General Sir John Kotelawala Defense University

Faculty of Computing

Department of Computer Science

Group Project Undertaken in partial fulfillment of the requirement for the

BSc Computer Science/ Computer Engineering/ Software Engineering Degree

Intake 36

FINAL THESIS

Group Details		
Group Number	**Student Number**	**Student Name**
Group 9	D/BSE/19/0004	C S Wanigasooriya
	D/BSE/19/0003	MFAR Fernando
	D/BSE/19/0005	SHCKD Silva
	D/BCE/19/0001	PSM De Silva
	D/BSE/19/0001	PH Perera
	C/BCE/5714	RLBJS Jayawardhana
Project Details		
Project Title	Result Management System	
Supervisor	Dr. Buddhitha Hettige	
Co-Supervisor		

Table of Contents

Table of figures

List of tables

Chapter 01: Introduction and background

1.0 Introduction

This chapter will emphasize the details about the overall background for the proposed results management system. Introduction to the project will be given at the beginning of the chapter. Then the identified problem statement in relevant to the project is discussed and the proposed solution is elaborated. The aim of the project, objectives and the limitations for the project will be discussed further in this chapter.

1.1 Introduction to the project

The Faculty of Computing of the Kotelawala Defense University (KDU) conducts its end semester examinations bi-annually. However, the time lapse between the conclusion of the examination and the release of results is disproportionately large. An examination results management system could be the solution to alleviating this delay. We believe that if such a system was to be developed it would help in the release of results at an earlier date and reduce the burden placed on administrative staff and lectures.

1.1.1Existing Problems

Following are the problems related to manual results submission. The process of results released at KDU is time consuming and tedious. As a result of this the following issues may occur:

- Cause disruption in the students' lives
- Students do not have a system to view their results as soon as the completion of marks submission
- May limit the level of improvement by reducing the time period they have to study for their repeat exams
- No way for the lecturers and the department to view a summarized report of a student's examination results
- Lecturers need to fill 3 mark sheets manually, hence time consuming
- Too much of a burden on the administrative staff

1.2 Significance of the project

Our system is based on issuing end-semester results, calculating the GPA of each student of the Faculty of Computing at General Sir John Kotelawala Defence University and finalizing it at the end of the final semester. This system's purpose is also to further diminish the long-time consumption for lecturers as well as when entering the marks into the database. It will also reduce the amount of paperwork for each lecturer, the time taken to pass-on the said paperwork to the other relevant persons

Proposed Results Management System will increase the productivity, efficiency and also the transparency of results.

1.3 Benefits of the system

The following are the benefits of developing the Results Management System.

- **Save Time**

With the proposed system a lot of paper work will be minimized and also duplication of entering marks into several sheets is avoided. Two mark sheets (End exam and CAS mark sheets) can be imported to the system. And also any mark adjustments can be done on the system itself. Afterwards the final mark sheet can be obtained through the system hence duplication of entering marks will be avoided, as the system will automatically take relevant information from the two mark sheets that were imported to the final mark sheet. Hence time will be saved.

- **User friendliness**

Our system is quite easy to use. Any user of the system it can be the student, lecturer or the HOD can simply use the system without any burden.

- **High data security**

The system deals with student results. Therefore, the security of the system is a very crucial factor. Authorization guards have been used in the system along with firebase rules.

- **High responsiveness**

Responsiveness is the ability of a system to meet its objectives for response time or throughput. Our system can also be viewed from any device (laptop, mobile phone etc.) in the same manner without affecting the quality and the functionalities of the system.

1.4 Project Aim

The aim of this results management system would be to build an efficient and easy to use system that could speed up the process of release of examination results.

1.5 Project Objectives

Objectives of the project are identified as follows. Functional requirements are achieved by the accomplishment of objectives of the system development. These objectives are considered as the milestones to the aim of approaching the Results Management System at the end of the development.

i. Facilitate the release of examination in a timelier manner.
ii. Computerize as many of the processes involved in the computation of examination results
iii. Make the procedure easier and more efficient for all users of the system

1.6 Scope of the project

The proposed Results Management System will be initially implemented to the Faculty of Computing of General Sir John Kotelawala Defense University (KDU). The system comprises of the following functionalities online: to set the setter and the moderator for each module, to update results, to get summarized reports of student result, to view the graphical view of students' performance semester wise, stream wise or even intake wise. Authorized Department personnel may use the Results Management System to process the Grade Point Average (GPA) or Semester Grade Point Average (SGPA), to add or remove marks, and to update marks. The Results Management System is intended to decrease the University's results processing period by centralizing all required actions to one system.

1.6.1 Limitations

Time was the main limitation for us in order of developing this system throughout the project life span. It was a really high scope when we were starting this project and our supervisor helped us to get that to managing level since that limitation was to design on time. We did our best and some of our core modules such as the mark sheet came to desirable level on given period of time.

Knowledge of technologies and system architectures was another limitation that we successfully solved with the aid of our supervisor of the project.

1.7 Summary

This chapter concludes the overall idea of the project with the brief introduction given to the system. Aim of the project, Objectives of the project with significance of the project were discussed as a solution with respect to the existing problems in the problem domain including its benefits. The identified scope of the project and the limitations were discussed in this chapter.

Chapter 02: Literature Reviews

2.0 Introduction

This chapter will elaborate the existing systems of results management system that proposed. System module reviews, features, pros and cons of existing results management systems (much alike) will be discussed in this chapter.

2.1 Introduction to Results Management System

Our Effort is to design a web application of Results Management, for the Faculty of Computing at General Sir John Kotelawala Defence University. The University conducts its end semester examinations biannually. As the Faculty of Computing is comprised of about 250 students, the process of handling examination results from the point of collection of examination paper by the supervisor, to the time that examination results are released to the students can be quite demanding and time consuming. In fact, it has been noted that there is a significant lapse in time between the conclusion of the results and the release of examination results. This delay could cause disruption in the students' lives and may limit students' level of improvement by reducing the time period they have to study for their repeat exams. In addition, there is no way for the lecturers and the department to view a summarized report of a student's examination results.

A significant reason for this time lapse could be certain shortcomings in the current system. Described briefly, the existing system involves the papers being collected and sent to the setter (subject lecturer) and moderator (senior expert) for marking. A detailed mark sheet will be filled manually by both the lecturers. The two detailed marks will be sent to the Head of Department and he will check if there are differences and adjust as necessary. The final marks are sent back to the setter so that he/she can once again fill in the marks return sheet and the comments sheet. Finally, the marks will be sent to the examination department for it to be reviewed by the examination board. The current system is mainly processed using hard photocopies of the four sheets (Detailed Mark Sheet x2, Marks Return Sheet, and Comments Sheet) which is not time effective since the listed sheets must be hand delivered to each relevant person. Thus, it can be noted that the high number of manual processes involved in the system is time consuming and results in the whole process being delayed.

We believe that having a results management system would help to combat these problems. The main aim of this results management system would be to build an efficient and easy to use system that could speed up the process of release of examination results. Thus, we would consider the objectives of the development of such a system to be to facilitate the release of examination in a timelier manner by computerizing as many of the processes possible involved in the computation of examination results and make the procedure easier and more efficient for all users of the system this would mean that the whole process would speed up and examination results could be made available far earlier for the students. In addition, it would reduce the burden on the administrative staff and make it easier for the lecturers to log in their respective results.

We believe that the availability of results at a much earlier date could be a direct factor in improving students' results. It also lets the students know of their capabilities and them standing in the batch. This would encourage and motivate the students to improve on them work by the time the next exam takes places. In conclusion, it can be said that having such a results management system would improve the speed and efficiency of the examination results system and be much to the benefit of everyone in the university, be it the students, lecturers or administrative staff.

2.2 Technologies Incur with Existing Systems

In the implementation of existing results management systems (much alike) developers have focused on mobile user's experience too. All are web-based platforms and the following prevailing software technologies have been used in the development of those systems.

- TypeScript (Angular Framework)
- HTML
- CSS
- JavaScript
- PHP
- SQL
- Firebase
- Python

2.3 Pros and Cons

By comparing the existing Results Management Systems in the market following features will stand our proposed platform from others.

Improve the speed and efficiency of the examination results

Computerizing as many of the processes possible involved in the computation of examination results will make the procedure easier and more efficient for all users of the system. This would mean that the whole process would speed up and examination results could be made available far earlier for the students.

Improving Results

We believe that the availability of results at a much earlier date could be a direct factor in improving students' results. It also lets the students know of their capabilities and them standing in the batch. This would encourage and motivate the students to improve on their work by the time the next exam takes places.

Generates a summarized report

The lecturers will be able to generate a summarized report which contains the performance of each undergraduate, throughout the degree period.

Replacing minor staff

This is the main threat to job roles in real word, from the results management system. Since the system is automated there won't be a need to send the files of results and relevant documents from one place to another. The system will do everything itself. Hence the need for minor staff will be reduced.

2.4 Appraisal of Results Management Systems

In comparison with the existing results management system which is done manually, our system is completely computerized. Starting from assigning the lectures to modules to obtaining the summarized report of students' performance.

Further elaborating our system, firstly the admin (HOD) will assign the lecturers (setter and/or moderator) to each module. Then the setter and the moderator will be able to enter results into system by importing excel files. If there is any difference between the setter's mark and the moderators mark the HOD will be notified and the conflicts of the results will be displayed in his page. Then the HOD will have the authority to decide on the final mark that the student should obtain. After finalizing the marks, the lecturers will be able to generate a report of students' performance intake wise, module wise or even stream wise. Our system also generates a graphical representation of students' results.

We believe that since all the processes have been computerized and exist in a single system could speed up the process of release of examination results. In addition, it would reduce the burden on the administrative staff and make it easier for the lecturers to log in their respective results.

2.5 Conclusion

This chapter concludes with the details of existing results management systems, that provide platform for the lecturers to enter marks and the students to view them and analyze on their performance.

2.6 Summary

Literature review chapter of the results management systems concludes with the information about existing systems and pros of cons of them, why they stand out from the system that proposed. What the technologies that have been used in order to develop those systems.

Chapter 03: System Analysis

3.0 Introduction

The overall University Results Management System (URMS) analysis is discussed under this chapter. Steps taken for requirements gathering and the justifications of using those steps are explained. The gathered requirements are analyzed and connected appropriately to the design stage of the system. The existing Results Management System is explained in detail. Modules of the proposed system that were identified through analyzing functional and non-functional requirements are explained. The Unified Modeling Language (UML) is used to further elaborate the functionality of the proposed system.

3.1 Overview of the Project

The Faculty of Computing of the Kotelawala Defense University (KDU) conducts its end semester examinations bi-annually. However, the time lapse between the conclusion of the examination and the release of results is disproportionately large. This could create disruption in the students' lives and maybe be a taxing process for the administrative staff and lecturers.

An examination results management system could be the solution to alleviating this delay. We believe that if such a system was to be developed it would help in the release of results at an earlier date and reduce the burden placed on administrative staff and lectures.

Therefore, the aim of this project is to automate the examination results management system as this would speed up the process of releasing examination results and would make the system efficient and easy to use.

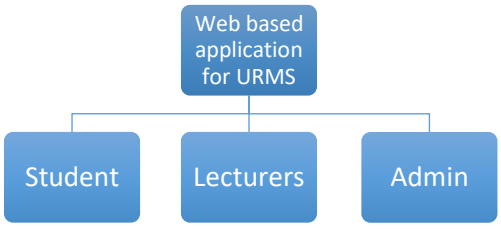


Figure 1: Basic Structure of Platform

In our Results Management System, we have three main types of roles: Student, Lecturer and Admin.

Here Students would be the ones who would use the system to check their results, exam performance and find out details about their GPA. Lecturers (setters and moderators) would use the system to enter the three types of mark sheets required from them. The Administrator would log in to set roles of the lecturers for each subject as setter and moderator. They would also need to adjust differences that may come up in student marks.

3.1.1 Problem Statement

The process of results released at KDU is time consuming and tedious. This delay in the release of results could cause disruption in the students' lives and may limit the level of improvement by reducing the time period they have to study for their repeat exams. In addition, there is no way for the lecturers and the department to view a summarized report of a student's examination results. Part of the reason for this time lapse could be the use of too many manual processes. We believe that if a majority of those processes were to be computerized, the whole process would speed up and examination results could be made available far earlier for the students. In addition, it would reduce the burden on the administrative staff and make it easier for the lecturers to log in their respective results.

3.2 Data Collection Protocols

This section elaborates on and justifies the fact finding techniques that were used to gather requirements. Deliverance of the information gathered through fact finding methods are mentioned as follows.

3.2.1 Data Collection Protocols Used

The proposed URMS is to be used to speed up the process of release of results at KDU. Meeting the user requirements of the users of the system is essential in order to achieve this goal. Interviews and Observation are the requirements gathering techniques we used.

3.2.1.1 Interviews

Students, Lecturers and Admin are the main key roles in our URMS. We decided that conducting interviews with persons satisfying each of these roles was the best method of requirement gathering.

The Administrator for our system would be the department head of the Faculty of Computing (HOD). Interviewing the HOD helped us to understand the existing system and identify the requirements of the proposed system. It also helped us to pinpoint the flaws in the existing system and how to ensure that those flaws are overcome in the proposed system. Furthermore, the HOD also clarified to us the process by which the release of results happens and the important steps to be carried out in this process.

The interview with a lecturer helped us identify their requirements when using the proposed URMS. We also understood what functionalities the system would need to possess to make the process as efficient and as easy as possible for the lecturers.

The third role is held by students such as ourselves. We are aware of what we need from this URMS and how the proposed system could aid in our exam performance.

Thus, we decided that conducting interviews was the most efficient way of gathering requirements.

3.2.1.2 Observation

As active students of KDU we experience that there seems to be a huge delay in providing the end semester results. We assume that the current result management system lags most of the other universities, and we believe it is due to the lack of computerization of the current system.

3.2.2 Requirement Analysis

Analyzing the data gathered is explained in this phase. Analyzing the data which is gathered and summarizing those data is identified as the major outcome of this phase.

3.2.2.1 Analysis of Gathered Interviews

The initial interview was conducted with the HOD of the faculty of computing. Questions that were asked from him were pre-prepared for the interview session.

Data which was gathered in the interview provided us with the main requirements of the new system. In addition, it helped us understand the old system as well.

The following points show the summary of quantitative data gathered from the HOD.

- The current system contains many manual procedures.
- The final results sheets must be handed over to the examination board
- Papers are marked by both setters and moderators who will need access to the system
- Discrepancies in marks must be corrected by the HOD himself
- The overall goal of the new system should be to increase efficiency
- All users must find the system to be user friendly

Through the interview we got to identify the many loopholes present in the current system. For example, occasions when processes are performed manually, time is wasted and efficiency is decreased.

Examination Results are the cornerstone of any university as they are the tangible proof of the knowledge levels of the students. Thus, it is important that examination results are handled carefully, leaving minimum room for error. In addition, the results must be made available for students in a timely fashion so that they can make improvements in their knowledge gaps and if necessary prepare for repeat examinations.

In this vein, students would benefit greatly from a faster automated system for results management. So, we took it upon ourselves to also carry out an interview on students such as ourselves to identify what they mainly expect from a University Results Management System.

Their main requirement is that the results be released faster than it is through the older system. In addition, they require a facility to be able to view their grades in a clear manner as well as for their GPA to be displayed so they need not manually calculate it. Students often use their grades and GPA as measuring points for how much harder they must strive or what sort of grades they must maintain in order to get the class of degree (First Class, Second Upper, Second Lower) they are aiming for. They further stated that they wished for the procedure to be accurate and free from error so that they can place confidence behind the grades they receive. Finally, they also said that they would appreciate the privacy and data security that comes from being able to log into their respective accounts and check their grades as opposed to it being printed on the noticeboard where it is visible to everyone.

We also interviewed a lecturer. They are the individuals who will make use of the new Results Management System the most. Each paper will have two lecturers as a Setter and Moderator. The Setter will be the lecturer who teaches the subject and sets the paper. The moderator would be the one who carries out the second marking of the paper for the sake of increased accuracy. If there are discrepancies in the marks of the two lecturers. It must be brought to the notice of the HOD.

The process of finding and correcting any differences in marks in the whole system is tedious and time consuming. With the new URMS we hope to make this process automated and save

much time. It will also be much easier for lecturers to upload their mark sheets rather than filling them in manually. Furthermore, the lecturers' requested that they be given a way to check the student's previous mark history as well as a chart displaying his or her performance.

Thus, through the above interviews we identified several issues that we sought to consider as requirements of the new URMS.

3.2.3 Productivity and Accuracy of Data Collection Protocols

The following section will elaborate on the productivity and accuracy of the data collection protocols that we used to gather data for the URMS.

3.2.3.1 Interviews

We identified the interviews we carried out as the main technique to capture data from future users of our system.

a. Interview No :01

Interview No 01	Objectives
<u>Pre Plan</u> Interviewee: Head of the Department (HOD – Dr. Pradeep Kalansooriya) Date: February 2020 Venue: University Premises	▪ Planned to have a meeting with the HOD as he is the head of the section and the admin user of the system. ▪ Hoped to identify major system requirements as well as flaws of existing system. ▪ Expected a briefing on the procedure that is followed in the marking of examination papers.
<u>Actual Plan</u> Interviewee: Head of the Department (HOD – Dr. Pradeep Kalansooriya)	▪ Conducted the interview as expected.

Date: February 2020 Venue: University Premises	▪ Was able to clearly note down the whole results process from when the exam is first conducted to when results are handed over to the exam board. ▪ Identified the main users of the system and the roles and responsibilities of each such user.

Table 1 : Interview 1

Comment: Gained a great deal of knowledge about current system and what is expected from the new system.

b. Interview No: 02

Interview No 02	Objectives
Pre Plan Interviewee: Lecturer (Major RMM Pradeep) Date: March 2020 Venue: University Premises	▪ Planned to meet a lecturer as they are one of the main users of our planned URMS. ▪ Hoped to identify the system requirements specific to lecturers and understand how we can make their job easier and more efficient.
Actual Plan Interviewee: Lecturer (Major RMM Pradeep) Date: March 2020 Venue: University Premises	▪ Met Major Pradeep and identified what requirements the lecturers would need from the system. ▪ Identified issues the lecturers have with the current system. ▪ Noted down his requirement for lecturers to be able to view previous results of students.

Table 2 : Interview 2

Comment: Gained some insights about how the lecturer login should be designed and the features it must have.

c. Interview No: 03

Interview No 03	Objectives
Pre Plan Interviewee: Student Date: March 2020 Venue: University Premises	▪ Planned to meet a student as they are one of the main users of our planned URMS. ▪ Hoped to identify the system requirements specific to students and understand how we can make the URMS cater to their needs.
Actual Plan Interviewee: Student Date: March 2020 Venue: University Premises	▪ Met the student and identified what requirements the students would need from the system and why they require it. ▪ Identified the student's main issues with the current system.

Table 3 : Interview 3

Comment: In addition to our own experiences as students, we gleaned information on what would be required by our fellow batch mates.

3.2.4 Complications Faced in Data Gathering and Solutions

In this part of the chapter we have included the complications that we faced in the process of data gathering using the data gathering technique that we mentioned above and the solutions that we took to overcome them.

- **Complications Faced**

    - Coming up with interview questions to pinpoint exactly what we needed to know.
    - Due to confidentiality of exam results, being able to view sample database entries.
    - Limited number of participants to be interviewed and the inability to interview them face to face due to the Covid-19 pandemic.

- Difficulties were arisen when meeting parties for the conducting of the interviews with their tight work schedules.
- All the questions were not answered properly by some participants reluctant to answer the questions due to security reasons.
- The views of multiple interviewees were incompatible.

- **Solutions Identified**

  - Reviewing the questions several times and having group discussions to improve the questions as much as possible.
  - Asking broad questions in order to obtain as much information as possible.
  - Asking to be able to view empty formats of the three types of mark sheets- detailed mark sheet, marks return sheet and comments sheet.
  - Conducted interviews over the phone.
  - Questions were prepared as short as possible by excluding questions which the answers can be found in using a different research technique.
  - Participants were given the full freedom to avoid from answering any question if they wish not to involve in the process.

3.3 Current Results Management System

The Faculty of Computing at the General Sir John Kotelawala Defense University conducts its end semester examinations biannually. As the Faculty of Computing is comprised of about 250 students, the process of handling examination results from the point of collection of examination paper by the supervisor, to the time that examination results are released to the students can be quite demanding and time consuming.

In fact, it has been noted that there is a significant lapse in time between the conclusion of the results and the release of examination results. This delay could cause disruption in the students' lives and may limit students' level of improvement by reducing the time period they have to study

for their repeat exams. In addition, there is no way for the lecturers and the department to view a summarized report of a student's examination results.

A significant reason for this time lapse could be certain shortcomings in the current system. Described briefly, the existing system involves the papers being collected and sent to the setter (subject lecturer) and moderator (senior expert) for marking. A detailed mark sheet will be filled manually by both the lecturers. The two detailed marks will be sent to the Head of Department and he will check if there are differences and adjust as necessary. The final marks are sent back to the setter so that he/she can once again fill in the marks return sheet and the comments sheet. Finally, the marks will be sent to the examination department for it to be reviewed by the examination board.

The current system is mainly processed using hard photocopies of the four sheets (Detailed Mark Sheet x2, Marks Return Sheet, and Comments Sheet) which is not time effective since the listed sheets must be hand delivered to each relevant persons. Thus, it can be noted that the high number of manual processes involved in the system is time consuming and results in the whole process being delayed.

We believe that having a results management system would help to combat these problems. The main aim of this results management system would be to build an efficient and easy to use system that could speed up the process of release of examination results.

3.3.1 Detailed Process Flow of Current Results Management System

The current system is mainly processed using hard photocopies of the four sheets (Detailed Mark Sheet x2, Marks Return Sheet, and Comment Sheet) which is not time effective again since the listed sheets must be hand delivered to each relevant person. Another problem that has been faced to persuade our team to proceed with this project is that lecturers don't get a summarized report of each individual student.

Steps are shown as below:

1. Setter checks the paper and fills the detailed mark sheet.

2. Moderator again checks the paper and fills another detailed mark sheet.

3. Both mark sheets are sent to the HOD.

4. HOD cross checks the two given sheets to see if there is an unacceptable pair of marks.

5. If there is a big difference, then the HOD adjusts the marks as he/she sees fit.

6. The mark sheets (including the mark sheet containing the final marks for each student) are then sent back to the setter for him/her (Setter) to continue to proceed on to the marks return sheet and the comment sheet.

7. Then the marks return sheet and the comment sheet are sent to the examination dept.

If we look at the above process in terms of the three roles of the system, the responsibilities of each role is as shown below:

Lecturer (Stetter and Moderator):

- Setter checks the paper and fills the detailed mark sheet.
- Moderator again checks the paper and fills another detailed mark sheet.
- When the mark sheets (including the mark sheet containing the final marks for each student) are sent back to the setter she/he must continue to proceed on to the marks return sheet and the comment sheet.

Administrator (HOD):

- Assigns Setter and Moderator for each subject.
- Cross checks the two sheets given by the moderator and setter to see if there is an unacceptable pair of marks.
- If there is a big difference, then the HOD adjusts the marks as he/she sees fit.
- Sends the marks return sheet and the comment sheet to the examination dept.

Student:

- Views their final examination results on the notice board.

3.3.2 Problems and Limitation of Results Management System

The current Results Management System contains several problems. This manual system is still very much paper based. Below are the identified problems with the manual prevailing system.

- System has too many manual processes.
- There is a redundancy error in some of the used mark sheets.
- The whole process is time consuming and tedious.
- Students don't get results within an acceptable time period.

3.3.4 Constraints Identified in the Development

Constraints of the proposed Results Management System are identified in the areas of time and resources.

3.3.4.1 Time Constraints

- Time criticalness is a major constraint in the design phase and development phase of the system as we have to work according to a deadline.

3.3.4.4 Resource Constraints

- Insufficient knowledge on the technology that use to develop the system.
- Team members experience on best suitable technology may be low.

3.4 Requirement Specification for the Proposed University Results Management System

This section contains the detailed description of what the functional and non-functional requirements of the system would be and how these requirements would help the system to reach its full potential and benefit its three main users.

3.4.1 Functional Requirement Specifications

Functional requirements of the proposed vendor base platform system are identified under 3 main perspectives.

- Admin Perspective
- Lecturer Perspective
- Student Perspective

3.4.1.1 Functional Requirement Specifications: Admin

The Admin is one of the three main roles of the system. In our system the admin would be the Head of the Department (HOD).

- Faster transfer of documents to and from relevant people
- Providing summarized reports for each individual student
- Ability to confirm setter and moderator
- Manage the results of the university students and keep a record of results of the students

3.4.1.2 Functional Requirement Specifications: Lecturer

Functional requirements of the lecturers for the proposed system are listed as follows. Mainly they require a quick and efficient way to upload mark sheets to the system.

- The web application enables the lecturer (setter and/or the moderator) to enter the results of students to the detailed mark sheet, marks returned sheet and comments sheet.
- This sheet contains all relevant fields which make the document contain less redundant fields and substitute certain fields which simply can be generated automatically.
- Providing summarized reports for each individual student.
- Allows to generate result of students for different examination and different types of exams during the year as oral, practical, written, etc.

3.4.1.2 Functional Requirement Specifications: Student

- Results can be viewed semester wise, stream wise, class wise or even subject wise
- Graphical view of students' performance
- Manage the results of the university students and keep a record of results of the students

3.4.2 Non-Functional Requirement Specification

Previously we have discussed the functional requirements of the proposed URMS. Here we are going to elaborate on the non-functional requirements of the system that we are proposing.

- Security: In our web application system unauthorized users cannot access the data and cannot perform any operation, because the system does not allow them to login. Therefore, security is provided.

- User Interface: The system is designed in such a way that instructions are given clearly to navigate through the System. Warnings and error messages are provided throughout the system.

- Scalability: The system supports large amounts of data that can be stored and retrieved. Hence the system is scalable

- Reliability: Our web application provides students information and some notifications to the lecturers, that information must be reliable, and the user should be able to depend on those details.

- Responsiveness: The web application should complete the task according to the given time. 7 For example, when the lecturer updates a mark in the detailed marks sheet then the Marks Return Sheet needs to be updated at that time itself. •

- Start -up-time: The start-up time of the web application should be minimum in order to increase the efficiency. •

- Efficiency: User can easily access the system and search very fast and accurately.

- Delivery: The entire system is expected to be delivered in one year of time.

3.4.3 Modules of the Proposed University Results Management System

The development of a computerized Results Management system contains several modules to make the complete system. This section will describe about the organization of the modules that it consists of.

Module 1: Registration/Authentication/Login Module

- Admin Login
- Lecturer Login
- Student Login

Module 2: Setter and Moderator fill Detailed Mark Sheet for a subject

Both the setter and moderator of a subject will log in to the system and fill in two detailed mark sheets.

Module 3: Setter fills Mark Return sheet for a subject

The setter will log in and fill the mark return sheet with both end semester and continuous assessment (CAS) marks.

Module 4: Setter fills Comments Sheet for a subject

The setter will log in and fill the comments sheet for a subject.

Module 5: Lecturer checks report on student's performance

A lecturer will log in and search for a specific student's past examination performance.

Module 6: A Student checks his or her exam performance

A student could log into their account and check their exam grades and GPA.

Module 7: The Administrator assigns setter and moderator for each subject.

The administrator will assign the lecturers to the posts of setter and moderator for each course module.

Module 8: The Administrator settles differences is setter and moderator marks.

The administrator will be in charge setting any discrepancies between the marks awarded by the setter and the marks awarded by the moderator.

Module 9: The Administrator adds a module.

The administrator will log in and add modules as necessary and assign a lecturer to teach each module.

Module 10: The Administrator adds a Lecturer.

The administrator will log in and add lecturers as necessary to later assign as setter and moderator to each module

Module 11: The Administrator adds a Student.

The administrator will log in and add students as necessary.

These modules will later be discussed in the 4th chapter.

3.4.4 Technical Requirement Specification

In the following list we have pointed out the technical requirements of the proposed University Results Management System.

Our aim is to create a dedicated web application for our Results Management System. It will be mainly based on languages such as TypeScript (Angular Framework), HTML, CSS, JavaScript and Python.
At first, we thought of using PHP, JavaScript and HTML technology in the development but in the end, we decided to use Angular which is a TypeScript-based open-source web application framework.

We will be using MYSQL for database connection. We used firebase hosting to serve our website to our clients,

- TypeScript (Angular Framework)
- HTML
- CSS
- JavaScript
- PHP
- SQL
- Firebase
- Python
- PHP as a REST API for backend communications.
- MYSQL 8.0.17 community edition (Database) Server-side development:
- MYSQL server Description:
- Python – To develop and design applets and programs that runs in web browsers. (web services)
- TypeScript, JavaScript, CSS, HTML– To design the website in case the app connects with the internet.
- MYSQL 8.0.17 community edition – To develop and design the back-end database. Compatible with all front-end platforms and software.
- MYSQL server- To connect front-end and back-end database using data objects passing.

3.4.6 Modules for the Proposed Results Management System

This section of the chapter will elaborate the diagrammatical expression of the processes in the modules of the proposed URMS using UML techniques such as sequence diagrams, Use Case diagrams and class diagrams.

3.4.6.1 Sequence Diagram

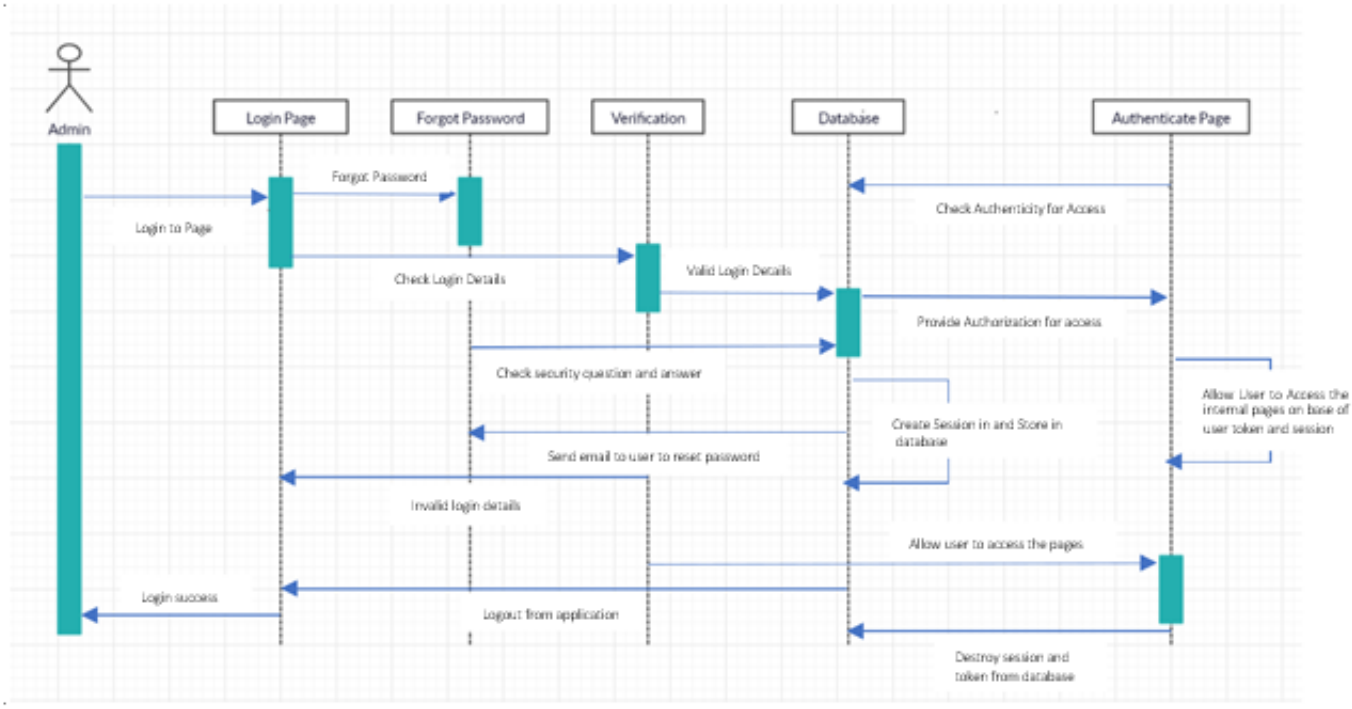


Figure 2 : Sequence Diagram

3.4.6.2 Class Diagram

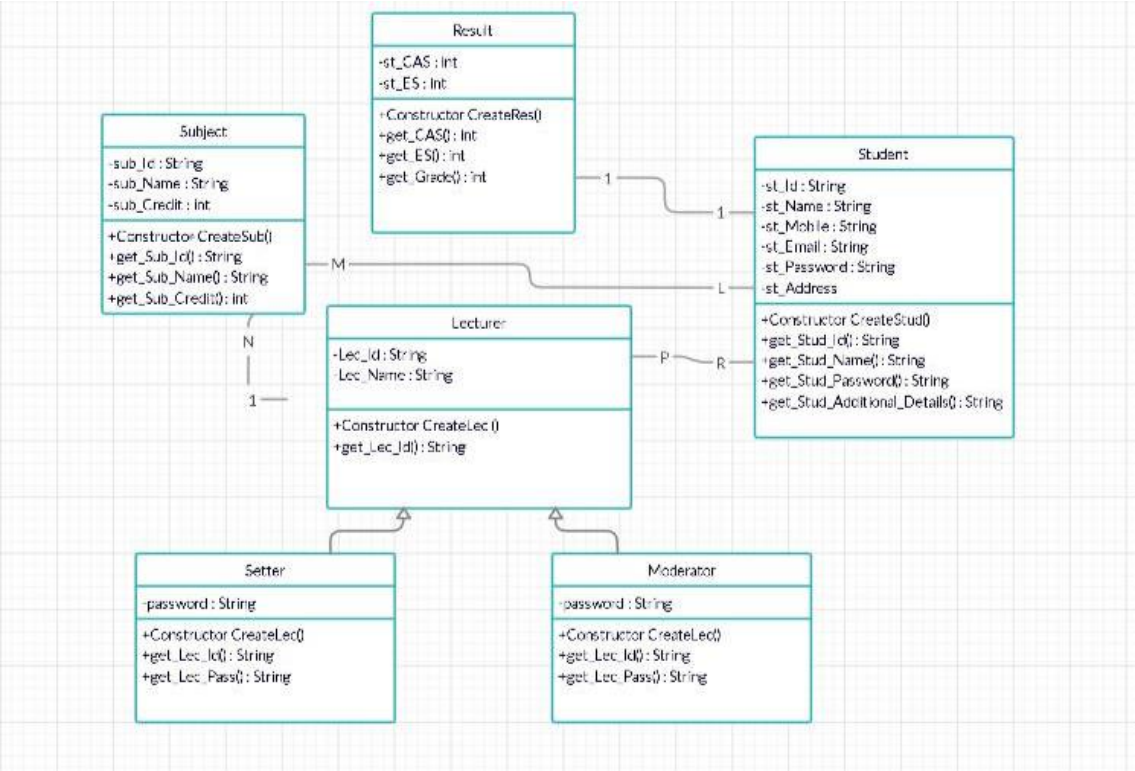


Figure 3 : Class diagram

3.4.6.3 Use Case Diagram

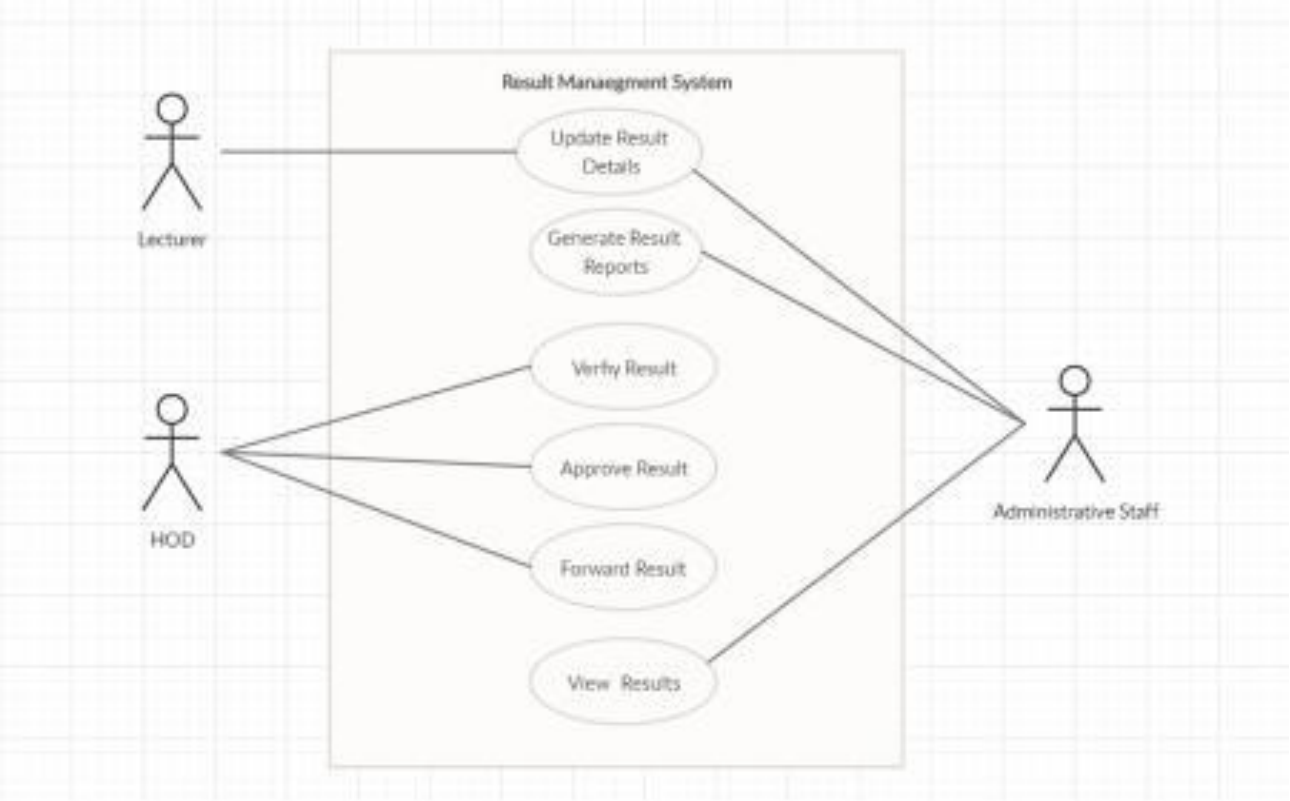


Figure 4 : Use case diagram

3.5 Summary

This chapter focuses on the overall idea of the analysis of following phases

1. Data gathering processes

2. Analysis of the gathered data

3. Detailed description of the current system

4. Detailed description of the proposed system

In the 1st phase we have mentioned the data gathering process that we used to carry out requirement gathering. Data gathering techniques used for data gathering of the University Results Management System are discussed under the particular reason for the selection of that method to gather requirements.

Data which is gathered through the data gathering techniques are analyzed under the expectations of the users. Responses of those methods that are acquired from the users, were carefully analyzed to identify the true requirements. The analyzed data is represented in graphical format to make the decision-making process much easier.

Detailed description up running processors and functionalities of the current system are mentioned in the chapter. Procedures and the functionalities were represented using flow charts and activity diagrams to enhance the flow of events in the current system.

The final phase of the chapter describes the functional and non-functional requirements along with technical requirements and usability requirements of the proposed University Results Management System. Graphical representation of the system was shown with the aid of UML diagrams.

Chapter 4 Overall System Architecture

4.0 Introduction

Under this chapter we have emphasized the database structure of the proposed University Results Management System with the aid of conceptual data modeling and database relationship diagrams. This conceptual data modeling gives an abstract view of the entities of database. Database relationship diagrams reveal how the database tables should be in the implementation proceedings.

Architectural design of the system gives an idea about the overall architecture of the system. The application layer will decide the logic of the system and the data layer will consider the data storage, while the presentation layer work hand in hand with interfaces of the system. Modular architecture of the system will give an understanding about how atomic modules preform in the proposed University Results Management System and how these can be understood even by a person with limited technical expertise. The final product of the University Results Management System will be the combination of all these modules. Detailed descriptions of these modules will presented in this chapter. Interfaces of the system will also be added to this chapter to give the understanding of how the system will flow further.

4.1 Overall System Architecture

System architecture design is a crucial step in developing a system. It describes the basic software structure by separating the functioning areas into layers. In other words, a system architecture is the conceptual model that defines the overall structure, behavior, and more views of a system. It describes how system interacts with the users and what happens inside the system.

The architectural design is formal description and representation of a system, organized in a way that supports reasoning about the structures and behaviors of the system. The architectural design given according to the three-tier-architecture where overall design is split in to three layers of presentation, application and data tier. The overall system architectural design for the proposed system is as follows;

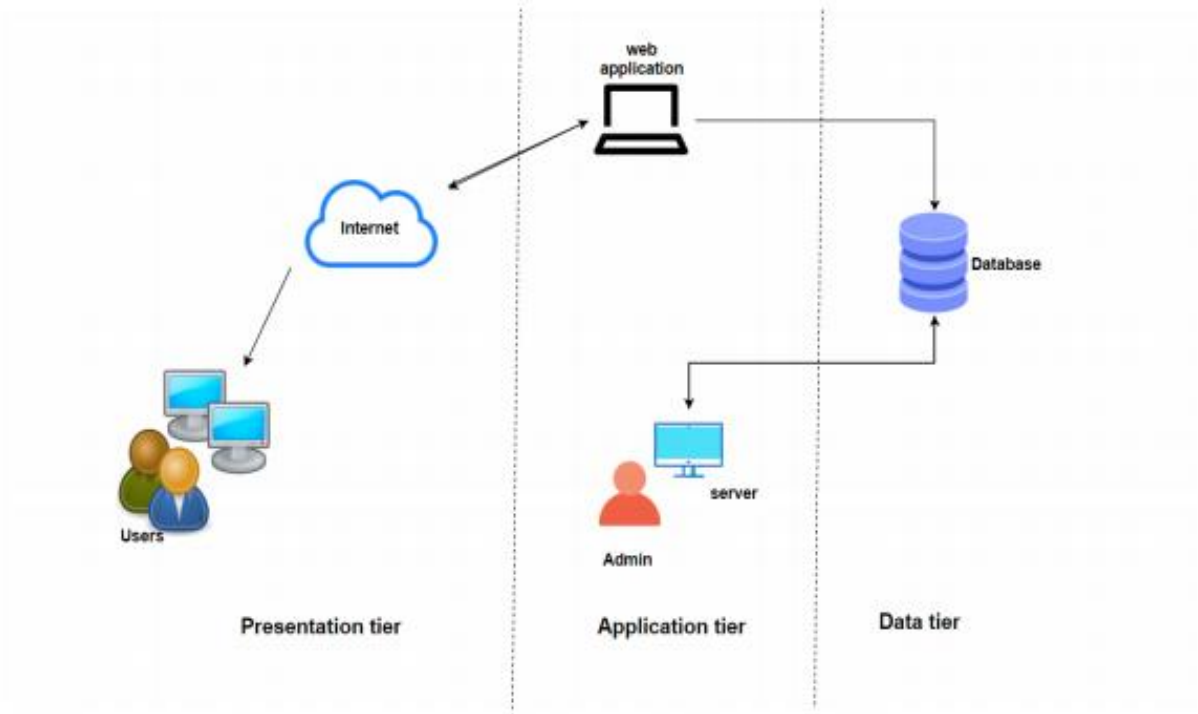


Figure 5 :Architecture

4.1.1 Application Layer

Application layer is the heart of our overall system. It indicates that our results management system as a web application. Web application is connected with application layer and admin has the authority to control this layer. The results of each student will be displayed in the application layer after the lecturer (setter and/or the moderator) enters the result. Lecturers have the ability to update results. Application layer will interact with both presentation layer and data layer. Any changes done in this layer affects both the other presentation and data layers.

4.1.2 Data Layer

All the relationships between entities of the database in our proposed results management system defines in this data layer. Implementation of our system is supported by a central database that developed with SQL to store all the required information that need to take out action which need to complete processes with the system functionalities in the proposed results management system. Data layer will always be connected with application layer and presentation layer both since it controls the overall system architecture. Data layer facilitate the insertion data to database, retrieval of data from database, delete and update data which is already stored in database. In our system only the lecturers have the ability to insert, delete, or update results. As an example of this data layer working hand in hand with application layer and presentation layer, all users (lecturers, HOD, administrative staff) have to login to the system in order to interact with our platform. When a user trying to log into system using their username and the password, application layer will connect with the data layer to check the user with the database whether user is available in the database and the username and password that user provide are matching with database details.

4.1.3 Presentation Layer

Presentation layer enables to get the interaction of the users. This monitors the interfaces of the web application. This is the only layer which is visible to the user. User has the ability to enter details in the presentation layer and the details entered in the presentation layer will be delivered to the application layer. Designing higher user-friendly interfaces and maintaining the clear architecture for the interfaces are the key roles of presentation layer. All the users are proceeded to take out action on this results management system through a web-based application under moving through those interfaces that are designed. For an example when a user (lecturer, HOD, administrative staff) is trying to log into our system using login interface they have to enter their username and the password in the correct place we have provided by using text boxes and proceed with clicking login button, if user is available in the database and the username and password of them are matching with the data in the database, they will proceed to their respective dashboard page. Otherwise they will get the username or password is incorrect message in the same window which was used to login to the system.

4.2 Software Architecture

4.2.1 Module Architecture of the Proposed University Results Management System

Software architecture is based on a modularized approach where the software is divided into parts. Each module is allocated to execute one or more tasks of the overall system in order to achieve the ultimate objectives expected.

The developing of a computerized Results Management system contains several modules to make the complete system. This section will describe about the organization of the modules that it consists.

4.2.1 Module Architecture of the Proposed University Results Management System

Software architecture is based on a modularized approach where the software is divided into parts. Each module is allocated to execute one or more tasks of the overall system in order to achieve the ultimate objectives expected.

The developing of a computerized Results Management system contains several modules to make the complete system. This section will describe about the organization of the modules that it consists.

Module 1: Registration/Authentication/Login Module

Figure 6 : Registration/Authentication/Login Module

Users have to register on the web application. An email verification will be sent to the email address given by the user. The account will then be verified and the user can log in using the username and password saved in the Firebase database. Then user can then create their own profile by including their details. Afterwards, their information will be stored in SQL database and an account will be created.

Module 2: Setter and Moderator fill Detailed Mark Sheet for a subject

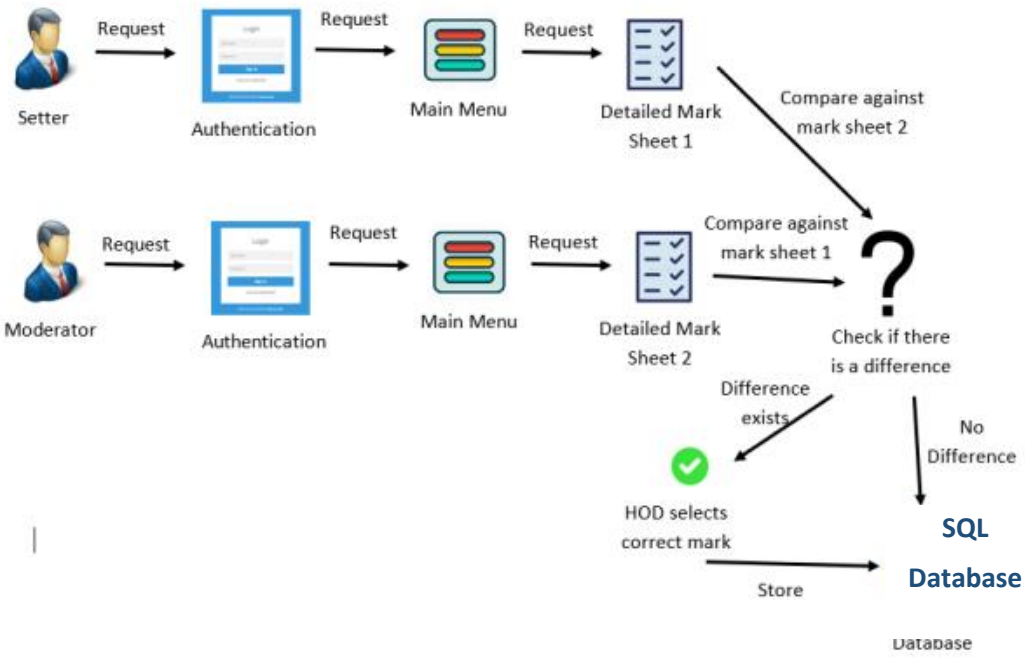


Figure 7 : Setter and moderator detailed mark sheet

Both the setter and moderator of a subject will log in to the system and fill in two detailed mark sheets. The marks in the detailed mark sheets will be analyzed to find differences in marks between the two sheets. If there is a significant difference, it will be sent to the HOD for him to verify proper mark. If there is no difference or after the difference is corrected, the marks are saved to the SQL database.

Module 3: Setter fills Mark Return sheet for a subject

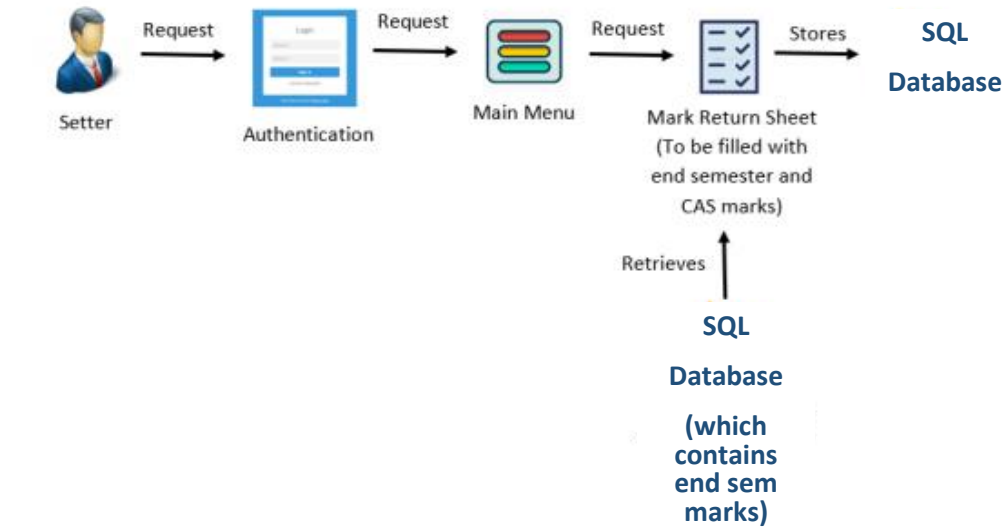


Figure 8 : Setter fills return mark sheet

The setter will log in and fill the mark return sheet with both end semester and continuous assessment (CAS) marks. The end semester marks will autofill for each student as it can be retrieved from the database where it is saved from module 2 previously. Afterwards the information in the mark return sheet will be saved to the SQL database.

Module 4: Setter fills Comments Sheet for a subject

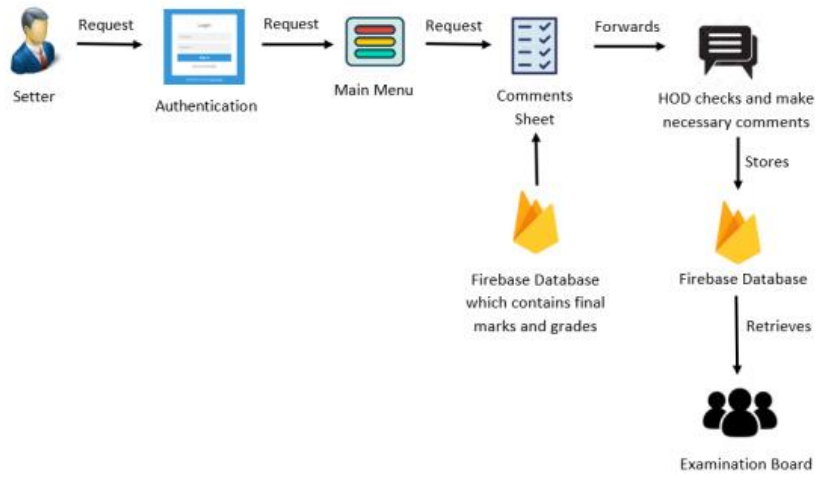


Figure 9 : Setter fills comments sheet

The setter will log in and fill the comments sheet for a subject. The final marks and grades will autofill as it can be retrieved from the database where it is saved from module 3 previously. The Comments sheet will be forwarded to the HOD for his comments and verification. Afterwards it will be saved to the SQL database. All the databases form modules 2, 3 and 4 can be accessed by the examination board.

Module 5: Lecturer checks report on student's performance

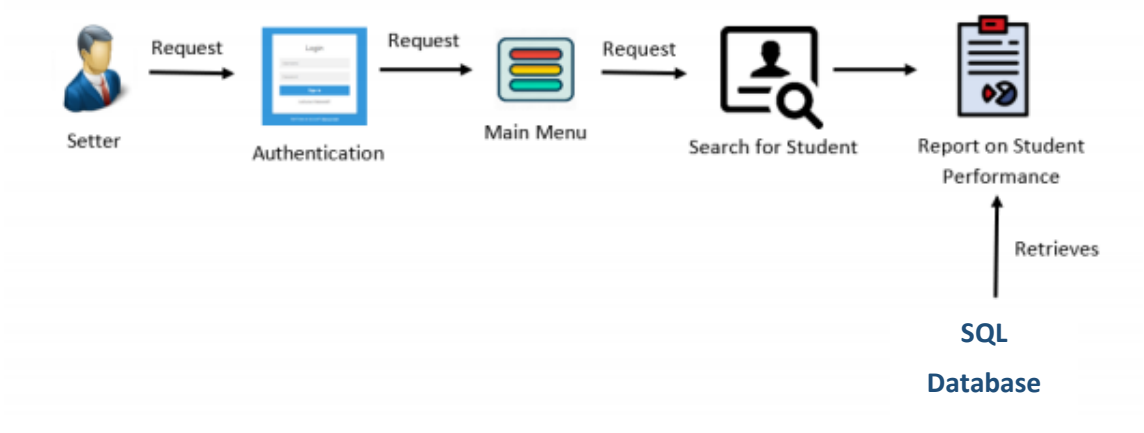


Figure 10 : Lecturer checks report

A lecturer will log in and search for a specific student's past examination performance. This information will be retrieved from the SQL Database where it is stored in Modules 2,3 and 4. It will be displayed for the user in the form of a report or graphical representation.

Module 6: A Student checks his or her exam performance

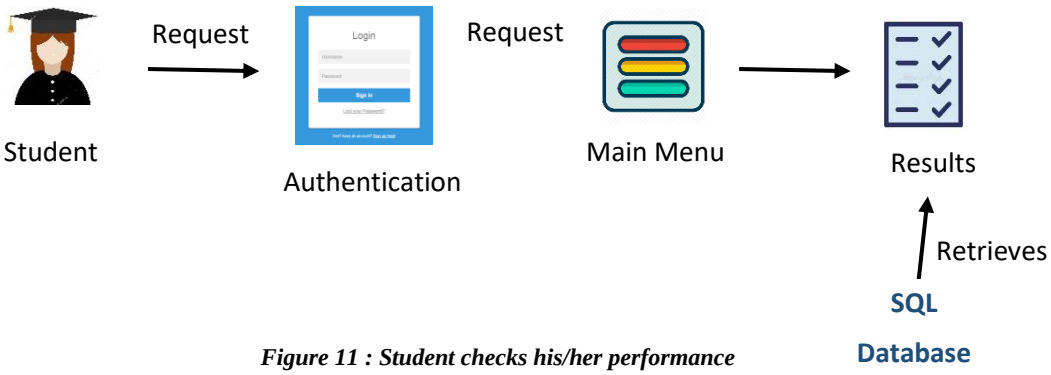


Figure 11 : Student checks his/her performance

A student will log in and check their results. This information will be retrieved from the SQL Database where it is stored in Modules 2,3 and 4. It will be displayed for the user in the form of a table.

Module 7: The Administrator assigns setter and moderator for each subject.

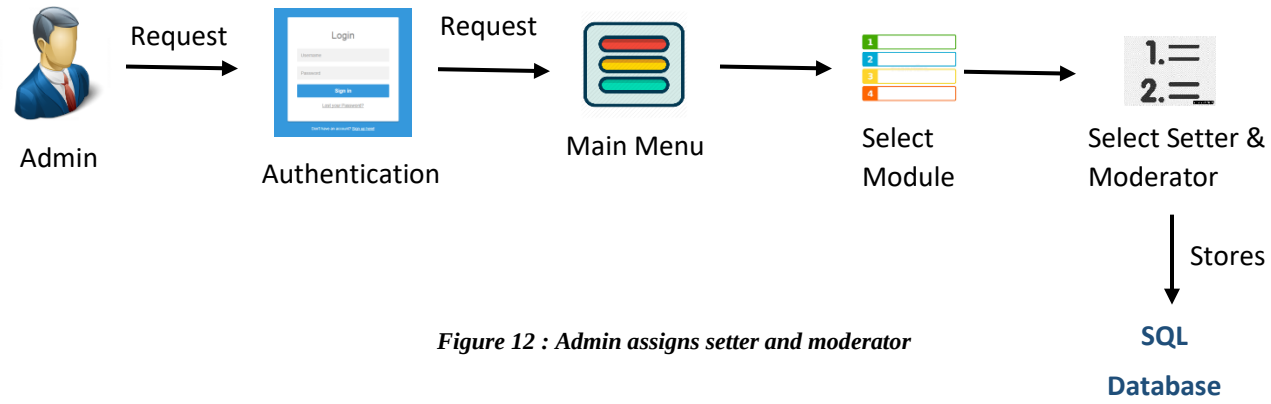


Figure 12 : Admin assigns setter and moderator

The administrator will log in and select a particular module. He will assign the setter and moderator of that module. Afterwards the information will be saved to the SQL database.

Module 8: The Administrator settles differences is setter and moderator marks.

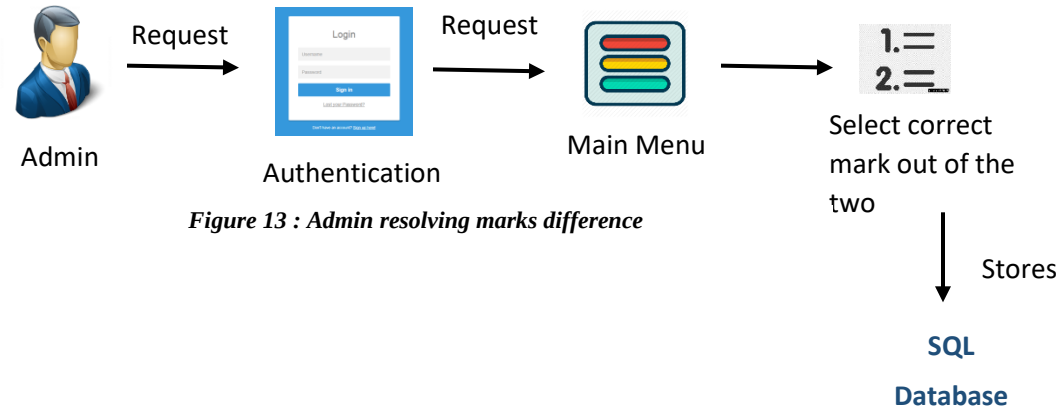


Figure 13 : Admin resolving marks difference

The administrator will log in and check the mark discrepancies shown. He will enter the correct mark and click confirm. Afterwards the information will be saved to the SQL database.

Module 9: The Administrator adds a module.

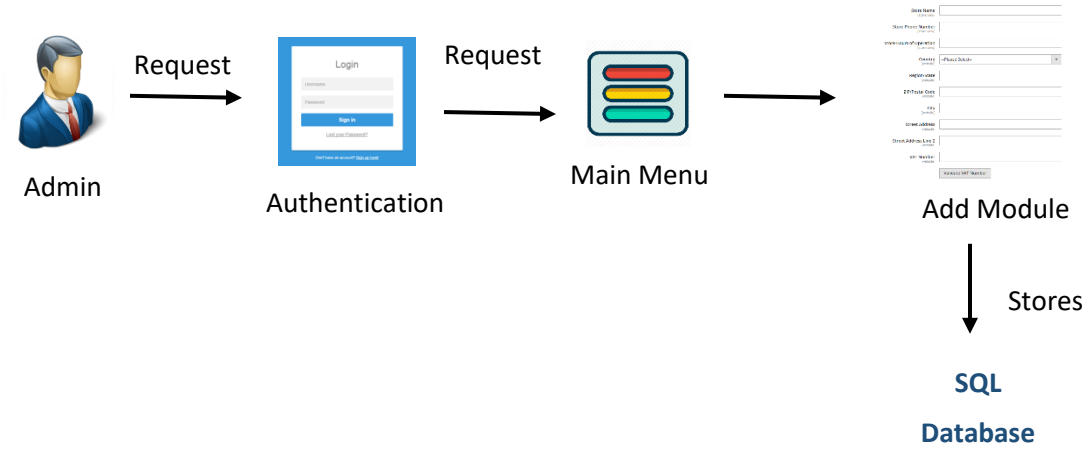


Figure 14 : Admin adds module

The administrator will log in and add modules as necessary and assign a lecturer to teach each module. Afterwards this information will be saved to the SQL database.

Module 10: The Administrator adds a Lecturer.

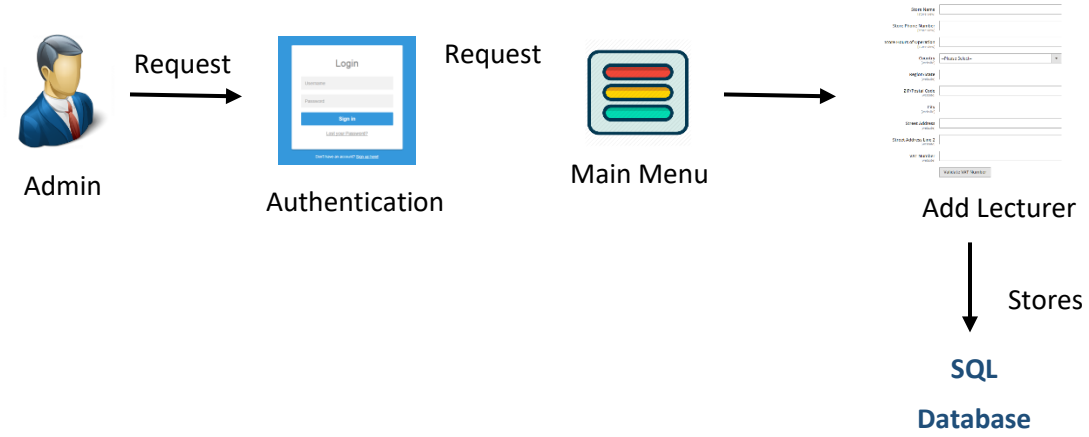


Figure 15 : Admin adds lecturer

The administrator will log in and add lecturers as necessary to later assign as setter and moderator to each module. Afterwards this information will be saved to the SQL database.

Module 11: The Administrator adds a Student.

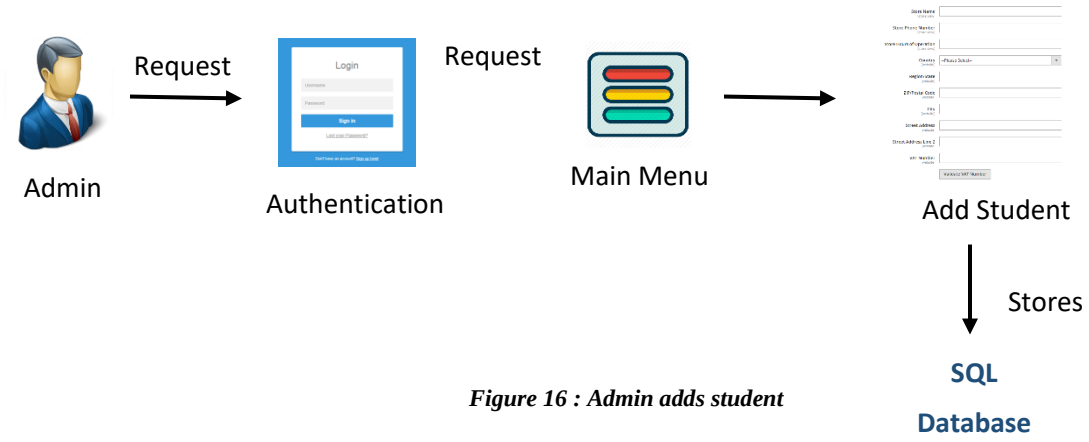


Figure 16 : Admin adds student

The administrator will log in and add students as necessary. Afterwards this information will be saved to the SQL database.

4.3 Data Design

The Results Management System will have a two centralized databases in the server. Firebase real-time Database and SQL will be used for this purpose. This section of the document represents the conceptual data design of the system, the process of converting the ER diagram into tables and the database relationship diagram. Furthermore, the tables of the database are also started with their attributes and data types.

4.3.1 Conceptual Data Design of the Proposed University Results Management System

Conceptual Data Design for the proposed University Results Management System indicates the detailed view of the database structure. Relationships among the entire entities are mentioned.

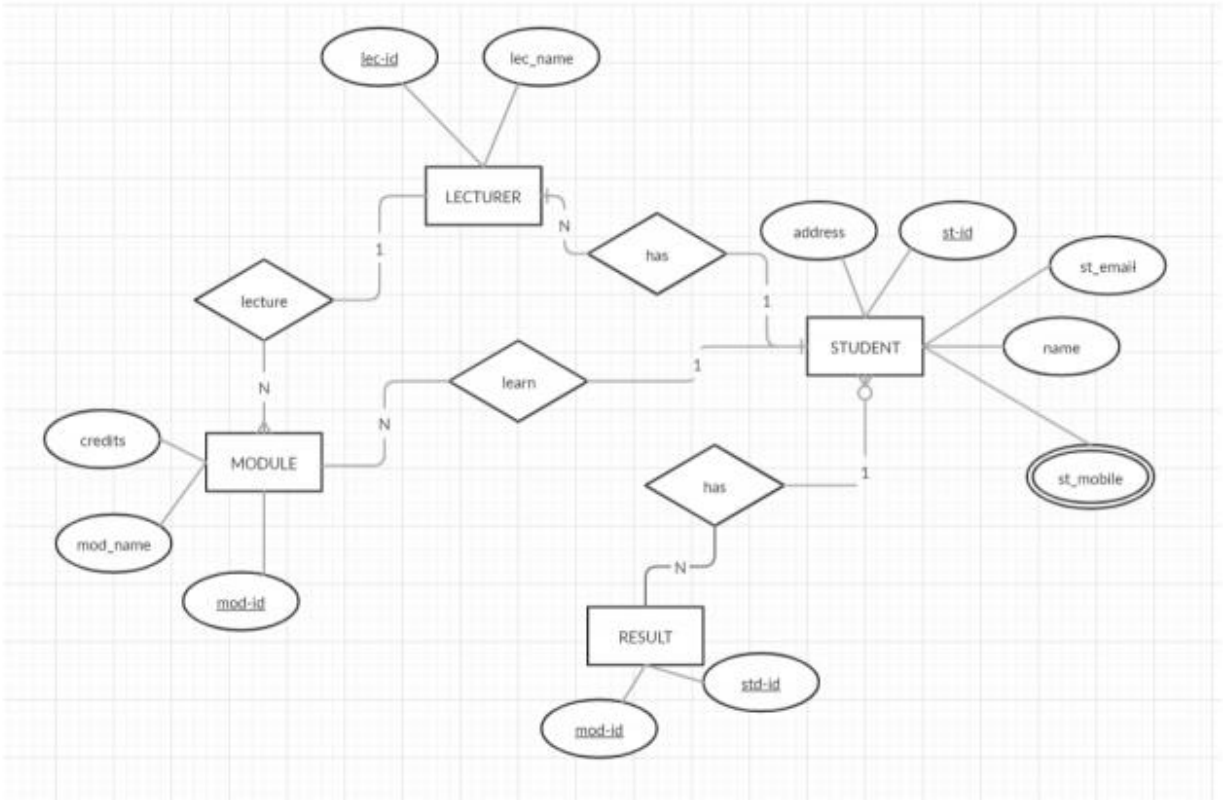


Figure 17 : conceptual design

4.3.2 Mapping the Entities Identified

Given below is the mapped conceptual model of the stated system categorized into:

1. Regular Entities
2. Binary Relationships
3. Associative Entities
4. Referential Constraints

Regular Entities

LECTURER (Lec_ID, Lec_Name)

STUDENT (Address, St_ID, St_Email, St_Name, St_Mobile)

RESULT (Mod_ID, St_ID) MODULE (Credits, Mod_Name, Mod_ID)

Binary Relations

One-to-Many

LECTURER (Lec_ID, Lec_Name)

MODULE (Credits, Mod_Name, Mod_ID)

STUDENT (Address, St_ID, St_Email, St_Name, St_Mobile)

LECTURER (Lec_ID, Lec_Name)

STUDENT (Address, St_ID, St_Email, St_Name, St_Mobile)

RESULT (Mod_ID, St_ID)

STUDENT (Address, St_ID, St_Email, St_Name, St_Mobile) –

MODULE (Credits, Mod_Name, Mod_ID)

Associative Entities

No such existing entities.

Referential Constraints

Table	Dependent on Table(s)
RESULT	STUDENT, MODULE

Table 4 : Referential constraints

4.3.3 Data Types Identified for the Database

This section of the database shows the tables of the database with their attributes and respective data types.

Attribute	Data Type	Length
Lec_ID	VARCHAR	5
Lec_Name	VARCHAR	30

Table: LECTURER

Attribute	Data Type	Length
St_ID	VARCHAR	6
St_Email	VARCHAR	20
St_Mobile	VARCHAR	15
St_Name	VARCHAR	30
Address	VARCHAR	100

Table: STUDENT

Attribute	Data Type	Length
St_ID	VARCHAR	6
Mod_ID	VARCHAR	6

Table: RESULT

Attribute	Data Type	Length
Mod_ID	VARCHAR	6
Mod_Name	VARCHAR	30
Credits	INT	1

Table 5 : Data Types Identified for the Database

4.4 Interface Design

Our proposed University Results Management System has 3 roles as the Admin, Lecturer and Student. Each of the three can log into separate pages. Our Interfaces are designed to be user friendly and efficient.

4.4.1 Login Page

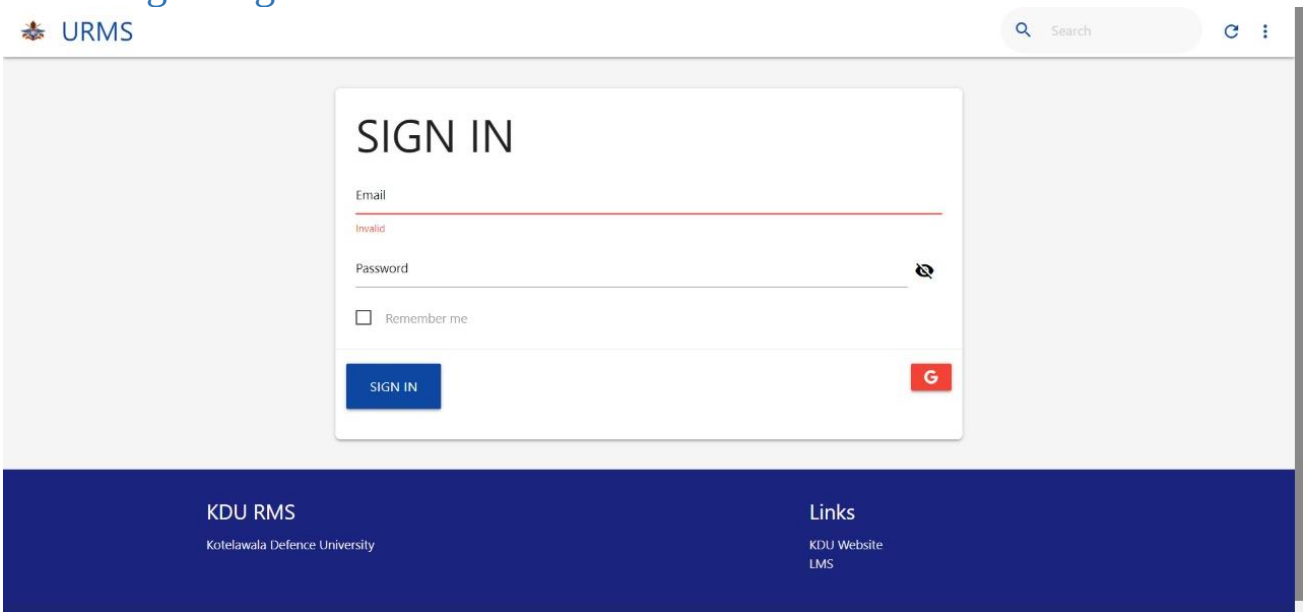


Figure 18 : login page

Here we have the login page which is used by the Administrator, Lecturer and Student to log into the web application and their respective home pages. The Login page has features such as email verification. It also has the option to log in through a google account

4.4.2 Administrator Login

4.4.2.1 Admin Dashboard

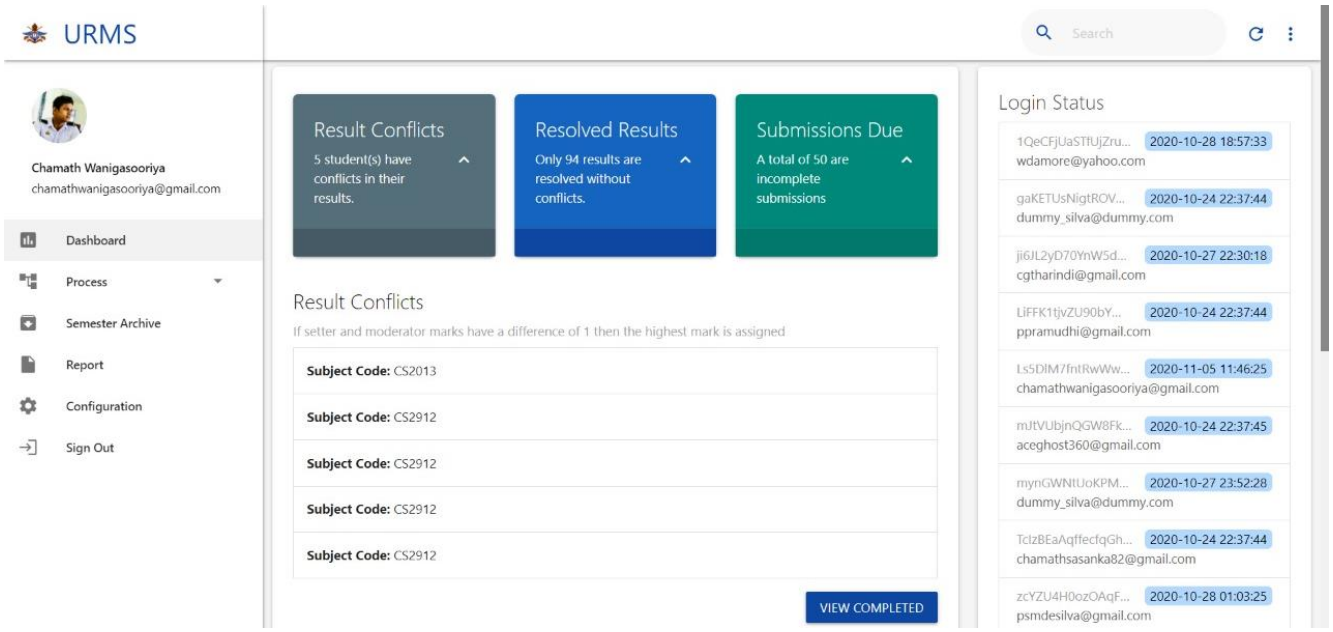


Figure 19 : Admin dashboard

The Dashboard of the Administrator Login is where the discrepancies between marks of the setter and moderator are available for the Admin to correct. He can do that by clicking on a subject code under Results Conflicts. Then the marks of both the Setter and Moderator will be displayed. He can type in the mark he considers to be most suitable and save it.

In addition, by clicking the View Completed button, he can view the results that have already been completed.

4.4.2.2 Add Lecturer

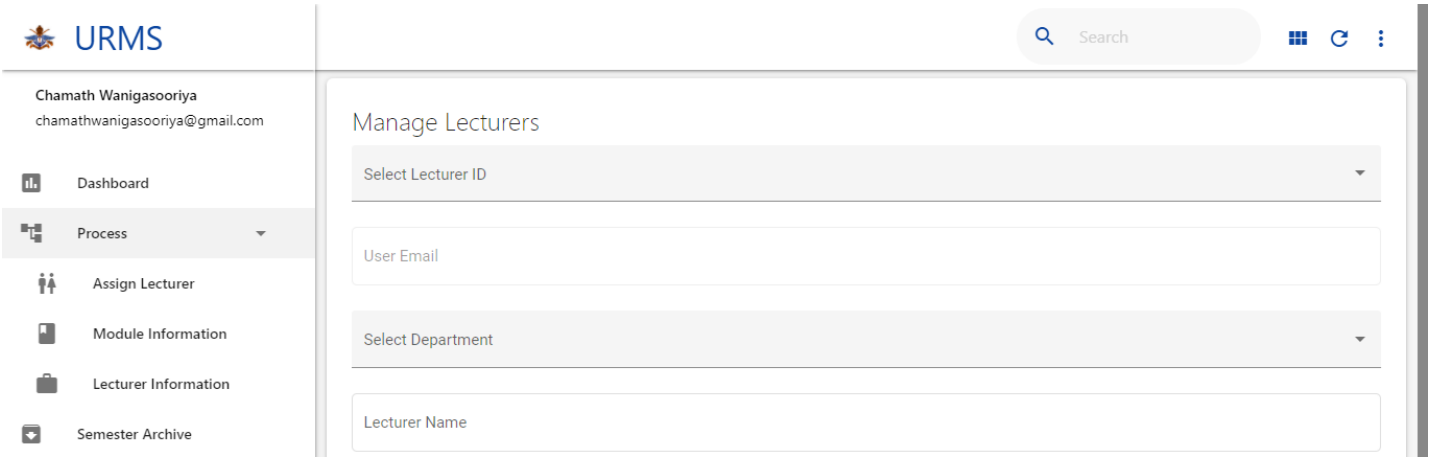


Figure 20 : Add lecturer

The Add Lecturer page is where the Admin can add lecturers to the system. He can do this by selecting the lecturer ID, email, department and name. This added lecturer will be displayed afterwards in the table below.

These lecturers will later be assigned as Setters and Moderators for Modules.

4.4.2.3 Add Module

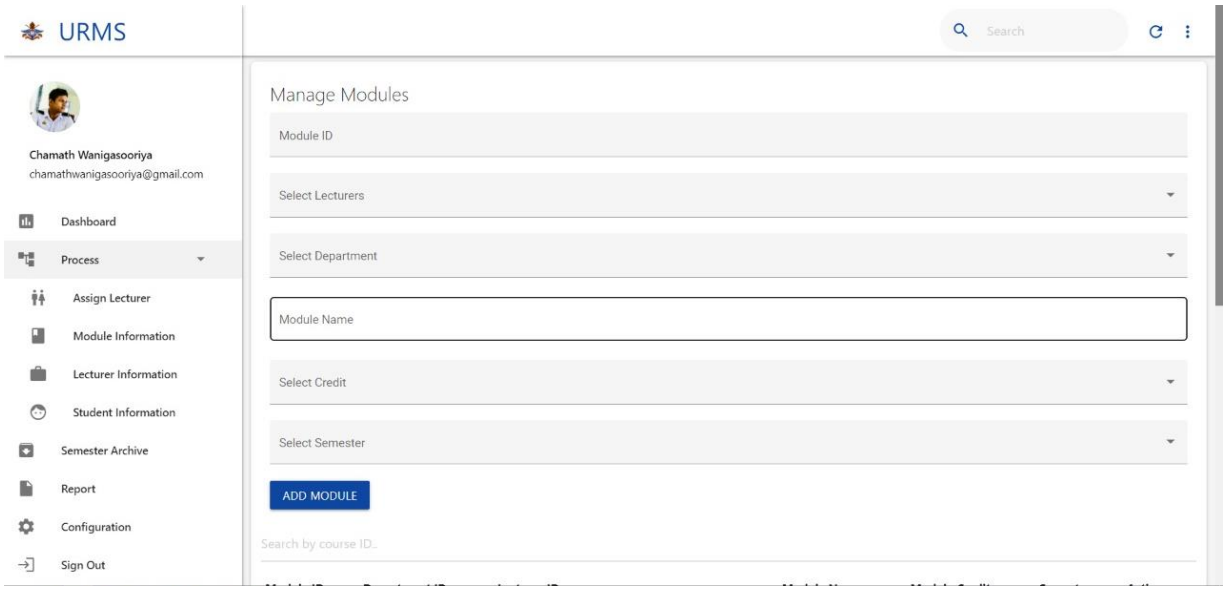


Figure 21 : Add Module

The Add Module page is where the Admin can add modules to the system and assign lecturers to teach each module. He can do this by filling the fields given above such as Module ID, Select Lecturers, Select Department etc.

After this is done, when the lecturer logs into his or her respective lecturer page their modules will be displayed.

4.4.2.4 Assign Lecturer

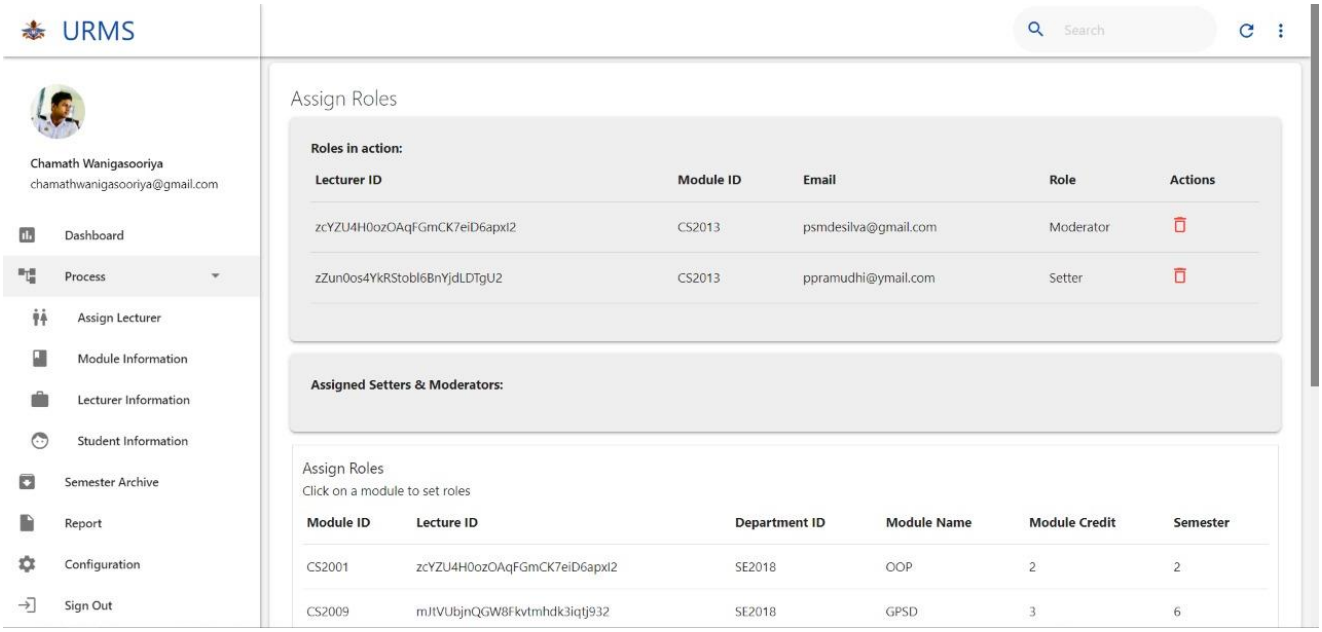


Figure 23 : Assign lecturer

The Assign Lecturer page is where the Admin can assign a setter and moderator to each subject. To do that first he must select the module in the table called Assign Roles. Afterwards there will be a pop up where he can assign the setter in step 1, the moderator in step 2 and then confirm. The assigned lecturers will be displayed in the Roles in Action table.

4.4.2.5 Add Student

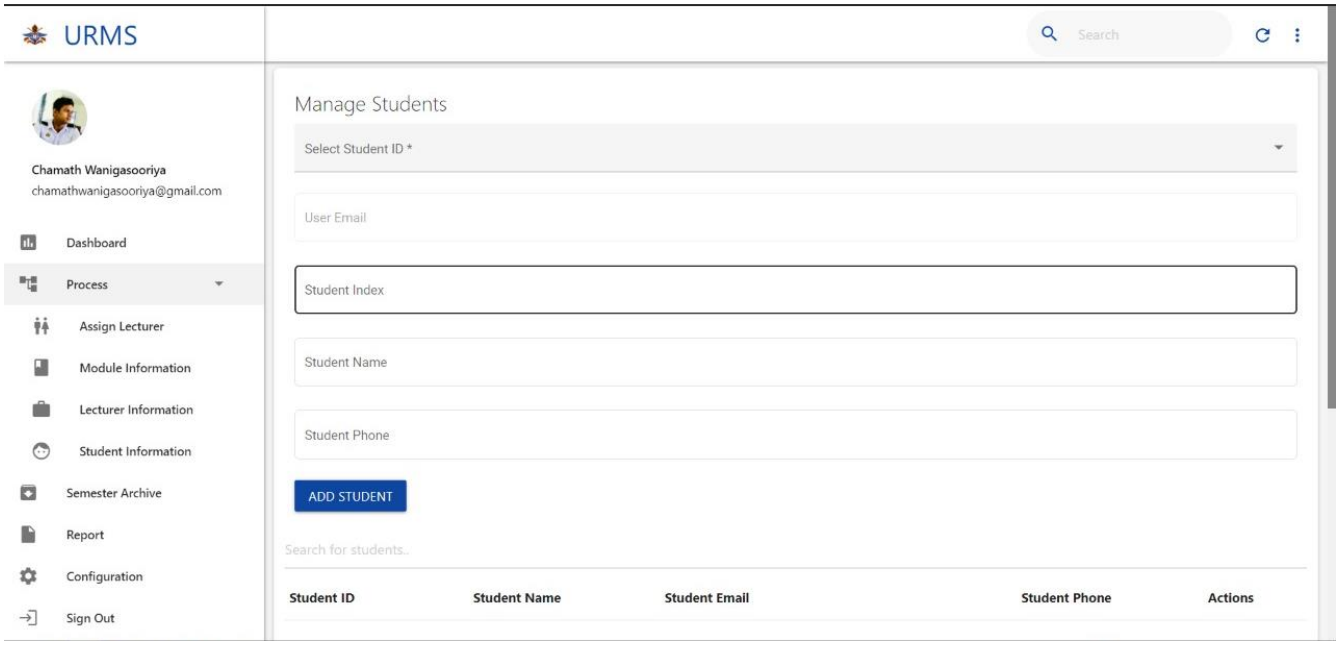


Figure 24 : Add student

The Add Student page is where the Admin can add student to the system. He can do this by filling the fields given above such as Student ID, Email, Name etc. Afterwards this added student will be shown in the table below.

These students will later be able to access their respective student pages.

4.4.3 Lecturer Login

4.4.3.1 Lecturer Dashboard

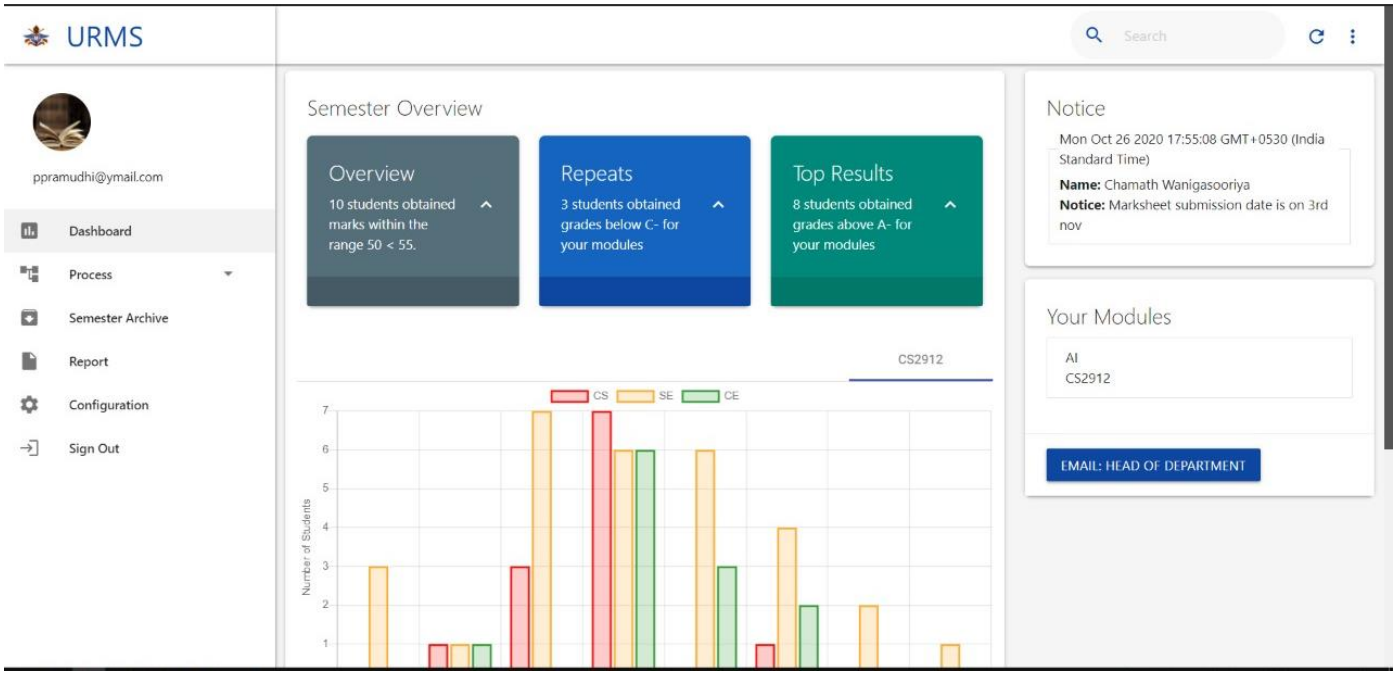


Figure 23 : Lecturer dashboard

The Lecturer Dashboard is where summarized information and details of the lecturer's modules in graphical form will be displayed. It'll also show any notices posted by the HOD.

4.4.3.2 Mark sheet

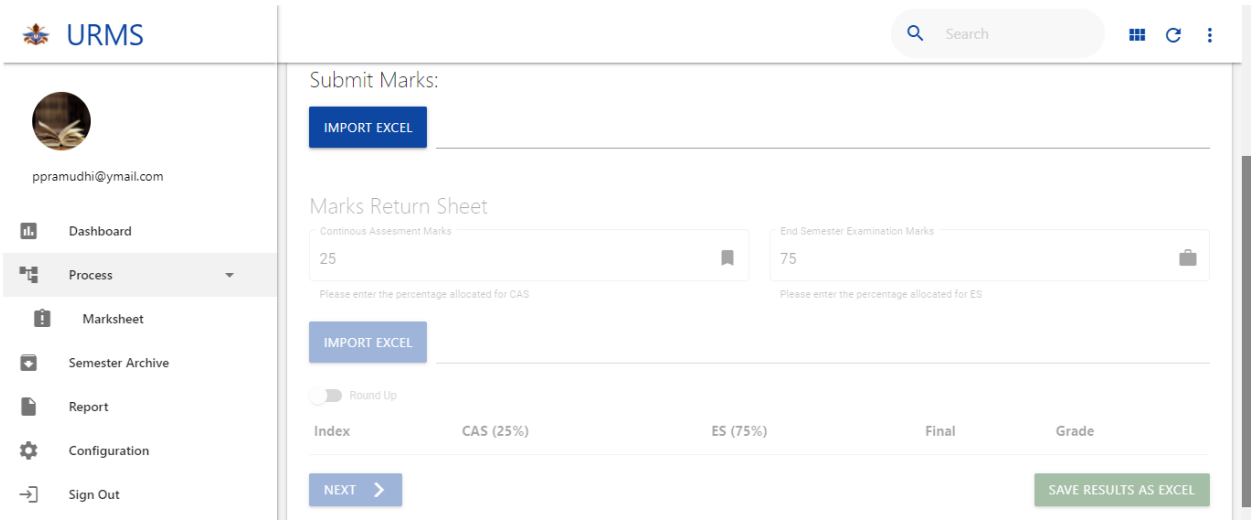


Figure 24 : Mark sheet

Mark Sheet page is where the detailed mark sheets can be imported as an Excel File. Afterwards the percentage of CAS and End Semester marks can be set by the lecturer. Then, the Marks Return sheet can also be imported as an Excel File.

4.4.3.3 Report

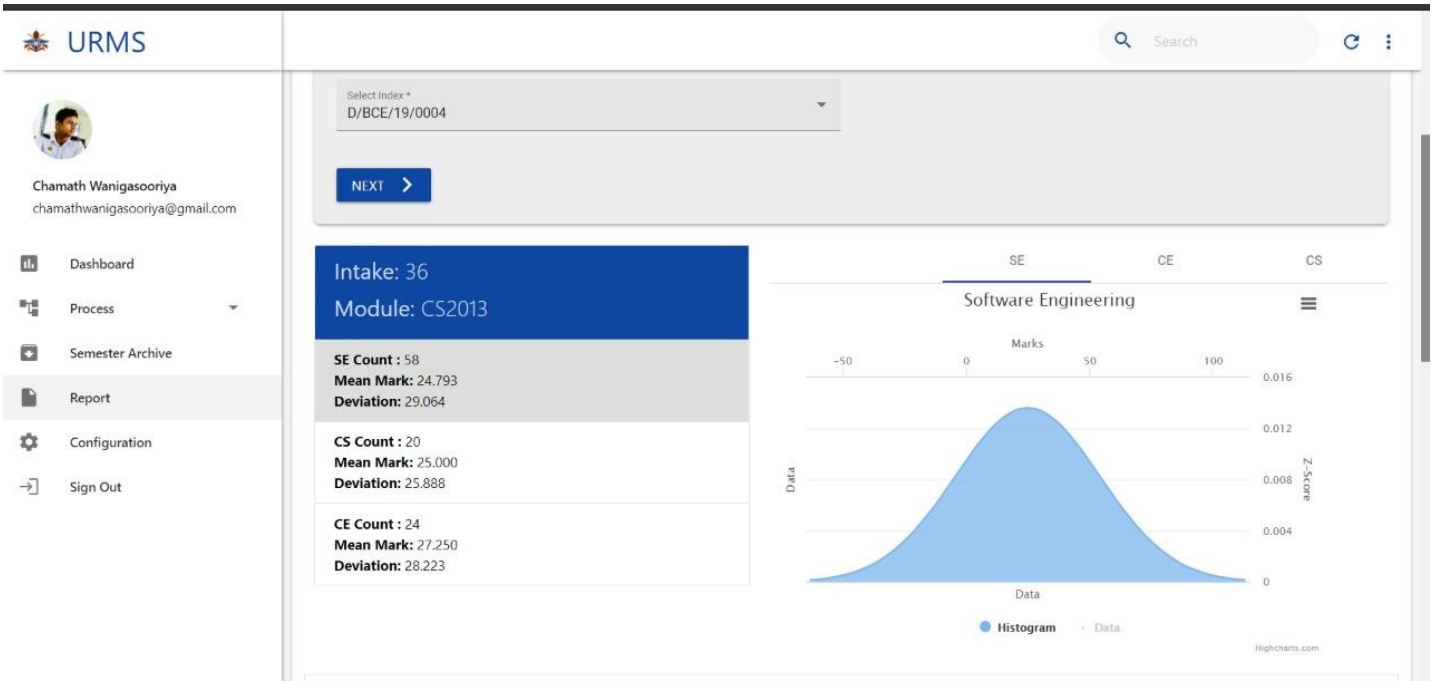


Figure 25 : Report

Report page is where the students' results are displayed in the graphical format for the use of the lecturers. The graph is shown for each stream when you select the respective intake and subject.

4.4.3.3 Semester Archive

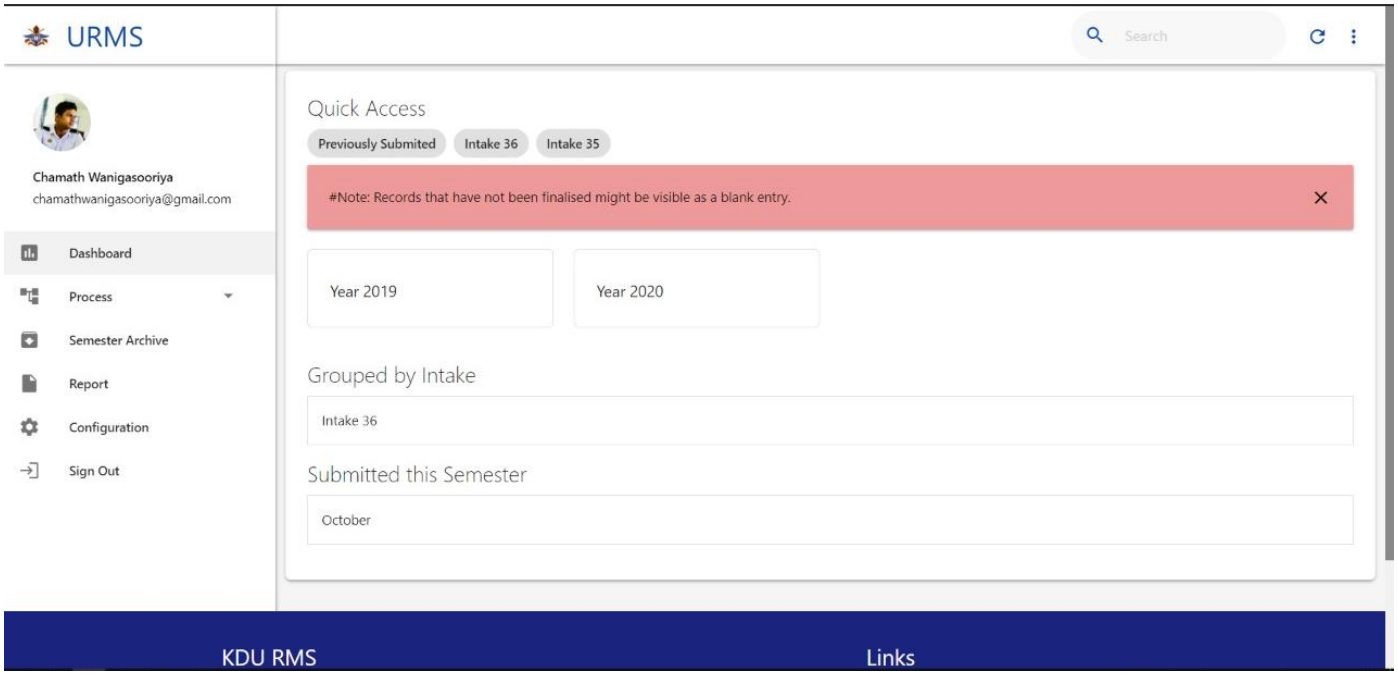
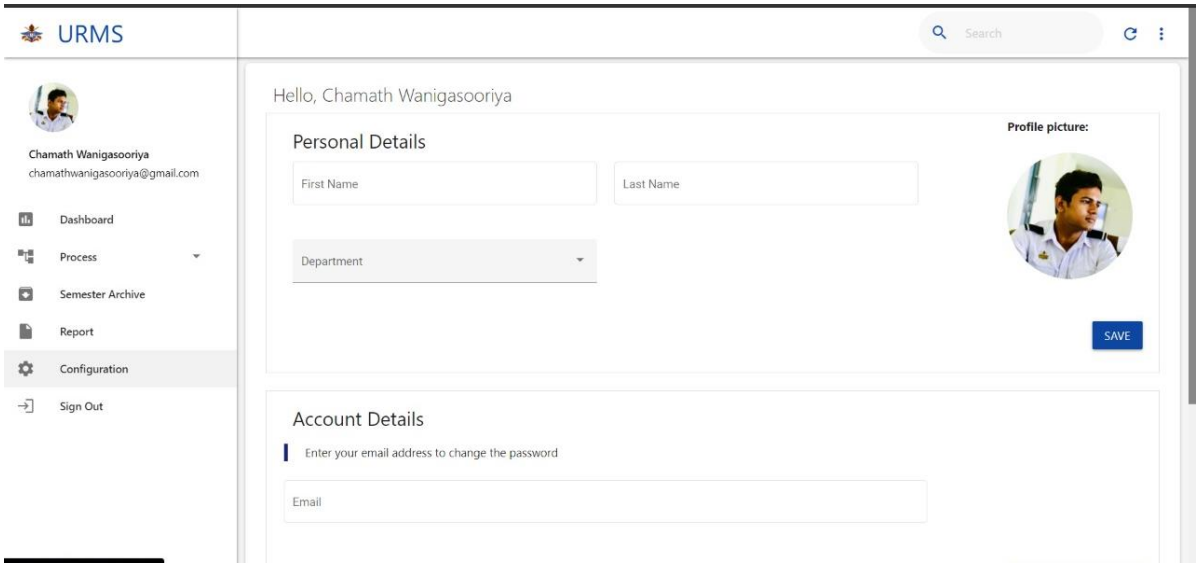


Figure 26 : Semester archive

Semester Archive is where the students' results are displayed as a report for the use of the lecturers. This report is also available for printing

4.4.3.1 Configurations



The

Figure 27 : Configurations

Configurations page is where profile details related to the users can be changed.

4.4.4 Student Login

4.4.4.1 Student Home Page

Figure 28 : Student home page

The Student Home Page will contain important notices as well as general information such as the grade point value table.

Students can navigate to the results page from here.

4.4.4.2 Student Results

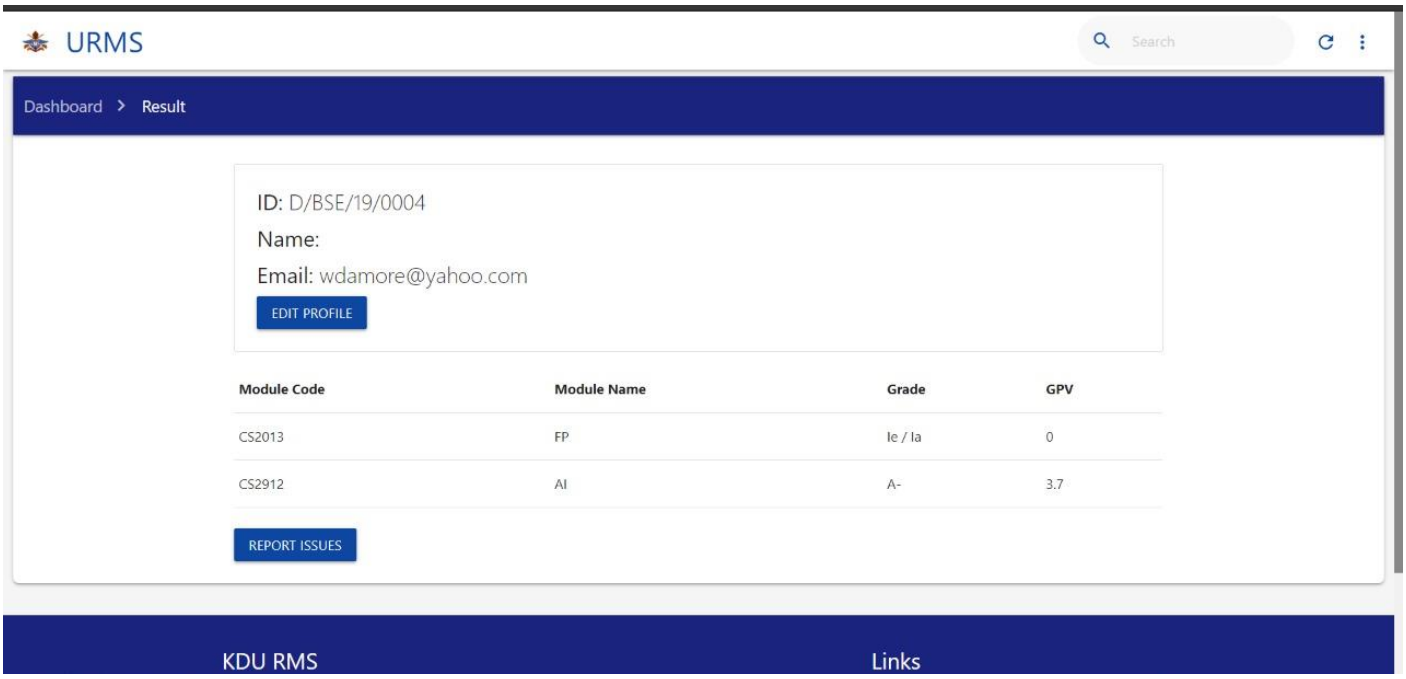


Figure 29 : Student Results

The Student Results page is where Students can access their Examination Results. If necessary, they can also notify or report any errors in their results.

Chapter 05: System Testing Implementation

5.0 Introduction

How the system is going to be implemented and tested is main considered in the system implementation and testing report. How the system is being developed physically is checked? Here the importance of appropriate languages selections that are used for the system is discussed.

The testing methods and their objectives will be discussed in detail. By testing the system, it makes it certain that the implemented system will run with minimum unseen bugs and errors.

Also, this report provides information on implementation facts such as system implementation procedures in depth so that the reader can understand regarding data runs, installation methods and system handover procedures.

5.1 Technology Considerations

The technology that is being used for the system should be decided by considering the domain and requirements of the system. The products quality doesn't depend on whether the advanced and complex tools or the low-quality tools that are used in the development. It depends on selection the appropriate tools and technologies.

Since our proposed system Result Management System is a web-based system, we need to consider about the time for the production, Efficiency and the performance of the system, Usability and Flexibility of the system and functionality of the system should be considered in developing the system. It is best to identify technological methodologies in order to meet the expectations of functional and non-functional requirements of the system in the system development procedure.

5.1.1 Selecting the Language

One of the necessary technical factors that we should focus when implementing the system is the programming language. When selecting the programming language, it is very necessary to select a language that goes with the development tools that the system is going to be developed with. It is a must. Out of several programing languages Selection of the most appropriate language was a challenge that came up during development.

It is hard to find the most appropriate language without a basic knowledge about several development languages which is available for the development, following are few languages we considered in the research level.

JavaScript, PHP, HTML, Typescript and Python.

At first, we thought of using PHP, JavaScript and HTML technology in the development but in the end, we decided to use Angular which is a TypeScript-based open-source web application framework led by the Angular Team at Google as our final programming language for the entire development along with PHP as a REST API for backend communications.

Following were the basic factors identified in the selection of the programming language

Angular applications are built using TypeScript language, a superscript for JavaScript, which ensures higher security as it supports types (primitives, interfaces, etc.). It helps catch and eliminate errors early when writing the code or performing maintenance tasks.

- Declarative UI

Angular uses HTML to define the UI of the application. HTML, as compared to JavaScript, is a less convoluted language. HTML is also a declarative and intuitive language.

- Reusability

  The component-based structure of Angular makes the components highly reusable across the app. You can build the UI (User Interface) with moving parts, while also ensuring a smooth development process for developers.

- Simplified Unit-Testing

  Being independent of each other, the components make unit testing much easier.

- Improved Readability

  Consistency in coding makes reading the code a piece of cake for new developers on an ongoing project, which adds to their productivity.

- Ease of Maintenance

  Decoupled components are replaceable with better implementations. Simply put, it enables efficient code maintenance and update.

5.1.2 Selection of Tools

During the implementation of the proposed Result Management System experience on onset tools were needed. By creating models of the system using tools helped in the system development making the making the development continent and easy for the developer. Selections of tools were done in a way such that the selected tools are compatible with the development. Following are some tools used,

- Server Support

  We used firebase hosting to serve our website to our clients, Firebase hosting includes the Firebase CLI, where you can get your app up and running in seconds. Command line tools make it easy to add deployment targets into your build process. Firebase Hosting is a free micro service provided by google that also allows us to rollback a website if there are any bugs or fixes

- Code Editors
  VS Code includes enriched built-in support for Node.js development with JavaScript and TypeScript, powered by the same underlying technologies that drive Visual Studio. VS Code also includes great tooling for web technologies such as JSX/React, HTML, CSS, SCSS, Less, and JSON.

5.1.3 System Development Strategy

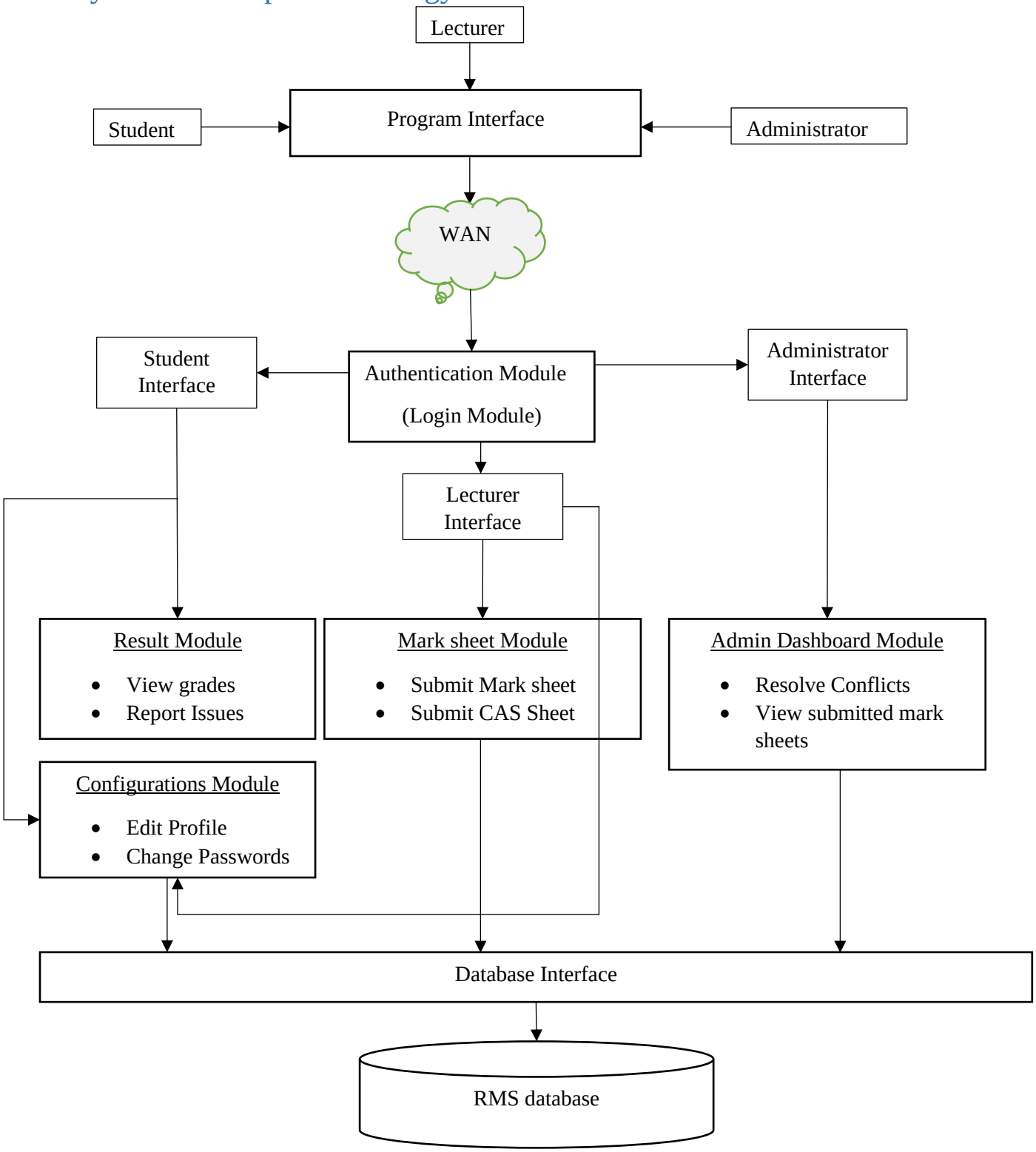


Figure 30 : System Development Strategy

System development strategy displays the development of Result management system for KDU. Implementing prototypes by looking at the interfaces are the initial act. Interface of prototypes let the user to understand and classify the flow of the system. Prototypes of interfaces acts as a usable prototype rather than looking about the functions of the system. By looking at the interfaces and flow of modules clients accept the model.

At later development proceeding with the module and database design in order, make the system complete in a modular type rather than developing the whole as single.

5.2 Testing

This stage is one of the prime tasks to ensure success of the new Result Management System. The testing of the system can be done at any time, for instance, testing the UI, and other important modules and functionalities.

This also means to issue an error/bug free system.

5.2.1 Objectives of testing the new system

The main aim of system development is to produce the proposed RMS in a usable, intuitive, simple, and functional way. Which can be taken as the objectives of the system testing.

- Explore Functionality of the system

  System tests are being done to see whether system is functioning with the implemented functions. Exploring the functionality through test cases, emphasize the fact that all the functional requirements are fulfilled. In most of test cases, in order to explore the functional achievements of the system, Functional prototypes are used.

- Identification of any, misinterpretation, misunderstanding and missing requirements

  Initial requirements are gathered and analyzed in the initial requirement gathering phase. Testing the system is helpful in identifying, “what the actual requirement is?” Hence, testing is useful in developing the system accurately by getting the feedback from the user regarding the requirement fulfillment.

- Identification of Connectivity with the database

The system developed must be checked against for the connectivity issues. Critical issues will be generated if RMS is not properly connected to the database, since connectivity to the database is prime to test the functionality of the system.

- Identification of errors in the Development

It is essential to have test runs to detect errors during system development. Error checking of the system testing can be started from the initial stage of the system development. Errors may occur due to coding errors, errors in connecting to the database (as mention in the above point), system compatibility issues with the platforms and with the server etc.

- Fulfilment of the non-functional requirements of the system

Checking of non-functional requirements such as Usability, performance, efficiency and security can be checked through the testing process.

- To rectify the flow of the system

By System testing we can make sure the system flows correctly by conducting integration testing on the intertwined system modules.

5.2.2 Testing Strategy

The test levels to be performed in testing and the description of testing activities within the test levels are known as test strategy. There are primarily three levels of testing as unit testing, integration testing and system testing.

- **Unit Testing**

The testing of an individual unit or group of related units is Unit testing. It is usually done by the programmer to test that the unit he/she has implemented is giving out the expected output when given input. It reduces the level of bugs in system and discovers usability issues.

The proposed system is a component-based development. The most convenient way of finding the bugs at the basic level is the unit testing. Unit testing is a fast testing level that will give out the result in less than a half a minute. Therefore, usage of unit testing level is prominent throughout the development process of proposed ASRS. Following Table shows the component and the objective of testing in that component.

Components	Description
Authentication/Login Module	All the Subscribers and Student Users are considered as users here as they prefer login as a lecturer or a student user. Each user is provided a unique username and password given by the campus administration, through that we verify from our database and redirect the user to respective dashboard.
Administrator Dashboard Module	Administrator can log into the system view and resolve any conflicts in the submitted mark sheet from the setter and moderator of each specific module.
Duty Module/ Role Assign Module	Administrator should assign setters and moderators for mark sheet submission.

Student Dashboard Module	Students must be able to view GPA tables, current KDU events and notices.
Student Results Module	Students' individual GPV values are displayed for each module.
Settings Module	Every user can change their respective password and specific credentials.
Editor Dashboard Module	Any lecturer who is assigned to a module will be able to view an overview of the performance of students along with a graph that represents the mark distribution for his/her respective module.
Mark sheet Module	Setters/Moderators Submit marks that are updated in the database, then later updated by the administrator if there are any conflicts.
Semester Achieve	Every mark sheet which has been submitted and approved by the administrator is shown categories according to the stream, intake, and submission date. Reports can be printed according to the required category.
Report Module	Summarized charts will be displayed for each module respectively.

Table 6 : Test Plan – Unit Testing

- **Integration Testing**

Testing of a group of components that are combined to produce an output is Integration testing. Also, in integration testing the interaction between software and hardware is done if the software and hardware components have any relation.

Integration testing works by getting the individual units that have been identified through the unit testing phase and integration of set of modules into a group. The integration testing phase makes sure that while the modules are being integrated together errors or bugs caused due to the integration of the modules are eliminated.

Components	Description
Authentication/Login Module	Users who have been authenticated as an ***administrator*** can access our system with administration privileges though the login module. Each user will be redirected according to their role.
Administrator Dashboard Module	Administrator and resolve conflicts in results in administrator dashboard if any exists, the conflicts must be updated as soon as the mark sheets are submitted by the mark sheet module, also assigning roles such as setter and moderator to users is done by Duty Module.
Duty Module/ Role Assign Module	
Student Dashboard Module	***Students*** must be redirected to a static page which displays the current events, GPA, and previous attempts of the user
Student Results Module	Students can view their previous GPV values, and report if any issues in the results.
Settings Module	***Any user*** can change his/her essential attributes such as passwords with proper validation and verification.
Editor Dashboard Module	***Setters/Moderators*** can generate previously submitted results, along with summarized reports of each module done by students.
Mark sheet Module	Again, the lecturer is able view mark distribution for all her modules. Mark sheets are submitted by the mark sheet module and updated in the database as well.
Semester Achieve	
Report Module	

Table 7 : Test plan - Integration testing

- **System Testing**

  As defined in software requirement's testing the behavior of the whole software/system is known as system testing. System testing is accomplished with full system implementation and environment. After integration testing is completed. The main aim of this test is to check the functional and non-functional requirements of the system. Also, system testing gives special importance to how the system will react in the real environment of the system implementation and issues that will arise; bugs and also the developer will be able to come across new requirements of the client in order to make the system a more successful product.

Components	Description
Authentication/Login Module	***Users*** provide a unique username and through that we verify from our database and redirect the user to their dashboard, respectively. Each Module must function and behave according to the user roles. Users without authentication are redirected to their respective dashboard if they try to access a module with is not with in their rights.
Administrator Dashboard Module	
Duty Module/ Role Assign Module	
Student Dashboard Module	
Student Results Module	
Settings Module	
Editor Dashboard Module	
Mark sheet Module	
Semester Achieve	
Report Module	

Table 8 : Test Plan – System Testing

5.2.3 Test Deliverables

The artifacts that are given to the stakeholders of the system project are known as test deliverables. Different test deliverables are used at different phases of the system development such as reports, charts and other documents which is provided on a regular basis. Some test deliverables are provided before and some are provided after the testing phase while some are provided after the testing cycle is over.

5.2.4 Errors and Bugs

- **Firebase Security rule errors**

We came across this error in some situations. This usually occurs when an unauthorized personal try to access an area, update unauthorized information or has an unstable internet connection. This error was fixed by validating logged in users with additional algorithms.

Figure 31 : Firebase security error

- **REST API errors**

Issues in the database connections occur when written invalid connection string or due to server incompatibility problems.

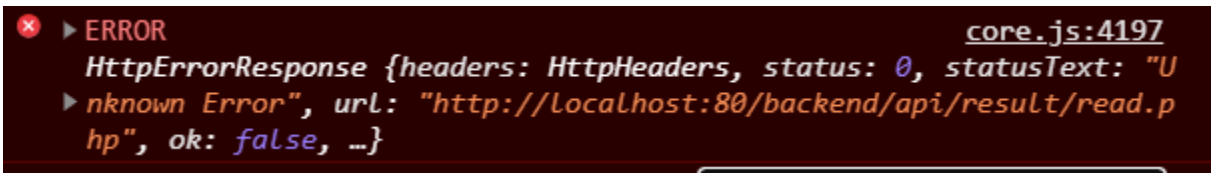


Figure 32 : REST API errors

- Error connecting to server

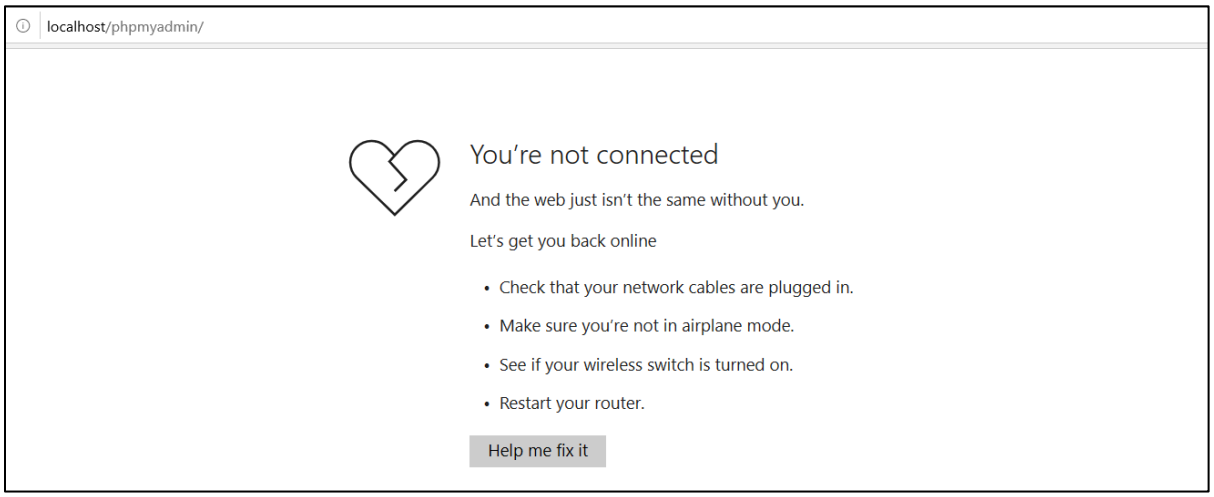


Figure 33 : Error connecting to server

- Errors on connecting SQL database

  Issues in the database connections occur when written invalid connection string or due to server incompatibility problems.

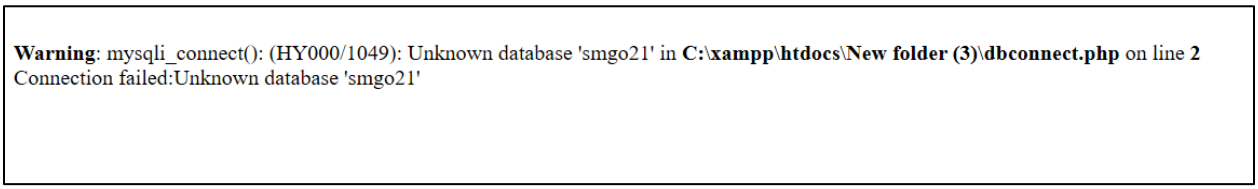


Figure 34 : Error on connecting SQL database

5.3 Implementation Plan

In the implementation stage, this part of the proposed system is decided and planned. the outcome of the implementation plan is to identify how the developed system will be deployed and transitioned into fully functional system. This plan will provide an overview of the system, i.e. major tasks which will be involved during the implementation and other requirements which supports to the implementation process.

5.3.1 System Overview

Functionalities of RMS are mainly focus on the students and lecturers. As a student we require to simply view results for the relevant semesters. For the lecturers however, are able to carry out assigning marks for each question for each paper, get a summarized report, publish results, and review student performance, and performance of earlier intakes for the same module using semester archives.

5.3.2 System Changeover

System changeover is about how the developed system should be implemented in the real environment. Out of the implementation methods we chose the Direct method as the most convenient method to our system. Because there is no old system to compare or work parallely on incase the new system does not work as expected.

5.3.3 User Training

User training is not mandatory since the application is straight-forward and easy to understand. The success of the system fully depends on the accurate mark/grade assignment of lecturers.

5.4 Summary

This whole chapter is about the system implementation and testing of the proposed system Result management system for KDU. The implementation phase represents how the system is developed and implemented. Also, this phase concentrates on the detailed description about how the system is developed with using appropriate selection of languages, tools, how the system is going to implement and whether the system needs user training or not.

The other major phase discussed in this chapter was the System testing. The system testing is done to check if the development is according to the requirements, to check the flow of the system etc. The errors that occur in the system are discussed in more detail in the testing phase.

Chapter 06: System Evaluation

6.0 Introduction

Assessment of the system about the analysis of the project, comprehensive description of the objectives achieved, the issues encountered throughout the course of the project and knowledge that are gathered by providing solutions for such problems will be discussed. Also give a detailed explanation on the measures that are taken to manage the occurred problems. Majorly the evaluation section is about, how much the system created gives solutions for the user requirements gathered at the initial section of development.

6.1 Evaluation on the Project Development Process

Evaluating the project proposal and also the deviations occurred throughout the phases of the project, success of the methods and also the difficulties faced are mentioned within the followings. Phases of the project are known as analysis, design and implementation.

6.1.1 Analysis Phase

In the data analysis part, conducting interviews, observations, and rummaging the present documents were the adopted methodologies. This phase plays as a crucial method since correct identification of user needs can facilitate to complete the project on time with less range of modifications once implementation.

- **Processes adopted in the Analysis Phase**
    - Fact finding
    - Identifying problems and limitations of the current system
    - Identifying functional and non-functional requirements for the system
    - Modeling this system and therefore the planned system via miniature specification languages like flow charts, sequence diagrams, activity diagrams, category diagrams.

- **Evaluating Analysis Phase**

According to the multiple interviews conducted we had certain doubts that had to be clarified, the reason why we used the interview approach is so that we could get a verbal explanation so that it would be easy for both our team and the interviewee to portray and understand the ideas given by both parties, rather than using a questionnaire approach which wouldn't be as understandable. We conducted the interviews after entire preparation of interview questions to reduce the time consumption, get exact requirements and increase the efficiency in conducting the interview. However, conducting interview was kind of delayed due to problems in allocation of time through appointments. Unavailability of reviewing certain documents which are very important in gathering information for the system implementation was avoided due to confidential reasons.

6.1.2 Design Phase

The system is designed to meet the expectations of the requirements identified in the analysis phase during the design phase. And the requirements identified in the Requirements Analysis Phase are transformed into a System Design Document that accurately describes the look of the system which will be used as an input to system development within the next section.

- **Processes adopted in the Design Phase**
    - Designing system, software and module architecture
    - Designing database
    - Designing interfaces
    - Integration of modules via system prototypes
    - Flow of the system modules are designed

- **Evaluating Design Phase**

This phase includes all the wireframes, prototypes, software architecture and elaborate module description diagrams concerning the system modules and people can depict the interaction among the system modules. Software design has been designed to give a transparent image concerning the elements of the system. All the databases were at first designed at this part. Interfaces were designed in order to develop the interface prototypes of the system. This part can carry an enormous responsibility on constructing the system in keeping with the specifications defined. All the initial constructions for the testing and implementation phases of the system are going to be carried out throughout this part.

6.1.3 Implementation Phase

This part carries a vast responsibility on constructing the system consistent with the specifications outlined. All the development, testing and implementation of the system will be meted out throughout this part.

- **Key process of implementation phase**
    - Identifying testing strategies
    - Design of Test plan
    - Identifying major tasks on implementation
    - Planning implementation

- **Evaluation of the Implementation Phase**

The overall development is done by integrating separately developed subcomponents together. Comprehensive tests have been administered throughout this phase before and after of modules so as to make sure of the development of a successful error free program.

Identifying the most important tasks of the implementation according to the correct implementation plan can let the implementation flow consistently.

Any error occurred during the implementation process directly affects the systems day to day processors so implementation plan should be done to minimize those kinds of risks. Minimize the implementation time by identifying the proper changeover method. Selection of a good testing strategy and correct implementation ways drove the implementation method to success.

6.1.4 Evaluation Criteria

Considering the achievements of the objectives of the system the evaluation of the development process is done. In order to achieve the aims of the development the objectives of the system are identified. Thus analysis of the achievements of the objectives, inherently evaluates the development process.

Objectives	Degree of Realization
Planning the system domain	Planning the system domain is that the initial objective to be achieved. Strategic study and also the business study conducted on the system development setting helps in understanding the domain relevant to the system development.
Identify the data collection protocols and gathering the requirements.	Data collection protocols have to be identified according to the domain of the system. Then the requirement gathering should be commenced with the identified protocols. Several requirements gathering protocols were more productive due to several reasons. The Mostly used data gathering system is interview.

Analyzing the data gathered.	Gathered data were analyzed. Analyzing of the acquired data effectively being handled so that the process of development can proceed with the implementation of the system with the clear idea about the users requirements in a more organized manner.
Identifying and design the modules of the proposed system.	Designing the modules of the planned system is being done using flow charts, class diagrams, activity diagrams and sequence diagrams. Data design is designed with the knowledge of drawing the ERD. In here, separate modules that ought to be developed within the system area unit known.
Evaluation of the identified modules of the system.	Evaluation of the modules of the system checks the availability of technology for the known modules and rechecks the wants of the system against the designed modules. In here, prototypes are used to get the user acceptance of the identified modules against the wants of the user and also can check whether or not the suitable technology is used or not.

Table 9 : Process Evaluation Source: Author

6.2 Evaluating the Product

To ensure weather the developed system has all the required functional requirements of the users from both the lecturers and students side system evaluation is done. Also, additionally system evaluation shows the non-functional requirements of the system.

Functional Requirements describe the tasks expected to be performed using our system. In our desktop application we are going to provide following features:

- A new document to be filled which is a collaboration of the three sheets- detailed mark sheet, marks returned sheet and comments sheet. This sheet contains all relevant fields which make the document contain less redundant fields and substitute certain fields which simply can be generated automatically. (e.g.: - **Total** which can be calculated by adding marks for each question)
- Faster transfer of documents to and from relevant people
- Providing summarized reports for each individual student
- Ability to confirm setter and moderator
- Preparing Class/Group-wise Result
- Graphical view of students' performance
- Allows to generate result of students for different examination and different types of exams during the year as oral, practical, written, etc. [1]
- Manage the results of the university students and keep a record of results of the students throughout the year.

Non-Functional Requirements are as follows

- Usability: The web application should be able to use without any extra effort. The initial configurations should be easy to learn.
- Reliability: since we are providing students information and some notifications to the lecturers, that information must be reliable, and the user should be able to depend on those details.
- Start -up-time: The startup time of the app should be minimum in order to increase the efficiency.
- Security: Outside users cannot access student and lecturer details. Need to take database backup in case of crashing database due to virus or OS failure.
- Scalability: It can be easily run in any platform.
- Application size: The web app size must be compact to download.
- Responsiveness: The web app should complete the task according to the given time.
- Efficiency: User can easily access the system and search very fast.
- Delivery: The entire system is expected to be delivered in one year of time.

6.2.1 Methods of Evaluation of the product

Following methods are used in the system evaluation.

- **Interviews**

  Feedbacks about the new system were identified through the initial interviews conducted with several lecturers including the HOD of computer science using the system. Instant user feedbacks about the system were also important.

- **Observation**

  Observation let to gather facts about how the implemented system is used in the real environment. Whether the system is user friendly or hard to use and understand. Our results management system is very much user friendly.

6.2.2 Evaluation Criteria

By comparing the functions of the newly created system against the issues and limitations noted during the requirement gathering process evaluation of the system is done. System evaluation is done under the following criteria,

- Functionality of the system
- User friendliness of the system
- Accuracy of the system
- Efficiency of the system
- Productivity of the system
- Compatibility of the system

6.2.3 Problems Addressed

Lecturers and students are identified as the evaluators of the system. And the following discuss the problems that they face.

Evaluators	Problems addressed on current system
Lecturers	• Need to fill 3 mark sheets manually, hence time consuming • Cannot view a summarized report of student's examination results
Students	• Delay in the release in examination results • Not being able to view their result on a system

Table 10 : Identifying evaluators and problems addressed. Source: Author

6.2.4 Evaluating the Process Solution Provided

In here, the effectiveness of the solutions for the problems in the current system is addressed from the users.

Problems addressed on current system	Solution Provided
• Need to fill 3 mark sheets manually, hence time consuming	• Two mark sheets (End exam and CAS mark sheets) can be imported to the system. And also any mark adjustments can be done on the system itself. Afterwards the final mark sheet can be obtained through the system hence duplication of entering marks will be avoided, as the system will automatically take relevant

	information from the two mark sheets that were imported to the final mark sheet.
• Cannot view a summarized report of a student's examination results	• Lectures will be able to generate a summarized report for each module, intake and stream and wise. • Ability to see the graphical representation(normal curve) of students' performance.
• Delay in the release in examination results • Not being able to view their result on a system	• Availability of results at a much earlier date could be a direct factor in improving students' results. • Students who have repeat exams will have enough time to be prepared when they get to know their results early as possible. • Students have the ability to view their result on the system at any time after the marks have been finalized.

Table 11 : Evaluating the Process Solution Provided Source

6.2.5 Evaluating Functional Requirements

The functional requirements are evaluated to identify if the systems components meet the specified requirements.

Functional Requirements	Component developed
Enable users to login to the system by entering the correct email and password	Login module
The web application enables the lecturer (setter and/or the moderator) to enter the results of students.	Mark sheet module
Ability to confirm setter and moderator	Assign lecturer module
Results can be viewed subject wise, stream wise, or even intake wise by lecturers	Semester archive module
Results can be viewed by students	Student module
Graphical view of students' performance	Report module
Resolve conflicts of setter's and moderator's mark	Dashboard module
Users(lecturers, admin, students) can edit their profile	Configuration module

Table 12 : Evaluating the functional requirements

6.3 Project Achievements

Achievements made throughout the project are talked based on project's aim, objectives and functional requirements and nonfunctional requirements.

6.3.1 Project Aim

The aim of this results management system would be to build an efficient and easy to use system that could speed up the process of release of examination results.

6.3.2 Project objectives

1. Facilitate the release of examination in a timelier manner.
2. Computerize as many of the processes involved in the computation of examination results
3. Make the procedure easier and more efficient for all users of the system

6.3.3 Other Project Achievements

Apart from the project achievements mentioned above we also gained a lot of knowledge and experience that will be useful in future when we face challenges in project development. Involving in this project gave us a chance to apply the project management skills and programming skills we learnt which was a great opportunity to test those skills in a real environment. Some of the skills, lessons learned, and achievements gained are,

- Sharpened our project management skills such as negotiation, decision making skills etc.
- Gained knowledge about many programming languages
- Importance of time management
- Learnt about trending programming languages
- Importance of teamwork
- Effective communication skills
- Improvement in Critical thinking
- Improvement of writing skills

6.4 Summary

A detailed evaluation on the project and the system developed are provided to the user in this chapter. The project lifecycle phases are evaluated under project evaluation. By discussing the issues and functional requirements of the new system the implemented system is evaluated.

Chapter 07: Conclusion and Recommendation

7.0 Introduction

This chapter gives a full picture about the outcomes of the project, as well as milestones and goals achieved during the project. Future enhancements we are going to add to the project are also consider under this chapter.

7.1 Project Result Overview

Successfully completing objectives leads to achieving the aim of the project.

7.1.1 Lessons Learnt Via the Accomplishment of Project Objectives

This section mainly discusses about the learning outcomes of the project with relation to the project objectives.

Objectives	Lessons Learnt
Planning the System Domain	• We learnt that planning the scope of the system is a very important step in the development. • By analyzing strategic and organizational viewpoints of the development process, we gathered knowledge about the domain.
Requirement Elicitation	• When we identified the scope properly, we moved on to learning how to select the most appropriate data collection method. E.g.; Since this system is being used by three main roles of people (Admin,

	Lecturer, Student), we identified that interviewing one person from each role was the best option. • Outcomes of requirement gathering: ▪ Carrying out interviews, helped us improve our communication skills. ▪ We learnt to adapt in different situations such as when an interviewee gives an answer we weren't prepared for. ▪ We improved our ability to listen and gather information, whilst making note of the most important points mentioned. ▪ We learnt to speak clearly and confidently and ask questions in a concise manner. ▪ Overall we were to gain knowledge about conducting proper requirement gathering.
Analyzing the Data gathered through Requirement Engineering	• We improved our ability at problem solving. • Developed analytical skills. • Learnt to take decisions in necessary situations. • Gained the ability to deal with requirement specification methods like flow charts, pseudo codes etc.

Identifying and designing the modules of proposed URMS	• Gained experiences about phase designing and how to analyzing important requirements and divide them into modules. • Gained the ability to deals with requirement specification methods like flow charts, pseudo codes etc. • Learnt how design theories translate to real life scenarios. Eg: Normalizing databases may seem easy in theory but we found it to be more complicated when actually trying it out, especially when it came to the detailed mark sheet table.
Evaluation of the designed modules of the URMS	• Gained a wide knowledge about new development techniques such as new languages and frameworks.
Implementing the system	• Gained the ability of handling errors and dealing with databases. • Identified testing levels and carried them out.

Table 13 : Accomplishment of Project Objectives

7.2 Important Features of the System

We have identified some of the unique important features of the URMS that we developed. The implemented system will be more productive and efficient due to the following features.

- Strong Security Features

  Currently we have features such as passwords, authorization guards and user verification. Since confidentiality is of utmost importance when it to comes to data such as examination results, the security of our system must be top notch.

- Responsive Web Design

  Our web application also has a responsive web design which means it will be efficient and look presentable regardless of whether its accessed on a mobile device, PC, laptop etc.

- Python Notifier Application

  At the initial stage we were mainly focused on our web application because at that is the cornerstone of our project. But later we developed a Python URMS notifier application.

- Protecting confidential nature of students' results

  In the existing system exam results are posted to the noticeboard where it is visible for everyone to see. In our system students can view their results personally by logging into their respective student account.

7.3 Further Enhancement

We also identified recommendations that can be implemented to improve the current URMS that we developed. The implemented system will become even better if following recommendations are implemented.

- A notification system can be developed for the students to be notified when results have been posted and are available for viewing.

- A GPA predictor can be developed to help students identify what grades they would have to obtain in the future for their GPA to be within the first or second class range.
- The project scope can be widened. At the moment the system can only be implemented for the Faculty of Computing at KDU. In the future, the system can be adjusted dos that it can be used for all faculties across KDU.
- A mobile application can be developed based on the web application for Android or IOS users.

7.4 Project Conclusion

In existing results management system most of the processes are manual and thus the process of computation of examination results for end semester examinations at KDU is taxing, time consuming and causes many delays. We believe that with the implementation of our results management system, we could help to alleviate many of these problems and make the process more user friendly and efficient.

Our URMS also brings in many features that the old system did not have such as the use of two mark sheets instead of three to minimize redundancy, the ability for students to check results online, performance reports for students, graphical representation of grades per subject, broadcast messaging, automated procedures for the HOD to select setter and moderator, automated procedure for the HOD to settle discrepancies in marks etc.

In addition, our system has unique and important features that improve its security and efficiency. For example, it has authorization guards to help with the security of the web application. Furthermore, the firebase rules are very strong and provides added security to our database of users. Our web application also has a responsive web design which means it will be efficient regardless of whether its accessed on a mobile device or PC.

All three types of users of the system- the lecturers, Admin (HOD) and students will benefit from it as it will greatly reduce their manual tasks, make their work more efficient and have the whole process happen at a faster pace.

The entire project process concludes as an effective development of a University results management system.

7.5 Summary

This chapter is the conclusion of the overall idea of the system development. The entire overview of the result of the project was shown through the learning experience gained throughout the project development with respect to the objectives.

The project was conducted as a group project where a group of students worked for a common goal for a time period of ten months. Therefore, good communication skills between the members and unity among them was essential to achieve our goal within the scheduled limited period of time. These qualities cannot be gained through an individual project. As well as the time management the work was divided among the members of the group. So the work load for a member is more manageable than individual projects.

The real time experience in system development was invaluable to students who are undergraduates of the computing field. In addition, the periodic documentation we provided throughout the development enhanced our documentation skills. Thus, this module is beneficial for sharpening our knowledge in all aspects of system development.

Furthermore, this chapter includes recommendations for the implemented URMS in order to increase productivity and performance.

References

[1]"Exam Result Management", *Iolite.org.in*, 2020. [Online]. Available: https://www.iolite.org.in/exam-result-management/. [Accessed: 06- Feb- 2020].

[2] Development of Students Results Management system. (2020). [online] Researchgate. Available at: http://www.researchgate.net [Accessed 6 Feb. 2020].

[3]"TeamGantt", *App.teamgantt.com*, 2020. [Online]. Available: https://app.teamgantt.com/. [Accessed: 06- Feb- 2020].

[4]"Exam & Result Management System (ERMS)", *Virtual University Projects*, 2020. [Online]. Available: https://vuprojects.net/index.php/portfolio-items/exam-result-management-system-erms/. [Accessed: 06- Feb- 2020].

[5] Problem Statement Form Results Management System. (2020). [online] University of UYO. Available at: https://www.researchgate.net/figure/Problem-statement-for-Result-Management-System-as-taken-from-case-study [Accessed 6 Feb. 2020].

Appendix A

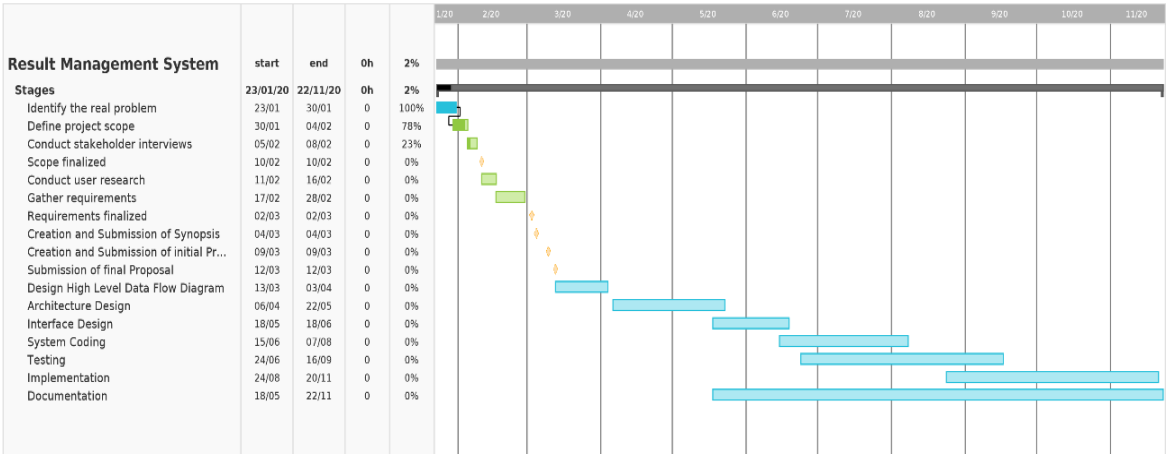


Figure 35 : Time plan

Appendix B

- **Interview Questions**

Interviews were conducted with the individuals representing the three roles of the system. (Admin, Lecturer and Students). The questions that we asked from them were pre-prepared for the interview sessions. The questions asked from each individual are given below:

Interview Questions for the HOD- Dr. Pradeep Kalansooriya:

1. What is the scope behind our software?
2. Who gets to mark the relevant papers?
3. What is the process behind the current results management system?
4. What are the additional features we could add into the software?
5. Who are the authorized respective individuals for each stage?

Interview Questions for Lecturer- Major RMM Pradeep:

1. What would you say are the drawbacks in the current system?
2. What are the additional features we could add into the software?
3. Would it be easier to fill the mark sheets through Excel as opposed to manually?
4. Are you able to keep track of students' performance for your modules through the current system?

Interview Questions for Lecturer- Major RMM Pradeep:

1. What would you say are the drawbacks in the current system?
2. What are the additional features we could add into the software?
3. Would you prefer to view your results in a more personal setting as opposed to the noticeboard?
4. Has your performance at exams been affected by the delay in releasing results?

Productivity and the Accuracy of the Data Collection Protocols: Interviews

We identified the interviews as the main technique to capture the data related to Results Management System.

d. Interview No :01

Interview No 01	Objectives
Pre Plan Interviewee: Head of the Department (HOD – Dr. Pradeep Kalansooriya) Date: February 2020 Venue: University Premises	▪ Planned to have a meeting with the HOD as he is the head of the section and the admin user of the system. ▪ Hoped to identify major system requirements as well as flaws of existing system. ▪ Expected a briefing on the procedure that is followed in the marking of examination papers.
Actual Plan Interviewee: Head of the Department (HOD – Dr. Pradeep Kalansooriya) Date: February 2020 Venue: University Premises	▪ Conducted the interview as expected. ▪ Was able to clearly note down the whole results process from when the exam is first conducted to when results are handed over to the exam board. ▪ Identified the main users of the system and the roles and responsibilities of each such user.

Table 14 : Interview 1

Comment: Gained a great deal of knowledge about current system and what is expected from the new system.

e. Interview No: 02

Interview No 02	Objectives
Pre Plan Interviewee: Lecturer (Major RMM Pradeep) Date: March 2020 Venue: University Premises	▪ Planned to meet a lecturer as they are one of the main users of our planned URMS. ▪ Hoped to identify the system requirements specific to lecturers and understand how we can make their job easier and more efficient.
Actual Plan Interviewee: Lecturer (Major RMM Pradeep) Date: March 2020 Venue: University Premises	▪ Met Major Pradeep and identified what requirements the lecturers would need from the system. ▪ Identified issues the lecturers have with the current system. ▪ Noted down his requirement for lecturers to be able to view previous results of students.

Table 15 : Interview 2

Comment: Gained some insights about how the lecturer login should be designed and the features it must have.

f. Interview No: 03

Interview No 03	Objectives
Pre Plan Interviewee: Student Date: March 2020 Venue: University Premises	▪ Planned to meet a student as they are one of the main users of our planned URMS. ▪ Hoped to identify the system requirements specific to students and understand how we can make the URMS cater to their needs.
Actual Plan Interviewee: Student Date: March 2020 Venue: University Premises	▪ Met the student and identified what requirements the students would need from the system and why they require it. ▪ Identified the student's main issues with the current system.

Table 16 : Interview 3

Comment: In addition to our own experiences as students, we gleaned information on what would be required by our fellow batch mates.