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BACHELOR'S DEGREE

INFORMATION AND

RECOMMENDING SYSTEM

CASE STUDY: MAKERERE UNIVERSITY

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ABSTRACT

Choosing the right program to apply for at Makerere University in Uganda after finishing secondary school is something that cannot be done easily with limited information because it can lead to a person applying for a program they don't qualify to get and doesn't suite their career prospects. Therefore the aim of this is project was to develop a Web based system that will provide students with an ability to calculate their weights based on their previous results in both UCE and UACE, and recommend them to possible university programs basing on the cutoff points of the previous year of admission at makerere. This system will also help students identify programs that would best suite their future career prospects by providing them with an ability to search for a career and get recommendations of programs that suite the career searched. With this information, students can be able to apply for programs which suite their career prospects and also programs they can easily get when they apply at Makerere University. This in turn solves the difficulty some students face when deciding which programs to apply for at Makerere University.

In this report, we present a BDIRS that will recommend to students programs they can be offered at the Makerere University basing on their academic weight score and desired job professions. The system was tested and validated to ensure that it provides users with ability to get recommendations on programs they can do at Makerere University.

CHAPTER ONE

1.0 Introduction

Public universities in Uganda are funded by government through the ministry of education. The government subsidizes the cost of education making it cheaper than private universities (Badagawa P, 2013). According to (Badagawa , 2013) there are eight public Universities in Uganda namely Makerere University, Kyambogo University, Busitema University, Gulu University, Mbarara University of Technology, metropolitan Business school, Muni university and Soroti University of science and technology. These public universities are scattered throughout the country for example Makerere University and Kyambogo university are in the central region, Mbarara university is in the west, Busitema University in the east and Gulu University in the North and they admit both government sponsored and private students Ugandan and international.

According to (Uganda – Higher Education) Uganda had 888 students in 1965 enrolled in Makerere University and about 1000 students in other institutions of higher education. This number climbed to 2,581 students at Makerere by 1970 and well over 1000 at other institutions at Makerere by 1970 and well over 1000 at other institutions. This shows the numbers of students joining higher education is ever increasing year by year because at university students are able to get qualifications in different fields of interest to help them compete for jobs in the world market.

(Businge, 2012) shows that St. Mary'skitende, Namugongo, Ntare, kisubi and Namagunga are still the best Advanced level schools, if a parent is looking for government scholarship. This is because these schools provide best education services but also offer guidance to their students concerning public university programs in Uganda and which would best suite them basing of the A level combination they are doing students from less performing schools mostly rural areas don't get much guidance hence miss out on chance of joining public universities in Uganda because they may fail get the right university program to do.

BDIRS will provide assistance to students to help them know and select university programs that best suites them basing on their attained grades, subject combination, previous education history and also if private or Government sponsored. This will be done by calculating student's weights and then showing them public university programs that they can be able to do basing on the cut off points of the previous year

1.1 Background

In Uganda, selecting a bachelor's degree program to do after secondary school starts as early as the PUJAB session for those who hope to join public universities under the government's sponsorship have to fill the forms wisely according to their expectations in the form of possible scores at A level but they lack guidance on the best university programs to apply for to suite their career prospects. Public University booklets offered to students with various university programs still lack information like program description, fees structures, best public university for that program and possible careers attached to a program which would help a prospective bachelor student form judgment on which university program will best suite their career expectations. As a result some prospective bachelor students miss out of getting admissions to university and also may end up getting programs that might not suite their career prospects

In Uganda there is no system in place by public university that can help people aspiring to undertake a bachelor degree to identify and apply for programs that suite their career prospects yet this process of applying is associated with a non-refundable fee for example for 2015/16 admission a student had to pay a non-refundable fee of (50,000 UGX) for Ugandans and (172500 UGX) for non Ugandans.

According to (Wandawa, 2010) poor choices cause brilliant students to miss university admissions. This is because many secondary school teachers mostly in rural areas are too ignorant and makes mistakes in advising students on university programs they can do because they are not well informed this can sometimes cost brilliant students government sponsorship in case they apply for wrong university programs.

The challenge to find relevant services and information easily and quickly is often seen as a great irony of the information revolution (Smyth et al. 2004). This makes users face a lot of difficulty in selecting the right choice from a broad range of choices.

Recommendation systems help solve this problem of difficulty in making choices since some of the choices a person makes can affect or determine someone's future for example choosing the right program to do at the university.

BDIRS is a web based system that calculates student weights basing on their UCE and UACE results and gender, it then selects for them the possible course programs that they could be offered in Makerere basing on the previous cut off points and essentials that are derived from their A 'level combination. The system also recommends course programs to students that could help them become what they want to be in future by giving them an input parameter where they can input titles of their future interest professions.

1.2 Problem Statement

Quite a number students are not admitted to Makerere University because they select university programs that don't suite them in terms of possible professional careers that they may want to do and also weights for a given program they would want due to lack necessary information like cut-off points of previous years for a university program and programs that don't suite there career prospects. Such information provides a foundation on which students can determine which possible program they qualify for and that suites their career prospects

Therefore, we recommend BDIRS for prospective bachelor students in Uganda that is capable of calculating the student weights and basing on last year's cut-off points the system displays a list of the best available programs in Makerere University and some relevant information required by the student about the program. It also enables students to search for a given career and get recommendations on possible programs that suite the career searched.

1.3 Objectives

1.3.1 Main Objective

To develop a web-based system that will support prospective bachelor degree students in making program choices on the university entry basing on the cut-off points stored on the system.

1.3.2 Specific Objectives

- i) To collect data to be used in identifying system needs
- ii) To analyse data collected to identify system needs
- iii) To design system
- iv) To implement, test and validate system

1.4 Scope of the Study

The main scope of this project are the students that desire to enter into Makerere University using senior six results that can be vetted and graded according to university standards.

The physical or geographical scope is Makerere University that will provide information relating to all their institutes, schools, and faculties detailing the course requirements.

The conceptual and theoretical scope requires a system that will provide information to applicants for university programs and allow them to input their information(results); The system will provide such information as required subjects, subject weight and for the qualifying applicants the possible programs and relevant details attached to them to enable students acquires information for their areas of interest.

1.5 Justification of the Study

The proposed system will be viable to support the decisions new university entrants make while selecting the programs to do. The proposed system will also help in guiding the students while applying such that they are not misled due to incorrect information filled in the application forms. This is normally due to the insufficient knowledge on the courses that the students may be offered at the university.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

In this chapter we present the system study including existing systems

What is a recommendation system

A recommender system are software tools and techniques providing suggestions of items to be of use to a user (F.Ricci et al (eds.))

Recommender systems are applied in instances when a person has limited information concerning a particular product or item. These recommender systems can help people get suggestions on items/products that may suite them.

Draw backs of recommendation systems

According to Macmanus R (January 28 2009), there are 5 problems of recommender systems are they include some below

- Lack of data

To formulate a recommendation for a user, data is required to be analysed to in order to get suggestions for a user. A recommender system requires a lot of information in order to formulate better suggestions for a user.

- Changing data

Data continuously change is unpredictable pattern which makes it hard for it to be analysed and thus may lead to poor results in recommendations issued to user.

- Changing user preferences

User preferences change every day and it's not easy to match what a user needs today and what they may need tomorrow

- Unpredictable items

Some items are not easy to predict and this results in wrong results

- This stuff is complex

Finding the right formula to recommend items to users is very hard and cannot be easily done.

Pros of recommendation systems

According to GeoViz (October 21 2014), there are numerous advantages of recommendation systems to a business and they include some below:

- Provide relevant material

These systems suggest to users material that benefit them in a particular way and a user can use this material to meet their needs

- Engage customers

When Users get suggestions they can get individually involved with suggestions that have been made for them hence save time in searching

- Offer recommendations and direction

Users are able to get on how to use suggestions offered to them in ways that suites their needs

What is a Web-based information system?

A web based information system refers to systems that use internet technologies to deliver information and services to users. They are software systems whose main purpose is to publish and maintain data by using hypertext-based principles. A web-based system can also be defined as one that not only disseminates information, but also proactively interacts with the user to aid them in their task (Takahashi & Liang, 1997).

Over the previous years, the information technology industry has put a lot of effort on the development of information systems using the world-wide web technology. These systems using WWW technology delivered by the internet are now prevalent throughout the world.

In Uganda today, most organizations are deploying web-based systems, including banks, government departments and other service providers.

2.2 Study of existing systems

2.2.1 Degree campus

This a course recommendation systems that helps students get make advantageous and informative choices about their education

This system matches students with courses that suite their talents and academic goals. This system model combines hundreds of thousands of past students' grades with each particular student's transcript to make individualized recommendations. It uses enrollment and grade data to rank courses according to factors that measure how well each course might help students progress through their own degree programs.

From the courses that apply directly to the student's program of study, the system selects those courses that fit best with the course sequence in their degree and are the most central to the university curriculum as whole. That ranking is then overlaid with a model that predicts the courses in which each student will achieve the best grades. The system most strongly recommends a course that is necessary for a student to graduate, that is core to the university curriculum and the student's major, and that the student is expected to succeed in academically. Denley T (September 4, 2013)

2.2.2 Course enrollment recommender system

(Hana Bydžovská CSU and KD Lab Faculty of Informatics Masaryk University, July 2016)

This system is employed in Masaryk University and it's used to help students with making course enrollment decisions at the university. It basically provides recommendation on selective and optional courses basing on a student's knowledge, interest and free slots in timetable. The system also warns students against difficult courses and reminds them mandatory study duties and this helps students to reach the minimum credits to proceed to the next semester.

How it works

This system uses data about a student from the Masaryk University information system. This system uses methods on data from information system to predict students' final grades and recommend them interesting the timetable interesting courses with respect to their skills, interests, and free time-slots in the timetable. This system also employs a number of algorithms

Pros of existing systems

Both systems recommend course units that suite a student in all aspects such as interests and capability

Cons of exiting systems

- They don't cater for students aspiring to join the university for a degree program
- They concentrate mainly on course units not the whole program as a whole

2.2.3 The University of Western Australia (UWA) web based system

(<https://study.uwa.edu.au/#>)

This web based system is employed by the University of Western Australia to provide information to students already at the university and also future students. It provides a variety of information such courses and careers, events, scholarships and fees, how to apply, research, why to choose UWA etc.

This find a course functionality enables future students to search for courses in postgraduate, undergraduate and professional programs offered in the university. The web based system also has an option for searching a career after which it recommends a program that one can pursue in their university in order to become what they have searched about.

Pros

- The system can recommend programs to suite ones needs

Cons

- The system only works at UWA

2.3 The Proposed system

The proposed system is a web based recommendation system that helps prospective bachelor degree students get recommendations on programs that suite them in terms of weight scores for particular programs and also their prospective career after completion.

The system calculates student's weights and matches them with last year cutoff programs and it also provides a user with ability to search a potential career and get suggestions on programs that suite the given career.

a) Benefits of the web based program recommendation system

- The system calculates the student's weights depending on their O-level and A- performance
- The system provides detailed description of the various programs in Makerere university for students to identify their areas of interest
- The system enables user to search for a profession and get recommendation what program suites the profession they have searched for

2.4 Conclusion.

In Uganda today, all new university entrants travel to different universities of their choice to calculate their academic weights (O' and A' level results) in relation to their desired programs that they would like to be offered before applying in to these universities in the country. Wrong program selection due to little information given to new university entrants about different programs in turn leads to most of them not getting admitted. Application to change of program is also another case faced by the new entrants. A few new university entrants also lack knowledge on how exactly weights are calculated and there is no automated system that would help them out in calculating their academic weights which leads to wrong calculations and thus wrong information on the exact programs to be filled on their online university application forms.

In conclusion, the proposed web based system will address all issues mentioned above that are lacking in the current systems that are being used by calculating weights for new applicants automatically matching their weight to possible programs that could be offered to them at Makerere University plus giving them a little information about these possible programs. So we decided to make our system web-based because

Web based systems can be easily accessed from anywhere as long as one can access an internet enabled device and a network connection.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This section consists of the methods in which the system development was conducted and has sections that include the Data collection technique, study population, system design, software requirements, system implementation.

3.1 Data collection technique

Questionnaires were issued to a number of senior six leavers most of whom were found at senate building while applying for scholarships. Questionnaires were used basically because different opinions from a number of students got and analyzed. This information analyzed was aimed at collecting user requirements for the system.

Some content was gathered from online sources concerning the system and also Makerere university curriculums were collected from Senate building from Deputy Academic registrar to elaborate more and give an understanding all the bachelor degree programs offered with in the university.

3.2 Study Population

Project covered mainly prospective bachelor degree students with emphasis on senior six leavers aspiring to join Makerere University to undertake bachelors' degree programs

3.3 System Design

Various diagrams such as use case diagram, Dataflow diagrams, system architecture diagram, entity relationship diagram and context diagram were used to represent the system design.

Use case diagram- shows how the actors use the system

Dataflow diagram- shows the system processes and data flows

Context diagram- represents the system boundary.

System architecture diagram – shows the system components

3.4 System Implementation

HTML programming language was used to build and implement the system. Elements of CSS and JavaScript were used to improve on system interface design as well as improve user experience.

PHP scripts were used to provide connection to MySQL database that holds the system data as well as design weight calculation algorithm. PHPmyAdmin interface was used to manage the database all of which was accessed through Xamp server interface

3.5 Testing

System testing was done locally on individual computers to test the system's ability to run and also identify any errors. This testing was also aimed at determining system usability with a number of people invited to try out a prototype of the system and advice on any improvements that might be needed.

3.6 System Validation

A couple of people were invited to try using the system and give their honest opinion. This is to make sure that user requirements from the system were met and how well the system ran on their machines and this was done locally on the user's computer

CHAPTER FOUR

SYSTEM STUDY, ANALYSIS AND DESIGN

4.0 Introduction

4.1 System overview

Web system for recommending programs receives O and A level Grades input from user then calculates the weights which are then compared with cut- off points of the previous year to recommend bachelor degree programs that a student may qualify for.

The system also enables a user to enter and search for a profession then the system recommends programs that suite the particular profession that user has searched for.

4.1.1 System Features

The web based system for recommending university programs will have the following features in it that will enable a student have a great experience with the system. They include;

- Input fields that will enable a student input their O and A level marks such that the system can compute their weight.
- Instant access to information on university programs in Makerere university
- A submit button that will enable a student submit their marks such that his/her weight is calculated and mapped to a possible program
- A search module that will enable a university entrant to search for desired careers and get recommended programs for the career.

4.2 DATA ANALYSIS

4.2.1 Analysis of data collected to identify user needs

Data was collected to identify user requirements for the system. Data was collected by use of questionnaires and was analyzed using Microsoft excel and the results are presented in the table below.

Analysis table

QUESTION	ANALYSIS	RESULTS	DESCRIPTION
WOULD YOU LIKE TO LOGIN INTO THE SYSTEM?	Chart was used to show percentage of findings	AID YES and 30% Figure 3	Majority of senior six leavers found logging into system unnecessary because system won't be used time and time again
WOULD YOU LIKE TO INPUT GRADES OR SELECT THEM FROM A POSSIBLE RANGE OF VALUES?	Chart was used to show percentage of findings	Did No and 60% said Yes Figure 4	If senior six leavers would like to select grades manually since it saves time and reduces chances of error.
WOULD YOU PREFER TO CALCULATE YOUR WEIGHTS MANUALLY OR YOU WOULD LIKE SYSTEM TO CALCULATE IT FOR YOU?	Chart was used to show percentage of findings	Did yes and 20% said No Figure 5	Senior six leavers would prefer to let system calculate the weights for them since it will show them the possible weights basing on different essential subjects of their combination

WOULD YOU LIKE A SEARCH OPTION IN WEB SYSTEM?	rt was used to show percentage of findings	id yes and 50% said no ure 6	the number agree and disagree on adding search option in web system. Those who agree believe some of them may need to search about programs they hear about from their teachers and other sources so as to learn more about them
DO YOU THINK WEB BASED SYSTEM FOR SELECTING UNIVERSITY PROGRAMS WILL HELP YOU CHOOSE THE RIGHT PROGRAM	rt was used to show percentage of findings	id Yes and 10% disagreed ure 7	ty of senior six leavers believe system can expose them to programs they didn't know about and also qualify for hence meaning they can be able to join university
HOW DO YOU ACCESS THE INTERNET?	rt was used to show percentage of findings	students use smart phones, 40% use laptops and the rest of 10% said tablets and others gure 8	f students own smart phones and internet based devices

Table 4.1: Analysis table

GRAPHICAL REPRESENTATION OF THE ANALYSIS CARRIED OUT

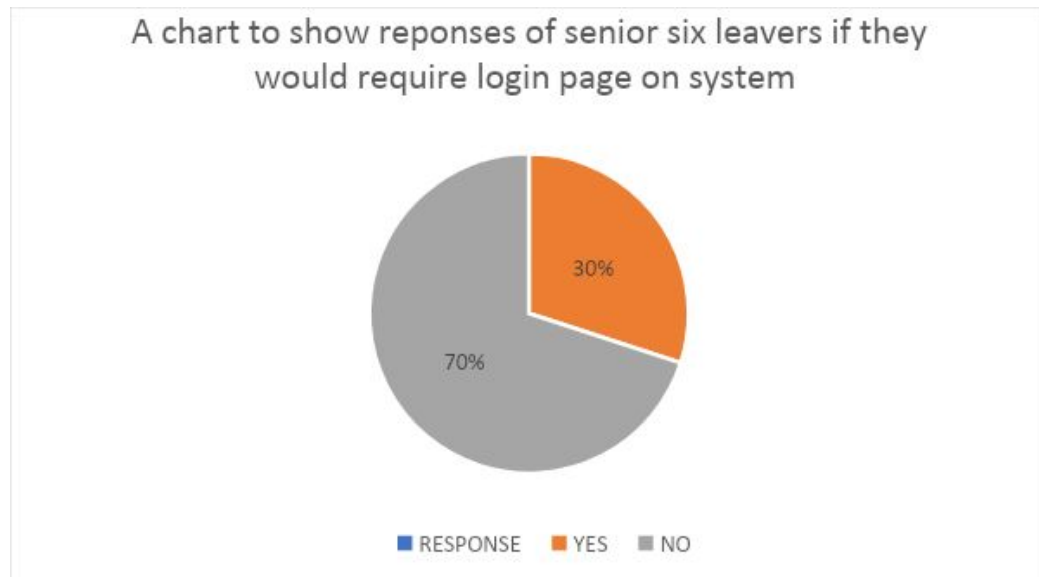


Figure 4.1: Responses of senior six leavers on if they would want to login to system

Description

Majority of senior six leavers found logging into system unnecessary because system won't be used time and time again

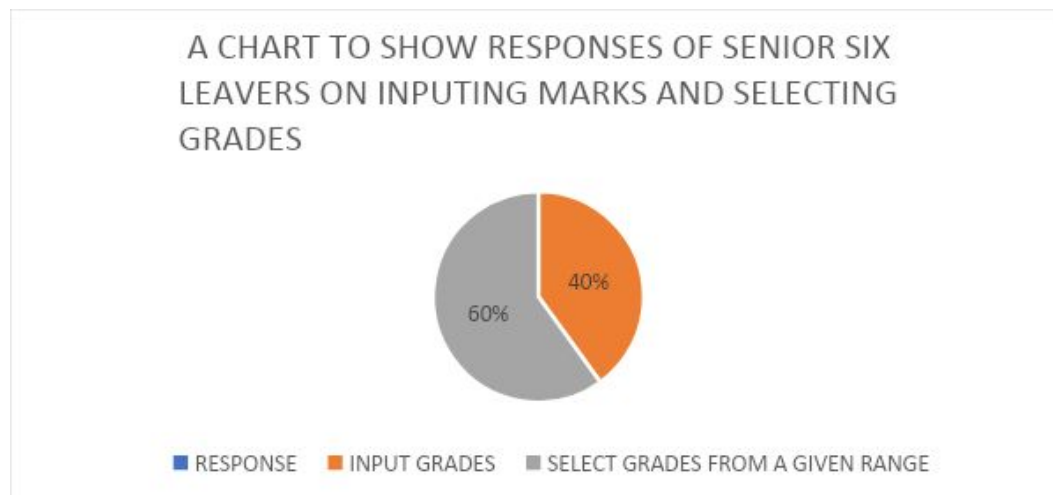


Figure 4.2: Responses of senior six leavers on inputting marks and selecting grades

Description

Most of senior six leavers would like to select grades manually since it saves time and reduces chances of error.

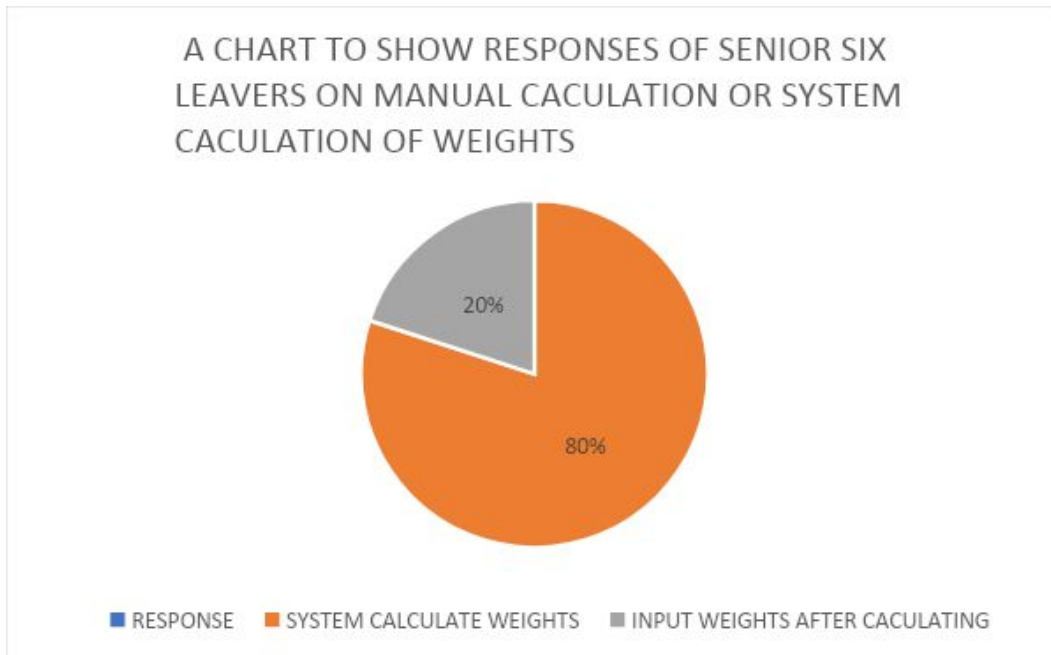


Figure 4.3: Responses of senior six leavers on manual calculation or system calculation of weights

Description

Senior six leavers would prefer to let system calculate the weights for them since it will show them the possible weights basing on different essential subjects of their combination

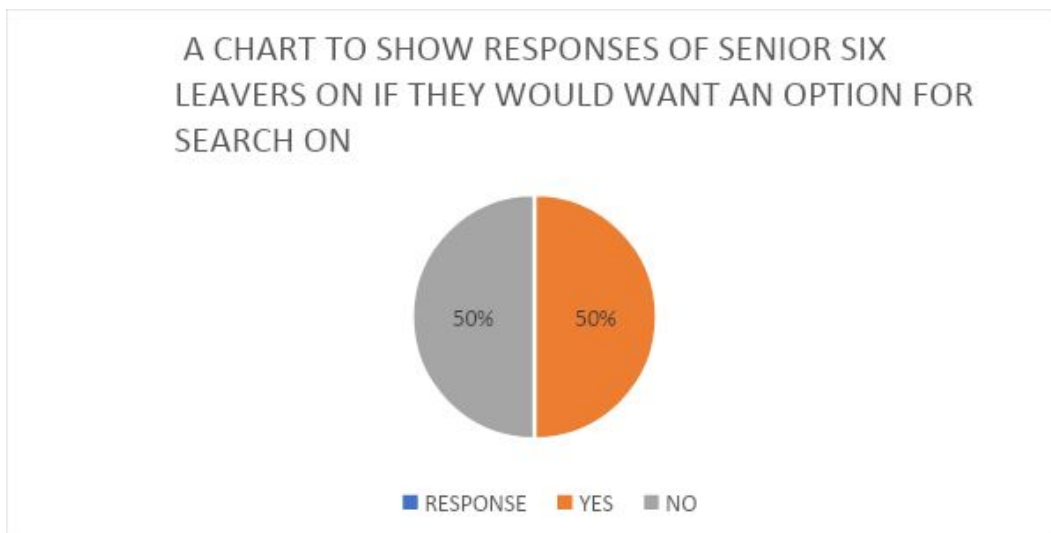


Figure 4.4: Responses of senior six leavers on if they would want an option for search on web based system

Description

Half of the number agree and disagree on adding search option in web system. Those who agree believe some of them may need to search about programs they hear about from their teachers and other sources so as to learn more about them

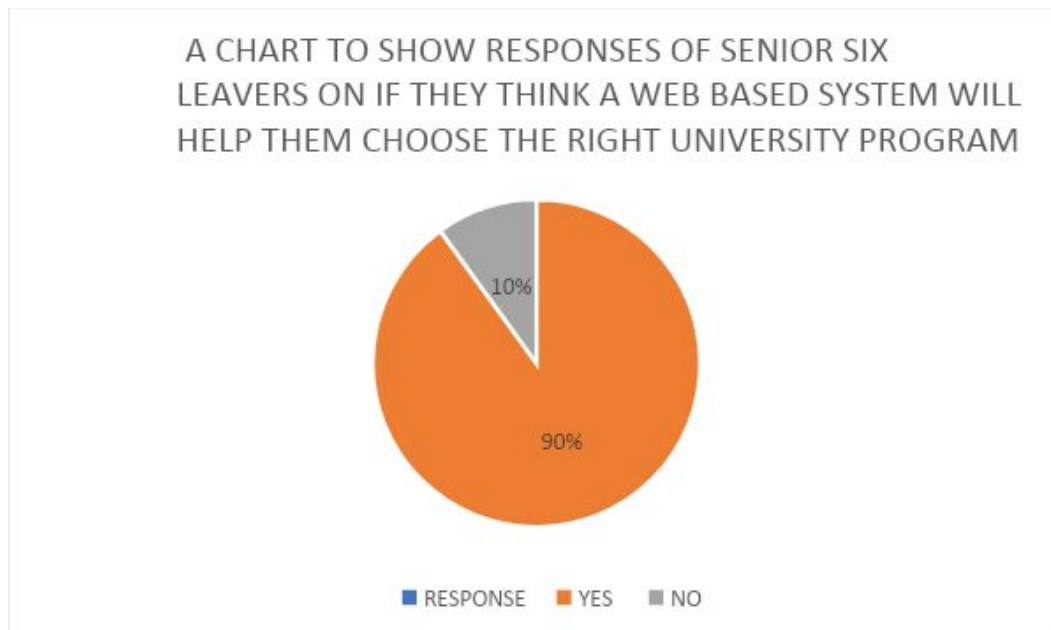


Figure 4.5: Responses of senior six leavers on if they think a web based system will help them choose the right university program

Description

Majority of senior six leavers believe system can expose them to programs they didn't know about and also qualify for hence meaning they can be able to join university

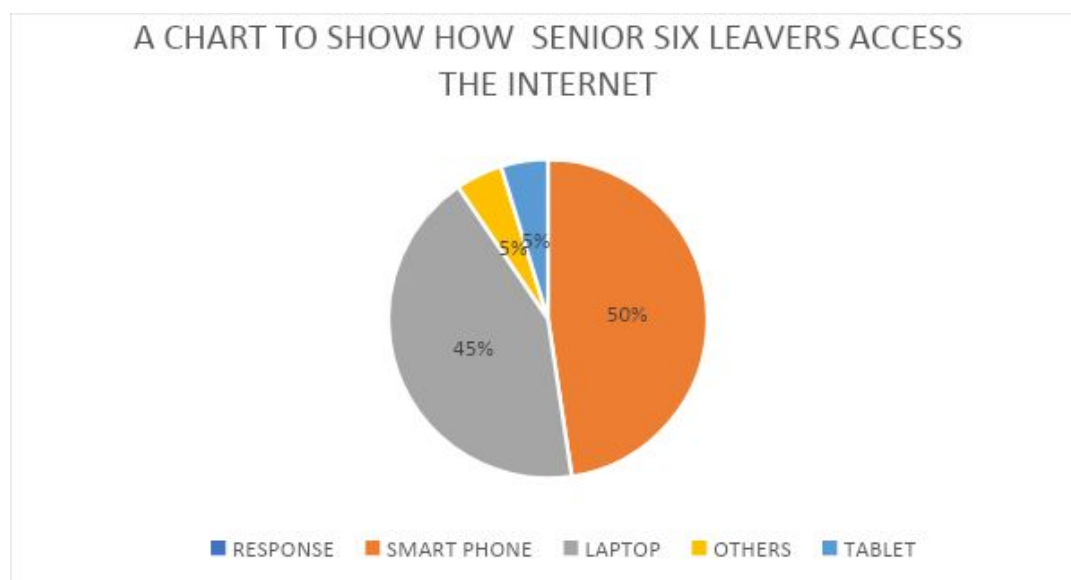


Figure 4.6: A chart to show how senior six leavers access the internet

Description

Most of students own smart phones and internet based devices

4.3 System requirements

4.3.1 User requirements for the system

This section highlights what a user expects from the system. The system should be able to;

- Receive input (O and A level Grades) from the user from capture form
- Be able to calculate weights of input grades
- Recommend programs based on the weights and cut off points of the previous year
- Capture job profession entered in search bar and return program that suites the profession.
- Be able to support more than one user a time
- Be easily usable by any person with little IT Knowledge
- User friendly and interactive

4.3.2 Functional requirements

This section explains the functional and non-functional requirements of the web based system by showing the various use cases and the overall system environment.

System environment

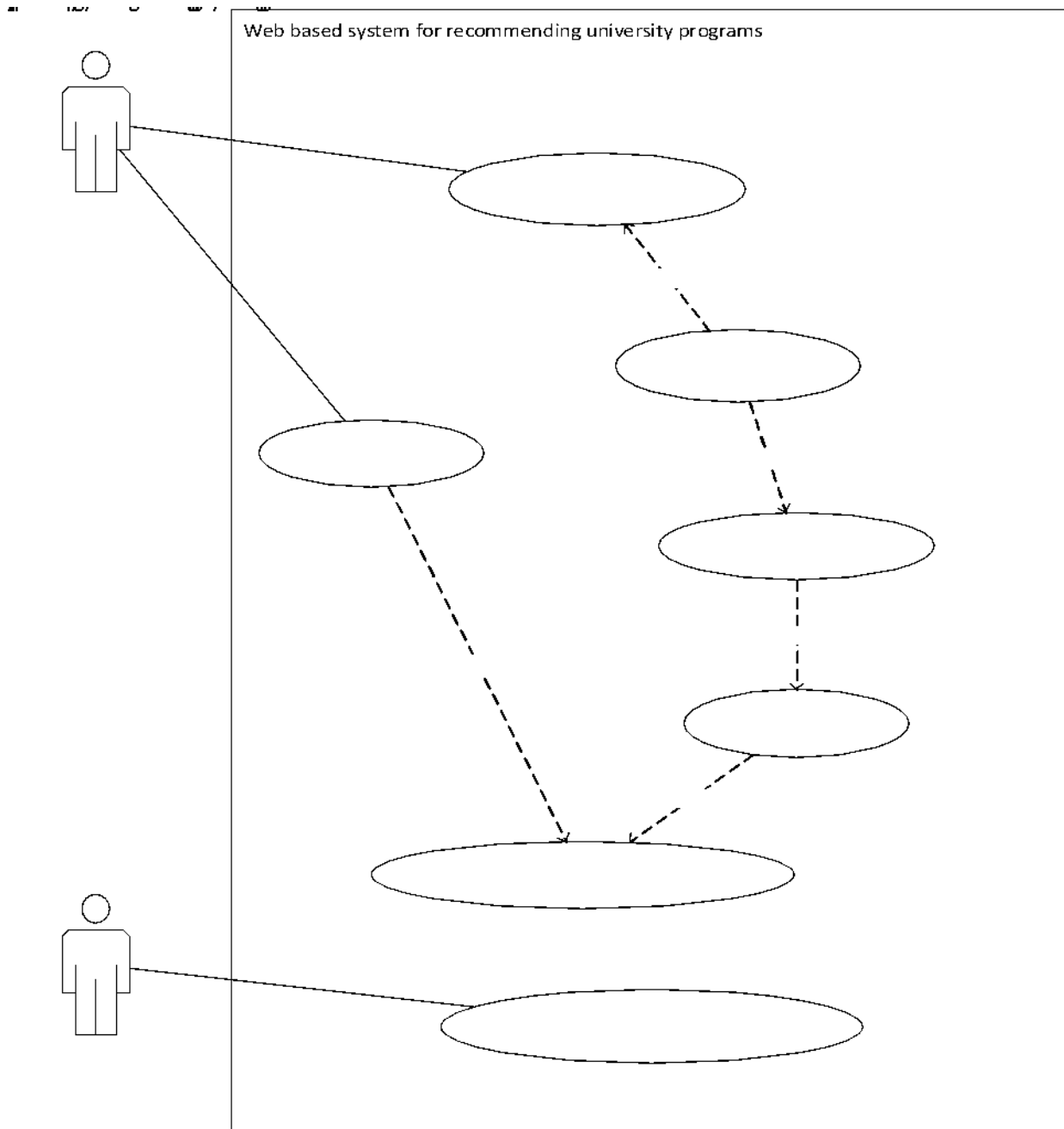


Figure 4.7: Web-based system for recommending University Programs

Functional requirements specification

This section shows the use cases for the web based system for recommending university programs and the main actors are;

- The university entrants desiring to enter Makerere university
- The Administrator responsible for updating and maintaining the web based system

i. Use case 1: Access system

Diagram:

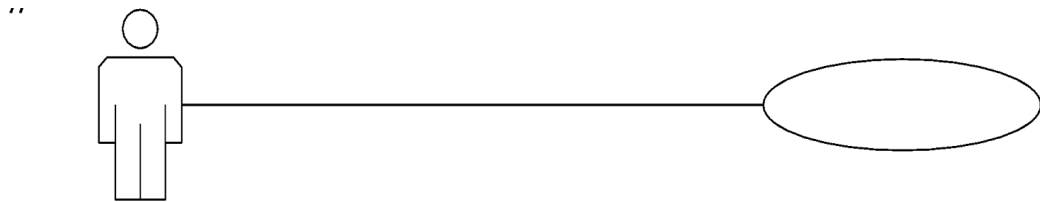


Figure 4.8: use case diagram for accessing system

Description

The user accesses the web based system for recommending university programs through a web browser.

ii. Use case 2: Select calculate Academic Weight option

Diagram:

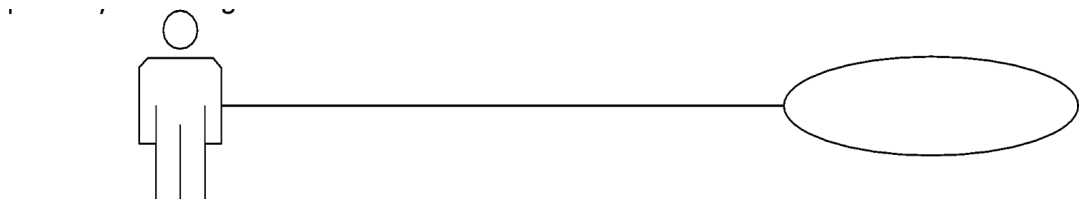


Figure 4.9: use case diagram calculating weights

Description

The user selects an option of calculating his academic weight.

iii. Use case 3: Input O and A level grades



Figure 4.10: use case for inputting O and A Level marks

Description

The user accesses an interface where he/she can input his/her O and A Level Grades.

iv. Use case 4: Calculate Weight

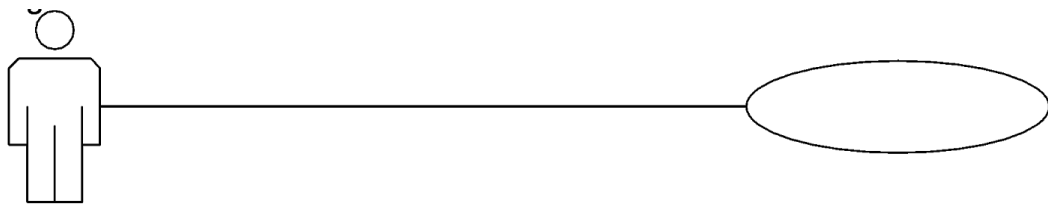


Figure 4.11: use case for calculate weight

Description

The grades are submitted by user and the academic weight is calculated.

v. Use case 5: Search Profession



Figure 4.12: use case for search profession

Description

Apart from calculating academic weights, the user searches for a profession of their choice in the system.

vi. Use case 6: Update and manage system



Figure 4.13: use case for update and manage system

Description

The administrator updates, maintains and makes changes to the system.

4.3.3 Non-Functional requirements

Reliability

For the web, based system to perform the task for which it is intended, there will be need to ensure that the users input valid data such that the results(weights) output are accurate.

To ensure validity of data input, the input fields for marks will be limited to numeric figures such that the system is able to calculate weights of the students.

Availability

The web based system will be available to all the users (Makerere University entrants) 24hours a day and 7 days a week. In case of a downtime, the system should be restored within two hours.

All information needed by the users of the system will be available to them when they access the system.

Security

The users of the web based system will not be able to alter anything in the system as this will ensure integrity.

The information and resources needed by the users of the system will be readily available when they need them.

The back end of the system shall be accessed by the administrators of the system as this will ensure confidentiality. Unauthorized users will not have access to it.

Maintainability

All the updates and fixes on defects in the web based application shall be made where necessary using the back end of the system. The code used in building the system should be easy and written in such a way that favors implementation of updates required.

Portability

For the system to be portable, simple libraries and tools will be used in development. Tools such as JavaScript, CSS and HTML will be used.

Furthermore, the web based system should run on a variety of platforms

Performance

The system will need a strong server since it's going to be web based.

The server should have a relatively high speed so that a number of users can use it simultaneously. The storage space should as well be high as this will improve on the performance of the system.

The web based system should be able to work on most platforms even with slow connections to the internet.

Simultaneous users of the web based system should be at least 150 at a particular time.

4.3 SYSTEM DESIGN

This section describes the architecture for the web based system for recommending university programs, dataflow. It highlights the chosen system architecture and also the system interfaces

4.3.1 Chosen System Architecture

The web based system for recommending university programs will use internet based architecture mainly because the user has to have an internet connection to access the system. It is broken down into two major parts which include a web browser application for clients and PHP application on the server side.

Web browser application on the client side has two components, the graphical which provides interface for accessing the system and its features and functional component written in PHP to capture user inputs and also perform calculations.

PHP application on server side is responsible for updating all data in the system and also providing a MySQL database where all the data used and required by the system is stored. Below is a representation of web based system for recommending university programs architecture

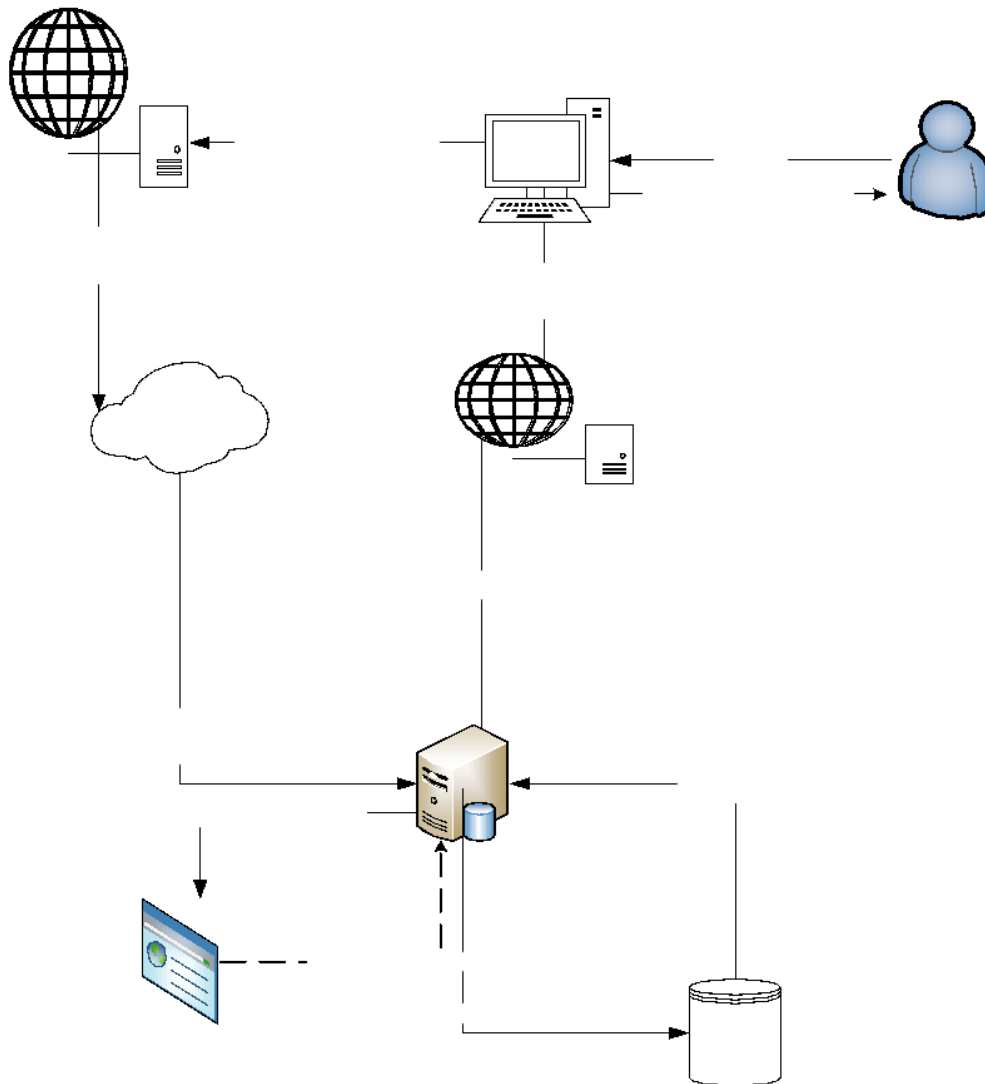


Figure 4.14: Representation of Web based system architecture for recommending University programs;

4.3.1.1 System components

This section highlights all the system components (both hardware, software, communication) and how they operate in the web based system for selecting university programs

a) Database-1

MySQL database will store all the necessary information that will be required by the system such university programs, careers etc.

b) Program Code -2

This basically is code that was written to provide functionality to the system. Html provides graphically interface to enable interaction with users for example text boxes, input boxes etc. on the other php code enables system to capture and perform calculations such as the calculating weights.

c) User interfaces -3

These interfaces consist of various **GUI** components, such as buttons, labels, text fields, and list objects. These components w display content to users to enable interaction with the system to provide tasks as required by users.

d) Xamp server

XAMPP has three main components that are used during development of the web based system for selecting university programs and they include

Apache web server

PHP

MySQL

e) Apache Web Server

f) It is a web server that used to host the web based system locally on the computer using local host as well as on the world-wide web. Hosting the web based system locally helped in testing and designing the systems functionality

g) PHP

A server-side programming language used to produce dynamic web pages. PHP code is embedded within HTML.

h) MySQL

In MySQL data and its relationships are stored in the form of tables that can be accessed by the use of MySQL queries. In the web, based system for selecting university programs after weights that have been input by user are calculated SQL statements are queried in the database to find programs were essential subjects input match with the calculated weights and then return them to user.

i) Web browser

This basically is on the user side; a user must access a web browser from the internet based device in order to access the web based system for selecting university programs.

j) Network

This is typically an internet connection required by the user in order to access the URL of the system. An internet connection is required by the system administrators in order to access the system and make updates to it.

4.3.2 System Interface Description

This section shows subsystems of the web based system for recommending university programs and how they work together to ensure functionality of the system.

Below is a representation of the system and interfaces;

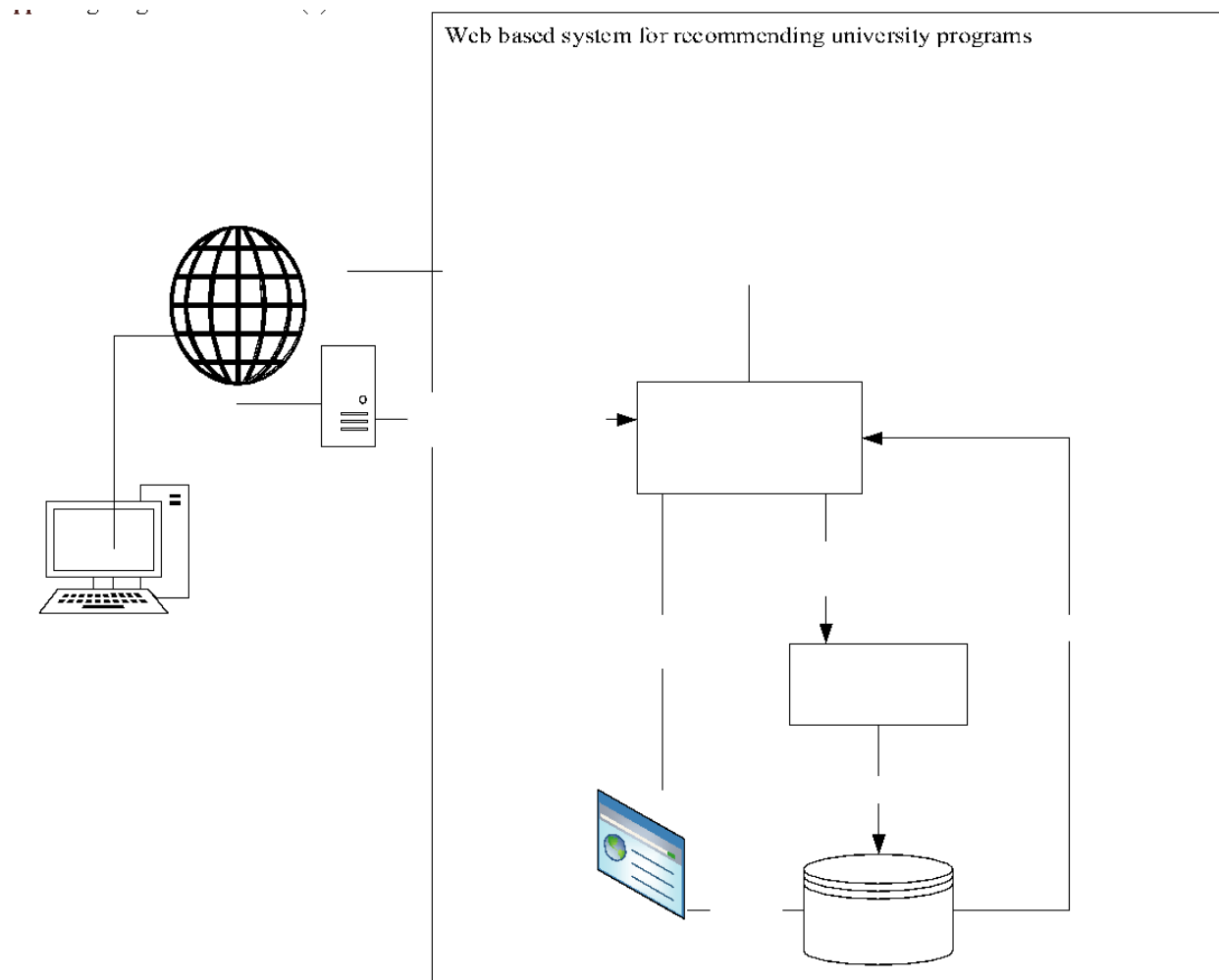


Figure 4.15: Representation of the subsystems for the web based system for recommending university programs.

□ Internet enabled device and web browser interface

These are responsible for providing the users with access to the system through the means of a network connection. A user simply opens an internet enabled device like a laptop and

accesses its web browser, from the web browser the user can input URL in the search bar which will then direct them to the web based system for selecting University programs

□ User interface and weight calculation system

Through the user interface a user inputs data this is to say O and A level results that are captured by the system. After data has been input weight calculation system in the PHP program code then performs the necessary calculations basing on the combination that has been input by the user.

□ Weight calculation system and database interface

When weight calculation is successfully completed, MySQL statements embedded in the PHP code will then get the calculated weights and query them through the database to find programs that match weights of the student.

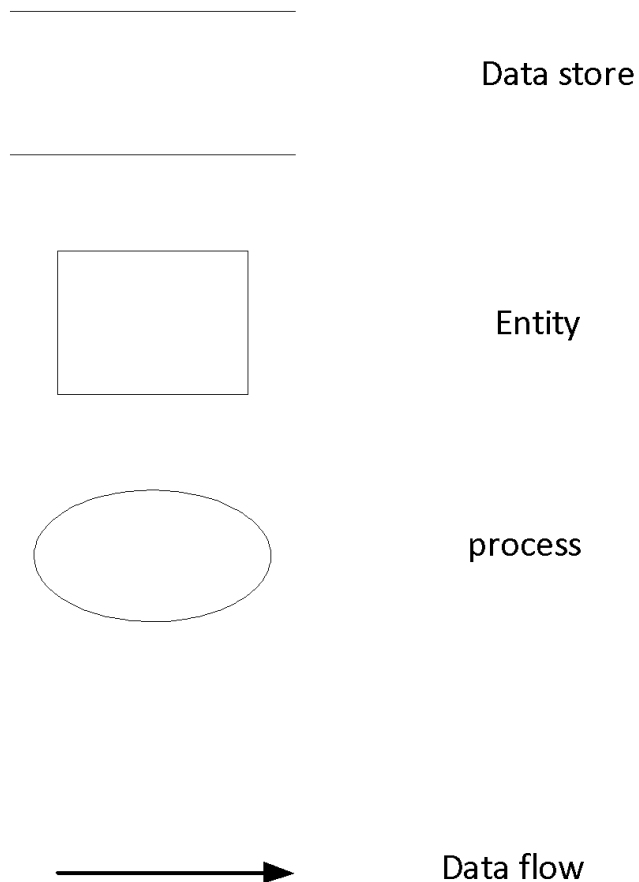
□ Database and user interface

After calculated weights have been queried in the database to find the possible programs, the results are returned and displayed to the user through the user interface.

4.3.3 Process Model Design

This section provides description of the process in the web based system for recommending university programs. It will highlight dataflow of data flow diagrams to show the processes and the data input and output by each process.

Below are some of the symbols used:



4.3.3.1 Context diagram of bachelor degree information and recommendation system

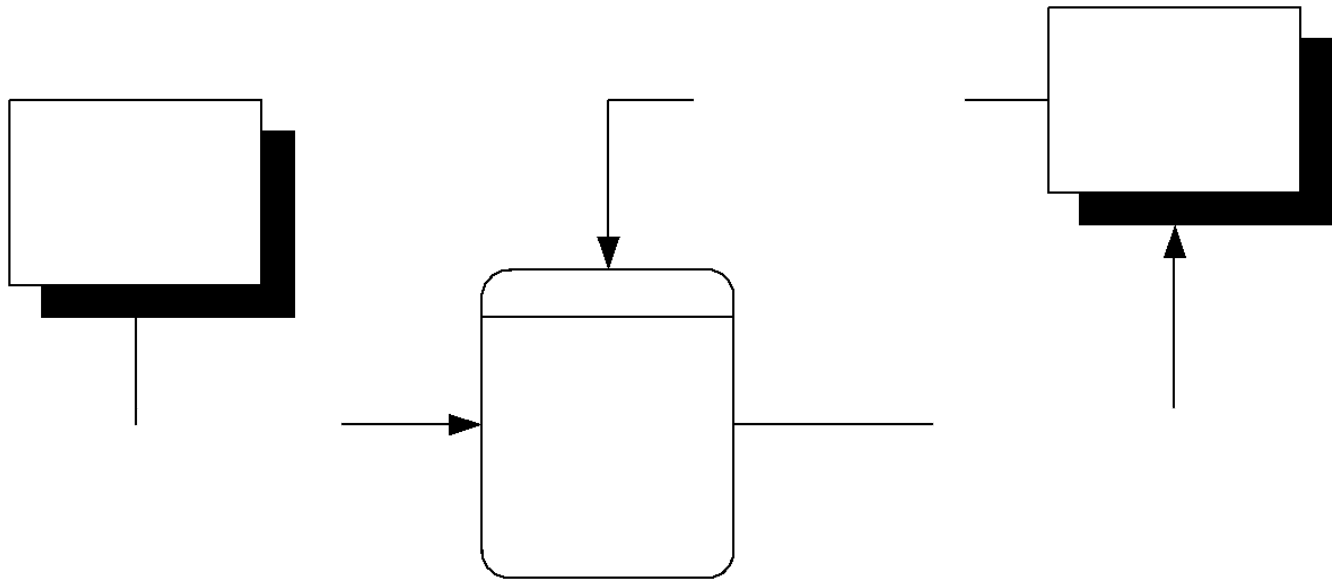


Figure 4.16: Context diagram for the web based system for recommending university programs.

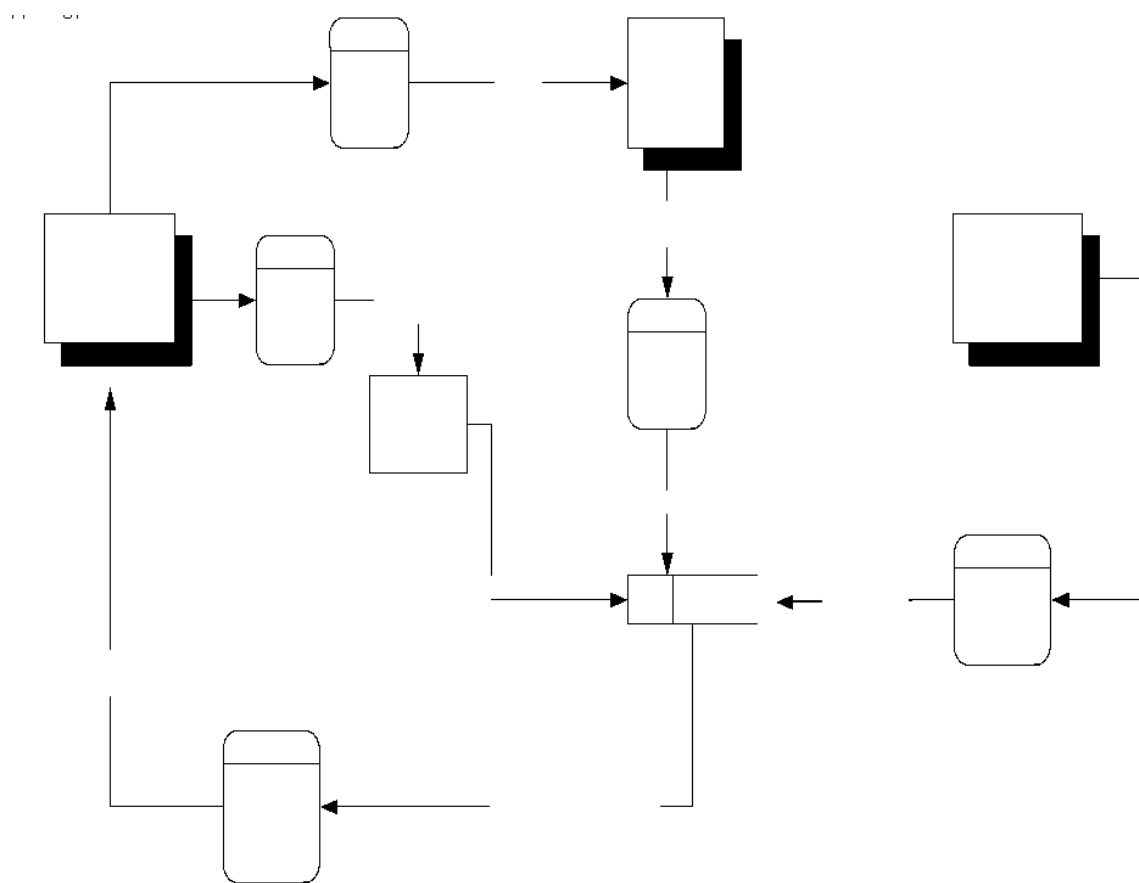


Figure 4.17: Data flow diagram for the web based system for recommending university programs.

4.4 DATABASE DESIGN

4.4.1 ENTITY RELATIONSHIP DIAGRAM

The database was created using **MySQL** and it will store various data needed by the users of the web based system such as;

The entities, attributes and relationships of the database for the web based system are shown in the Entity Relationship Diagram below;

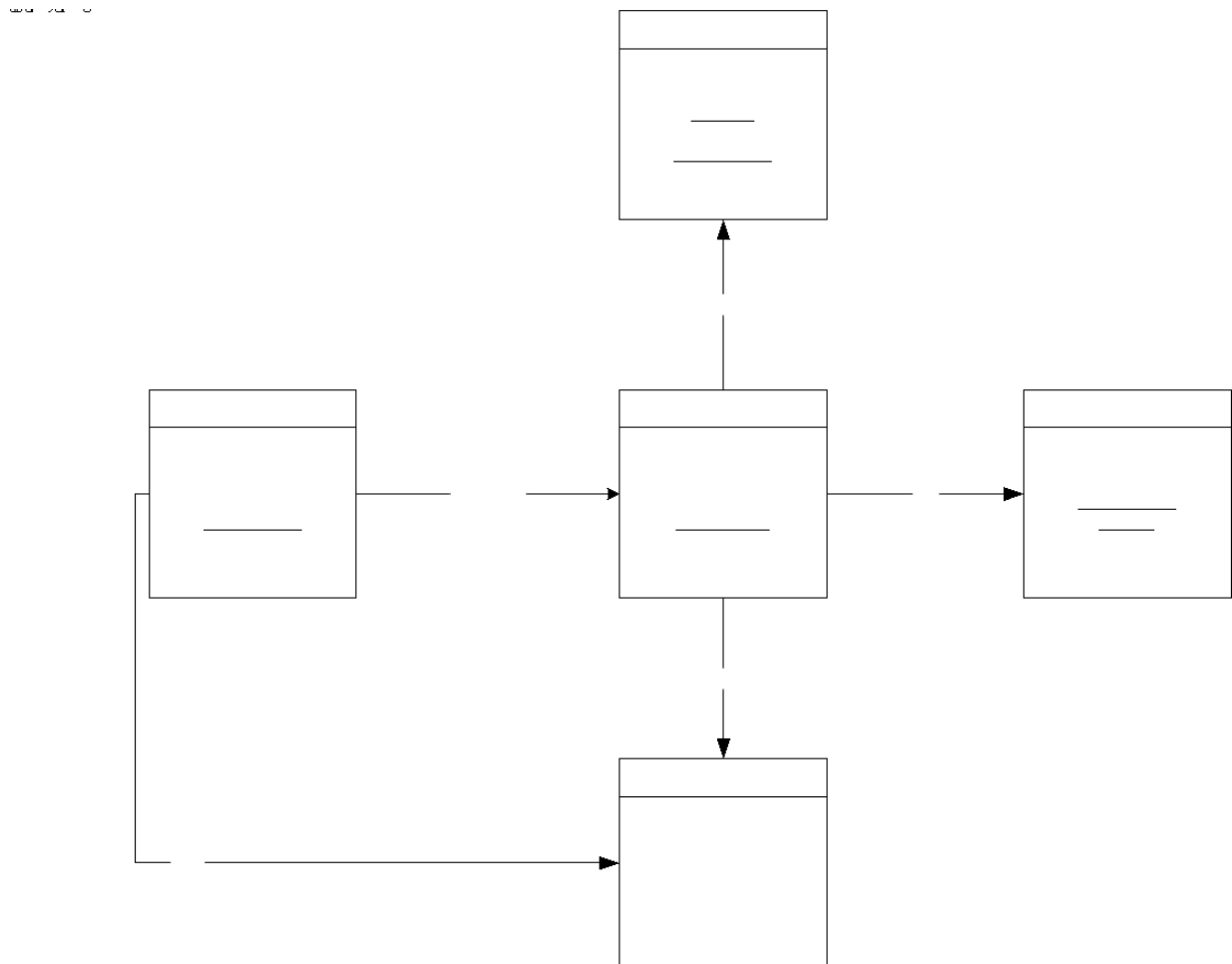


Figure 4.18: Entity Relationship Diagram for the web based system for recommending university programs;

The Admin of the system is responsible for making changes in the database where necessary and no unauthorized users will be able to in order to ensure integrity.

4.4.2 PHYSICAL DATABASE DESIGN

This section shows how data is stored in the database

Table name	Type	Length	Description
A level grading	Int/varchar	1/1	Grades for A level scores both aggregate value and name.
O level grading	Int/varchar	1/2	Grades for A level scores both aggregate value and name.
A level subjects	Varchar	8-12	Subjects offered at A level
O level subjects	Varchar	8-12	Subjects offered at O level
Careers	Varchar	8-20	Some of the careers available for the degree programs
Career sectors	Varchar	6-15	Areas under which a program falls under.

4.5 USER INTERFACE DESIGN

This section contains a description of the interface, the screen images of the pages of the web based system, and the objects and actions

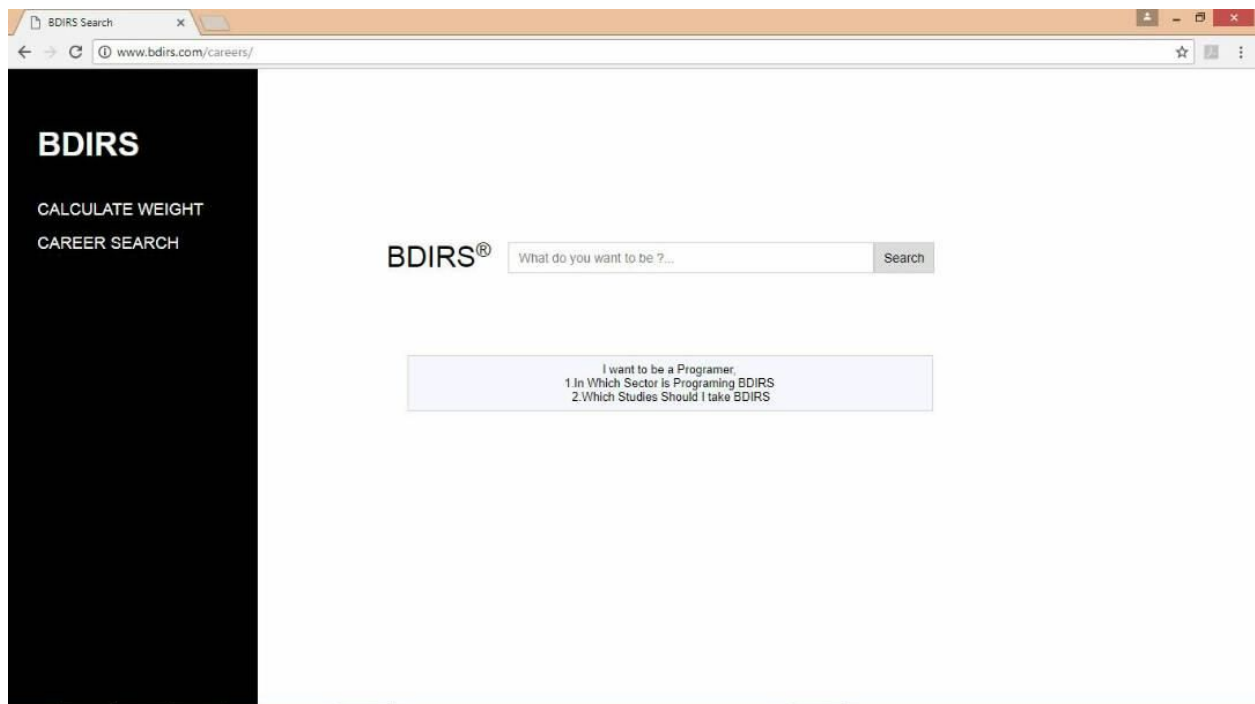
4.5.1 Description of the User Interface

Each of the pages of the web based system for recommending university programs contains a collection of graphical user interface (GUI) components such as buttons, drop down menus, search option, radio buttons. These components are arranged in such a way that the users of the system will find it easy to interact with the system since it will be easy for them to know the use of each of the components. Below are screen images of the system

4.5.1.1 Screen Images

The following below are the screen images for the interfaces that the users of the system will interact with

Screen image 1: HOME SCREEN



: home interface

Description

This is the default home interface for the system. When user types the URL of the system into the browser, the above page is loaded as default page.

Screen image 2 : **CALCULATE WEIGHT SCREEN**

Subject	Aggregate
Subject 1 Physics	D1
Subject 2 Mathematics	D2
Subject 3 Geography	C3
Subject 4 Chemistry	C4
Subject 5 Biology	C5
Subject 6 History	C6
Subject 7 English	C5

: calculate weight O-Level step 1

Description

After user clicks on calculate weight the above page is loaded to capture O level grades for the 7 compulsory subjects at O level. User selects their aggregate score from a drop down menu

Screen image 3: CALCUALTE WEIGHT

The screenshot shows a web browser window with the address bar displaying 'www.bdirs.com'. The page has a dark sidebar on the left with the text 'BDIRS', 'CALCULATE WEIGHT', and 'CAREER SEARCH'. The main content area is titled 'Enter Your Results' and contains a navigation bar with tabs: 'O-Level Step 1', 'O-Level Step 2' (which is active), 'A-Level', and 'Calculate'. Below the tabs, there is a form with three rows of input fields. Each row has a subject dropdown and an aggregate dropdown. The first row is for 'Subject 8' with 'Commerce' selected and 'D2' selected for 'Aggregate'. The second row is for 'Subject 9' with 'Islam' selected and 'D2' selected for 'Aggregate'. The third row is for 'Subject 10' with 'Agriculture' selected and 'P8' selected for 'Aggregate'. At the bottom of the form, there are 'Back' and 'Next' buttons.

Subject	Aggregate
Subject 8 Commerce	D2
Subject 9 Islam	D2
Subject 10 Agriculture	P8

: calculate weight O-Level step 2

Description

After user input their grades for compulsory subjects the user clicks next and O-level step 2 interface appears to capture grades for the optional subjects

Screen image 4: CALCULATE WEIGHT

The screenshot shows a web browser window with the address bar displaying 'www.bdirs.com'. The page has a dark sidebar on the left with the text 'BDIRS', 'CALCULATE WEIGHT', and 'CAREER SEARCH'. The main content area is titled 'Enter Your Results' and has four tabs: 'O-Level Step 1', 'O-Level Step 2', 'A-Level', and 'Calculate'. The 'A-Level' tab is selected. Below the tabs is a form with five rows, each for a subject. Each row has a subject dropdown and an 'Aggregate' dropdown. The subjects and their aggregates are: Subject 1 (Physics, A), Subject 2 (Mathematics, B), Subject 3 (Economics, C), Other Subject (Computer Studies, C4), and General Paper (General Paper, D2). At the bottom of the form are 'Back' and 'Next' buttons.

Subject	Aggregate
Subject 1 Physics	A
Subject 2 Mathematics	B
Subject 3 Economics	C
Other Subject Computer Studies	C4
General Paper General Paper	D2

: calculate weight A Level

Description

After user inputting grades for the optional O level subjects and click next, they are directed to A level input form where there A level scores are captured. The user then inputs there A level scores and click next

Screen image 5: Calculate weight

The screenshot shows a web browser window with the address bar displaying 'www.bdirs.com'. The page has a dark sidebar on the left with the text 'BDIRS', 'CALCULATE WEIGHT', and 'CAREER SEARCH'. The main content area is titled 'Enter Your Results' and contains a series of tabs: 'O-Level Step 1', 'O-Level Step 2', 'A-Level', and 'Calculate'. The 'Calculate' tab is active. Below the tabs, there is a heading 'Select Gender and then Click on Calculate'. Under this heading, there is a 'Gender' label followed by a dropdown menu showing 'Male'. At the bottom of the form, there are two buttons: 'Back' and 'Calculate'.

: select gender

Description

After inputting all users O and A level scores user is prompted to select their gender and click calculate

Screen image 6: Possible courses

University	Session	Course Name	Course Code	Essentials	Relevants	Desirables	Minimum Weight
Makerere University Kampala	DAY	Bachelor of Software Engineering	BSW	Physics Mathematics		Computer Studies	39.5
Makerere University Kampala	DAY	Bachelor of Science in Computer Science	CSC	Physics Mathematics		Computer Studies	35.3
Makerere University Kampala	AFTN	Bachelor of Science in Electrical Engineering	ELA	Physics Mathematics		Computer Studies	45.2
Makerere University Kampala	DAY	Bachelor of Telecommunication Engineering	STE	Physics Mathematics		Computer Studies	45.3
Makerere University Kampala	AFTN	Bachelor of Science in Telecommunication Engineering	STM	Physics Mathematics		Computer Studies	44.2
Makerere University Kampala	DAY	Bachelor of Science in Mechanical Engineering	MEC	Physics Mathematics		Computer Studies	45.2
Makerere University Kampala	AFTN	Bachelor of Science in Mechanical Engineering	MEA	Physics Mathematics		Computer Studies	44.1
Makerere University Kampala	DAY	Bachelor of Science in Land Surveying & Geomatics	LSG	Physics Mathematics		Computer Studies	45
Makerere University Kampala	AFTN	Bachelor of Science in Land Surveying & Geomatics	LSE	Physics Mathematics		Computer Studies	43.1
Makerere University Kampala	EVE	Bachelor of Science in Computer Engineering	CME	Physics Mathematics		Computer Studies	41.4
Makerere University Kampala	DAY	Bachelor of Science in Computer Engineering	CMP	Physics Mathematics		Computer Studies	42.9

: Possible courses

Description

After the users weight has been calculated it is mapped against the possible programs they may qualify for basing on the cutoff points of the previous

Screen image 7: Possible program description

The screenshot shows a web browser window with the URL `www.bdirs.com/possible_courses.php?essentials=1%2C+2&min_weight=45.3`. On the left is a black sidebar with the text "FAHAD", "POSSIBLE COURSES", and "CAREER SEARCH". The main content area displays a table of courses. A tooltip is visible over the first row, providing a description of the Bachelor of Software Engineering.

POSSIBLE COURSES

CAREER SEARCH

FAHAD

The Bachelor of Software engineering is a 4 year based program offered at the college of computing and informatics, with both the day and evening session. Tuition fees per semester are 1200000/= for local students and 1900000/= for international students. When a student undertakes this course program, their possible future Uncareers could include Software engineer, Data analyst, Administrator, among others.

				Relevants	Desirables	Minimum Weight
Makerere University Kampala	DAY	Bachelor of Software Engineering	BSW	Physics Mathematics	Computer Studies	39.5
Makerere University Kampala	DAY	Bachelor of Science in Computer Science	CSC	Physics Mathematics	Computer Studies	35.3
Makerere University Kampala	AFTN	Bachelor of Science in Electrical Engineering	ELA	Physics Mathematics	Computer Studies	45.2
Makerere University Kampala	DAY	Bachelor of Telecommunication Engineering	STE	Physics Mathematics	Computer Studies	45.3
Makerere University Kampala	AFTN	Bachelor of Science in Telecommunication Engineering	STM	Physics Mathematics	Computer Studies	44.2
Makerere University Kampala	DAY	Bachelor of Science in Mechanical Engineering	MEC	Physics Mathematics	Computer Studies	45.2
Makerere University Kampala	AFTN	Bachelor of Science in Mechanical Engineering	MEA	Physics Mathematics	Computer Studies	44.1
Makerere University Kampala	DAY	Bachelor of Science in Land Surveying & Geomatics	LSG	Physics Mathematics	Computer Studies	45
Makerere University Kampala	AFTN	Bachelor of Science in Land Surveying & Geomatics	LSE	Physics Mathematics	Computer Studies	43.1
Makerere University Kampala	EVE	Bachelor of Science in Computer Engineering	CME	Physics Mathematics	Computer Studies	41.4
Makerere University Kampala	DAY	Bachelor of Science in Computer Engineering	CMP	Physics Mathematics	Computer Studies	42.9

: Program description

Description

When user places cursor on the course name a brief description is given to the user concerning the course

Screen image 8: Career search interface

BDIRS

CALCULATE WEIGHT
CAREER SEARCH

BDIRS®

Ad Search

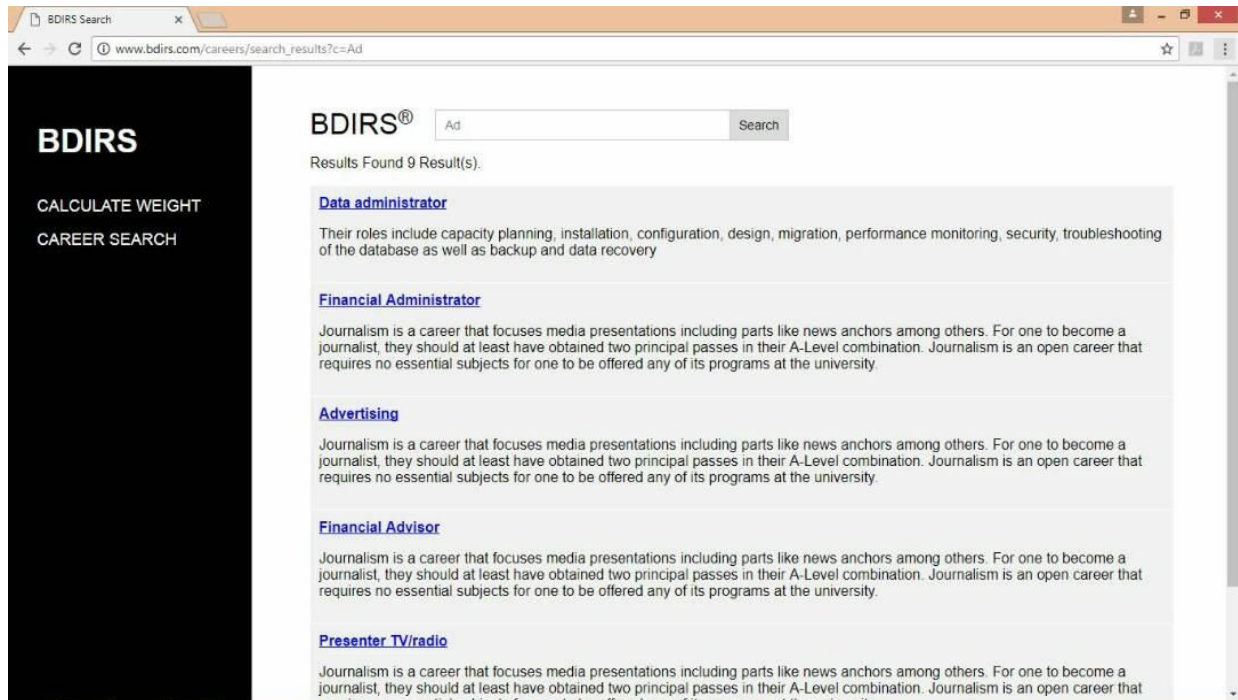
Data administrator
Financial Administrator
Advertising
Financial Advisor
Presenter TV/radio
Head Master / Mistress
Teaching Abroad
Database Administrator
Business Administrator

: career search

Description

User enters the career name into the search bar and clicks search

Results



:

Description

After user click search, the entered career is searched for in the database and if it's in the database it's returned with a short description about what it. The user can then click on the career to be taken to screen showing possible programs that may suite the desired career.

Recommended programs for a career

The screenshot shows a web browser window with two tabs: 'BDIRS Search' and 'BDIRS'. The address bar displays 'www.bdirs.com/careers/courses?c=48&cs=28'. On the left is a dark sidebar with the 'BDIRS' logo and links for 'POSSIBLE COURSES' and 'CAREER SEARCH'. The main content area has a heading: 'For one to become a Data administrator below are some of the courses programs he / she can undertake.' Below this is a red box with two numbered columns. Column 1 is labeled '1' and contains the text 'Bachelor of Information Systems'. Column 2 is labeled '2' and contains the text 'The above suggested course program(s) will best help you become a Data administrator if undertaken'.

: Course best suited for career

This screenshot is similar to the one above, showing the same browser window and sidebar. The heading is identical. However, the red box is replaced by a green box. Column 1, labeled '1', is empty. Column 2, labeled '2', contains a list of three courses: 'Bachelor of Software Engineering', 'Bachelor of Science in Computer Science', and 'Bachelor of Science in Computer Engineering'.

: other courses

Description

When user clicks on the career they have searched the best program that best suites the career is displayed first and also other programs that suite the career are shown

4.6 SYSTEM DESIGN LIMITATIONS

During system design there were a number of limitations encountered which affected the development process of the system and lead to coming up with alternatives in design of the system.

Initially in design of the search module of the system knowledge base management software were supposed to integrate with system such that the software analyses curriculums of Makerere University to provide program recommendations for a particular job profession that has been input by user. However this was not possible because software that could analyze the curriculums was not acquired to the fact most of the software was costly to acquire and also offered on trial version with limited functionality.

Also after failing to acquire knowledge base management software, a program that read contents of a file was developed to be able to read contents of curriculums. This was to enable system to read contents of a particular file basing on keywords that a user has entered in the search box but this approach didn't yield desired results because some files contained the same content but also information returned didn't in anyway relate to programs that a user word do.

Due to above limitations, a number of professions along with a description were collected and allocated to related programs available in Makerere University.

CHAPTER FIVE

IMPLEMENTATION, TESTING AND VALIDATION

5.0 Introduction

This chapter describes the implementation, testing and validation of the system.

5.1 Implementation

The system was implemented in a windows environment using HTML language as well as some components of JavaScript and bootstrap which helped to improve system interface design. Next section describes environment under which the system was developed and implemented

5.2 System Development

This section shows the environment in which the system was developed

Programing environment

Program	Use	Description
FOREUI (CSS 3 & HTML)	Interface design	ForeUI was used to prototype system interfaces and the design was done using sublime a
Sublime Text 3 (PHP and JavaScript)	Weight calculation system design	Weight calculation algorithm was done in PHP using sublime
PHPmyAdmin	Database design	PHPmyAdmin interface was used to provide interface to access MySQL database file and manage it
Xamp	System development, running and testing	Xamp server was used to host the system locally, test it functionally as well as to provide of how the system will run and look like

Table 2: Programming environment

5.3 TESTING AND VALIDATION

System testing was done to validate that system full functions to the expected needs of the user and also meet the system requirements document. Various modules of the system were tested individually and then merged and tested as whole system

The table below shows some of the tests cases carried out and their outcomes

5.3.1 FEATURES TESTED

- Weight calculation algorithm
- User input capture form/page
- Data base and page links
- Search module

5.3.2 FEATURES NOT TESTED

- Database

5.3.3 Test cases

TC ID	TC NAME	DESCRIPTION	STEPS FOLLOWED	OUTCOME
I	Links	<p>Links in the system were tested to ensure that they connect.</p> <p>✓ Database connection which connects the system was tested to ensure system can connect to database and pick required data</p>	<ul style="list-style-type: none"> • Input grades and calculate weights • Database queries to find programs within weights calculated 	Database returned information that was requested.
		<p>✓ Web page links were tested to verify that a user can navigate from one page to another.</p>	click on web page links	Web page successfully redirected to desired link when clicked
II	Input form	Interface that captures user input grades was tested to verify that when a user doesn't select a grade they can get notified.	Some fields were on input form were left blank	User was notified of blank field
III	Weight calculation	Program code for calculating weights was tested to verify its accuracy of returned results	Sample data was calculated manually and also feed into systems. Both results be compared	There was some inconsistency in values returned. But improvements were being made

IV	System usability	System was given to sample users to use and give feedback concerning its ease of use and also if any difficulty was encountered in using it. Also content was checked for any grammar or spelling errors	Sample of people were invited to use system prototype on developer computer	Some users believed information provided about a program was not enough and content should be added concerning a program description
V	HTM,CSS and PHP	Code was checked for errors	Program was ran in browser to check for any error starting from database to links in the forms	A few errors such as database connection were experienced because connection was timing out
VI	SEARCH	This module was tested to see if it returned programs that relate to programs entered in the system	A job profession will be entered into search box and results tested for validity in relation to program entered	Programs that were returned were related to professions assigned to them
VII	Browser capability	The system was tested on 3 browsers baidu, Mozilla Firefox and internet explorer	System was run on the browsers to see if there was any compatibility issues	No compatibility issues raised up

Below are some of test cases used during testing of the system

CHAPTER SIX

6.0 CONCLUSION

Choosing the right program to do at the university is some crucial because most determines what profession a person can undertake and be qualified to after finishing their bachelor degree program. It is important that a person aspiring to join university be vigilant when choosing a program to do at university. To make a decision on which on what program to do one must first certify that they qualify for the program and also that the program they want suite their career prospects.

Web system that recommend programs will ensure that a person aspiring to join the university gets all relevant information to enable them choose a program to do at the university. This system will help students aspiring to join the university to know programs suite their career prospects and programs they can qualify for in terms of subject combination and also their weights.

APPENDICES

I. APPENDIX A: QUESTIONNAIRE

Below is questionnaire used in collection of user requirements

MAKERERE UNIVERSITY KAMPALA

COLLEGE OF COMPUTING AND INFORMATION SCIENCES

Selection of University programs in public universities in Uganda Questionnaire

The objective of this questionnaire is to obtain user requirements for a web based system for selecting university programs.

Web based system for selecting university programs is a system that will enable a new university entrant get suggestion on the possible programs they can do at the various public universities in Uganda.

This system will basically require you to input your O and A level grades and choose university of choice then the system will calculate your weights and list for you possible programs you can do

Please note: The information provided is entirely for academic purposes and will be used with confidence. Please feel free to express yourself as much as you can to enrich the discussion and help us come up with a quality web based system for selecting university programs in public universities.

Thank you

Respondent's information

Name of student.....

Date

Personal number.....

School & Subject Combination

.....

QUESTIONS

Select where applicable

1. Would you like to login into system before using it?

YES

☐

NO

☐

2. Would you prefer to input O and A level grades or you would like to select them from a possible range of values

Comment.....

3. Would you prefer the system to calculate and display our weights or you would like to input in your weights after calculating them manually?

Comment.....

4. Would you like an option for searching on the web system?

YES

☐

NO

☐

5. IF YES, what information would you like to search about?

.....

6. How do you access the internet?

A. Smart phone

B. Tablet

C. Computer/laptop

D. Others (specify).....

7. Do you think a web based system for selecting university programs will help you select the right program to do in university of your choice?

YES

☐

NO

☐

8. What features would you suggest the web based system for selecting university programs to have?

-
-
-

II. LIMITATIONS FACED DURING PROJECT

There are a number of limitation that set back the progress of this project and they include some below

- Information needed for development of the system was scarce and not easily accessible for example university curriculums of the all university programs in makerere were not accessible on some of college websites. Some of the colleges kept their curriculums in hard copy which would be difficult to convert to softcopy due to size of the content. However we were able to get some of the curriculums at the office of the Deputy Academic registrar Makerere University at the senate building.
- Software required to integrate with our system to improve functionality cost a lot of money to purchase for example a knowledge base management system which would help us with analysing curriculum to identify possible programs that suite desired professions cost a lot of money to purchase and this resulted into development of a rule base system
- Time was a great limitation during the project because of the time allocated to us to design the system as well as write documentation was limited.

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