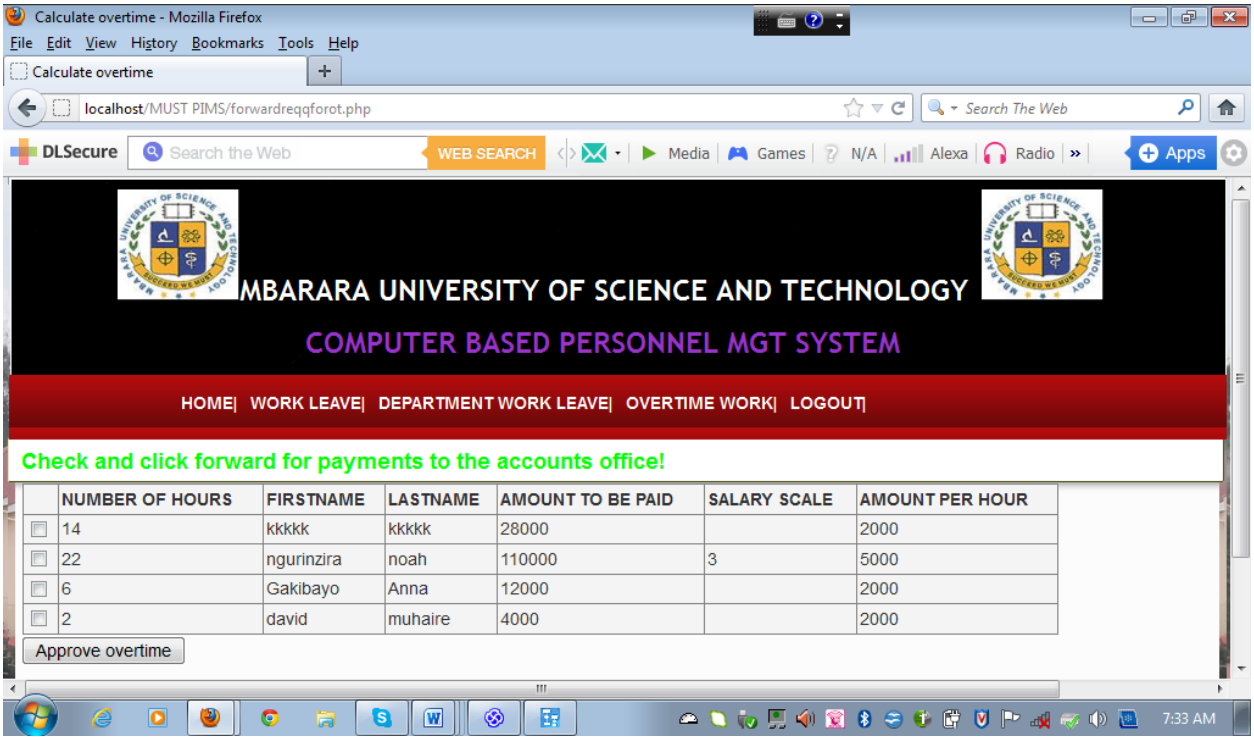
System testing was carried to acertain the system performance and to ensure that the user requirements were correctly addressed. White box testing is the method that was used for system testing.

The personnel Management System was tested to ensure that;

1. Data tables and files have been loaded properly,
2. Interfaces connect well to the database, and
3. Reports, which are generated, have accurate values.

4.8.1 Testing Results.

Testing results of calculating overtime in the computer based personnel management system.



CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents the summary of findings got during the research, conclusion and recommendations.

5.1 Summary

The computer based was developed basing on the personnel management processes of Mbarara University of science and technology. Data collection methods used were questionnaires and interviews which were conducted at the university. Technologies used to create the system are PHP, HTML, CSS and MySQL for the database. The system was developed to ease personnel information management at the university. It was developed using a bottom-up design approach and deployed with the parallel running method. System testing was carried to ensure that the system fulfilled the specified specifications

5.1.1 Challenges.

- The time scope provided for the system design and development was too short.
- Data collection was also challenging.

5.2 Recommendations

It is recommended that the following functionality should be developed to upgrade the usefulness of the system:

1. Evaluation functionality: The University can develop evaluation functionality so that employee appraisal can be computerized.
2. Sms or Email functionality: This functionality would employees be able to get notifications by sms or email about the progress of their requests.

Lastly, the system server should be kept in a secure place with good electricity supply plus the system should not be tempered with without the developer's knowledge.

5.3 Conclusion

A Personnel Management Information System was successfully developed. It is hoped that when the system is deployed it will improve the efficiency and effectiveness of managing the personnel data. Deploying the computer based personnel management system will make the management of personnel information easier and more secure. As a conclusion the four specific objectives of the project were achieved.

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APPENDICES

APPENDIX I: QUESTIONNAIRE FOR EMPLOYEES

As part of the requirements for the fulfillment of the requirements for degree of Master of Information System, Am conducting research aimed at developing a Computer-based personnel information system at Mbarara University of Science and Technology. There for, I am requesting for your participation by filling this questionnaire. All responses will only be used for academic purpose.

Instructions

Please fill in as appropriate

SECTION A. BACKGROUND INFORMATION

1. Gender……..

2. Level of Education……

3. Department ……...

4. Computer proficiency?

Excellent ☐ Good Fair Poor

SECTION B

5. How long have you been using a computer?

……

6. Where do you mainly access computer from?

(a). In my office ☐

(b). In school/faculty/institute's computer laboratory ☐

7. Briefly describe the overtime payment process at MUST?

……

……

8. What challenges do you have with that process?

……

……

9. Briefly describe the leave application process and its challenges?

……

……

10. Further comments

……

……

……

APPENDIX 2: QUESTIONNAIRE FOR PERSONNEL MANAGERS

As part of the requirements for the fulfillment of the requirements for degree of Master of Information System, Am conducting research aimed at developing a Computer-based personnel information system at Mbarara University of Science and Technology. There for, I am requesting for your participation by filling this questionnaire. All responses will only be used for academic purpose.

1. What processes do you undertake when handling overtime payment?

……

……

……

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2. What processes do you undertake when handling leave application?

……

……

……

3. How is the employee data collected?

……

……

…….

4. How do you manage the feedback from the university employees

5. What is your opinion about the way employee records are managed in terms of;

    i. Storage

    ii. Retrieval

    iii. Security

6. What are the shortcomings of the existing personnel management system?

Any questions?Any Concluding remarks?

Thank you.

APPENDIX 3: INTERVIEW GUIDE FOR PERSONNEL MANAGERS

Finding more information about the requirements for each user view, Operational Managers were asked the following questions as stated below:

Qn 1: What type of data do you need to hold on employees?

Qn 2: What sorts of things do you do with the data on employees?

Qn 3: What types of data do you need to process overtime?

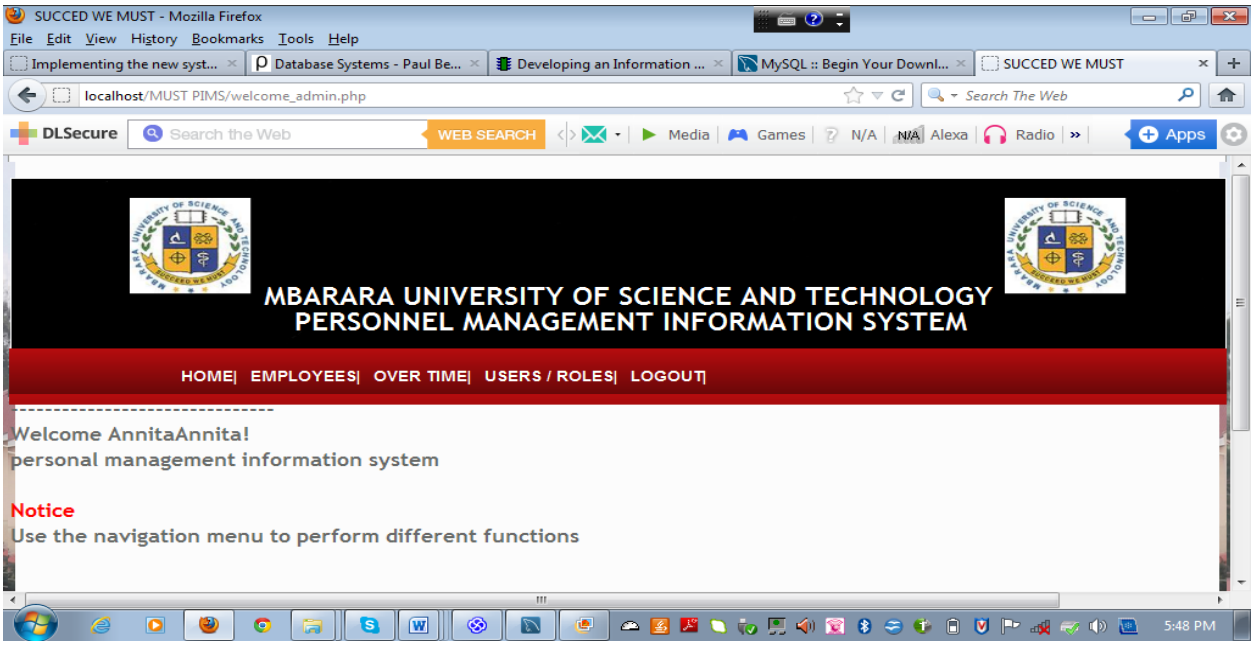
Qn 4: What types of data do you need to process leave?

Qn 5: How is employee information handled and stored?

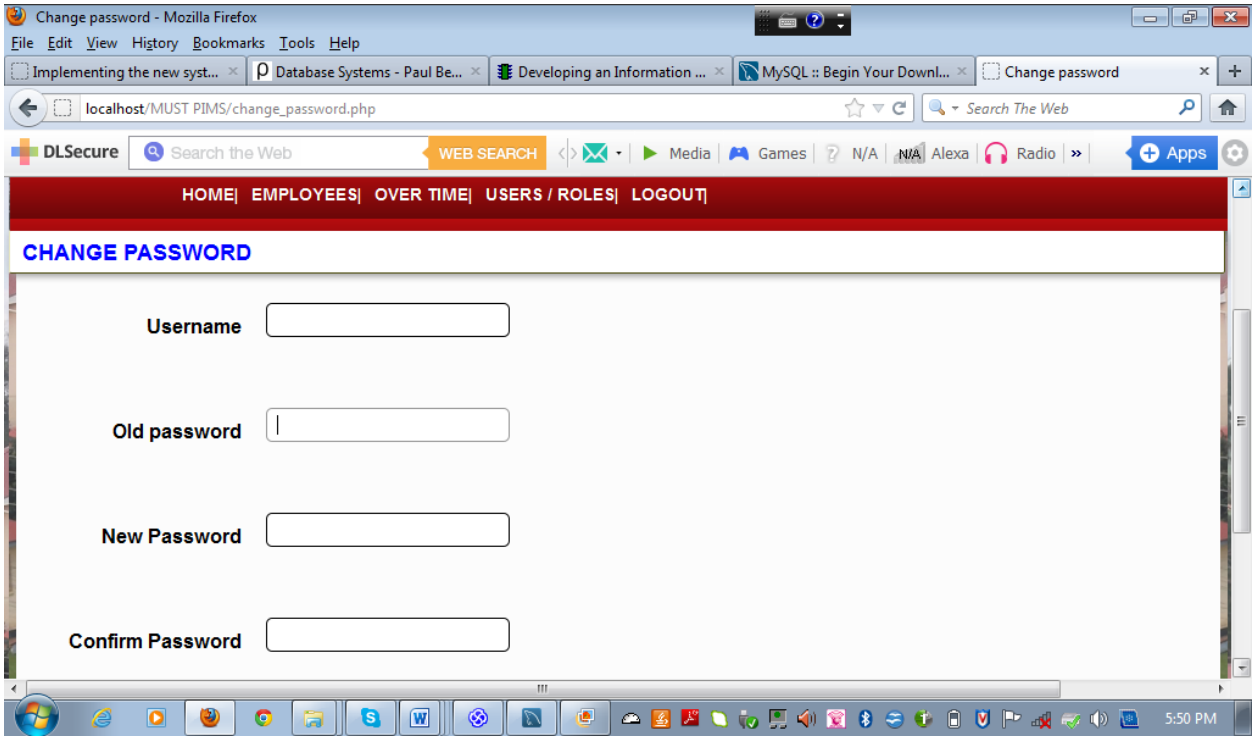
Qn 6: how do you keep track of employees that is to say their work designation, qualification and bio data?

APPENDIX 4: INTERFACES

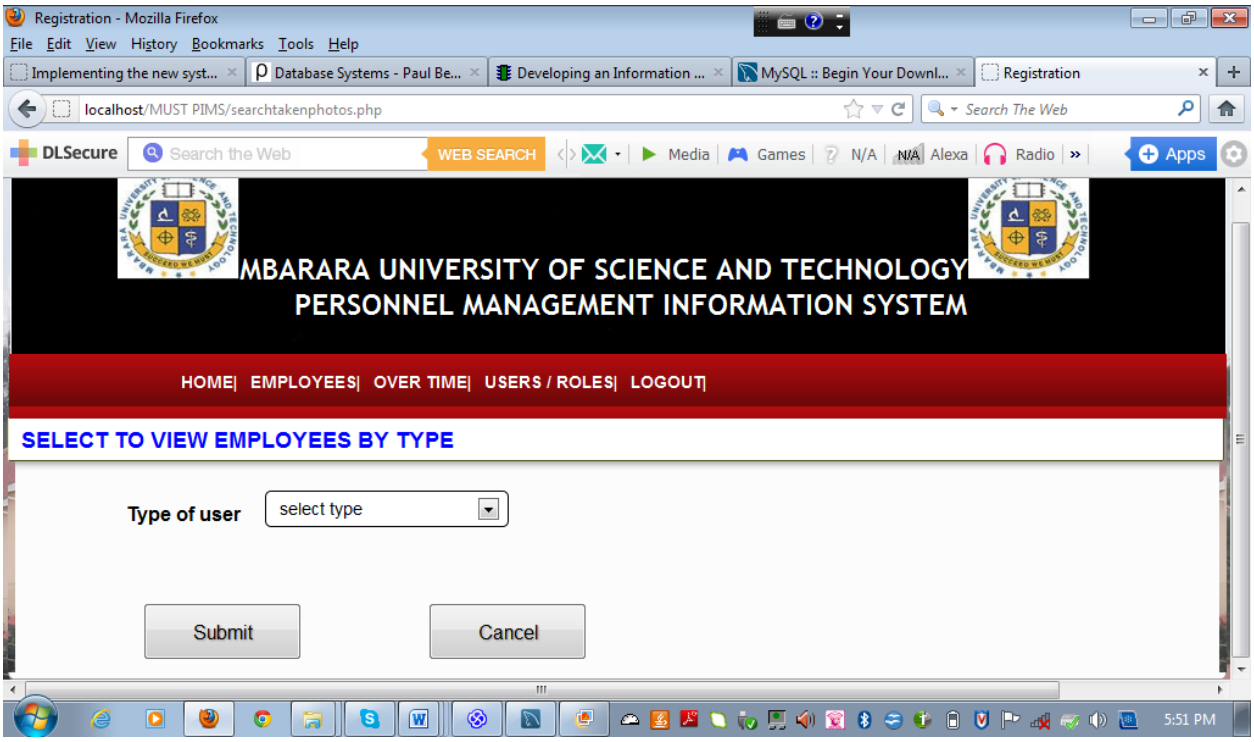
This is the home page of the system.



The system interface for changing passwords



This is an interface for employee searching



Database interface