



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

DESIGN REPORT

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1.0 Introduction

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.

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, examination results could be made available far earlier for the students and the burden placed on administrative staff and lectures would be reduced.

Thus, an Examination Results Management system could be the solution to this problem.

This document is the design report for the Examination Results Management System. This contains details under 4 main titles, namely Overall System Architecture, Software Architecture, Data Design and Interface Design.

The first subtitle is the Overall System Architecture. This contains information about 3 layers: The Presentation layer, Application layer and Data layer. We have described those layers with the aid of a diagram to give a clear idea about the process.

Software architecture is the next subtitle in the design report. This is based on a modularized approach, where the software processes are divided into parts. This section contains a list of modules and explanations about the modules.

Data design is the third subtitle in the design report. This section of the document represents the conceptual data design of the system, the process of converting this design into tables along with diagrams. The tables of the database are also started with their attributes and data types.

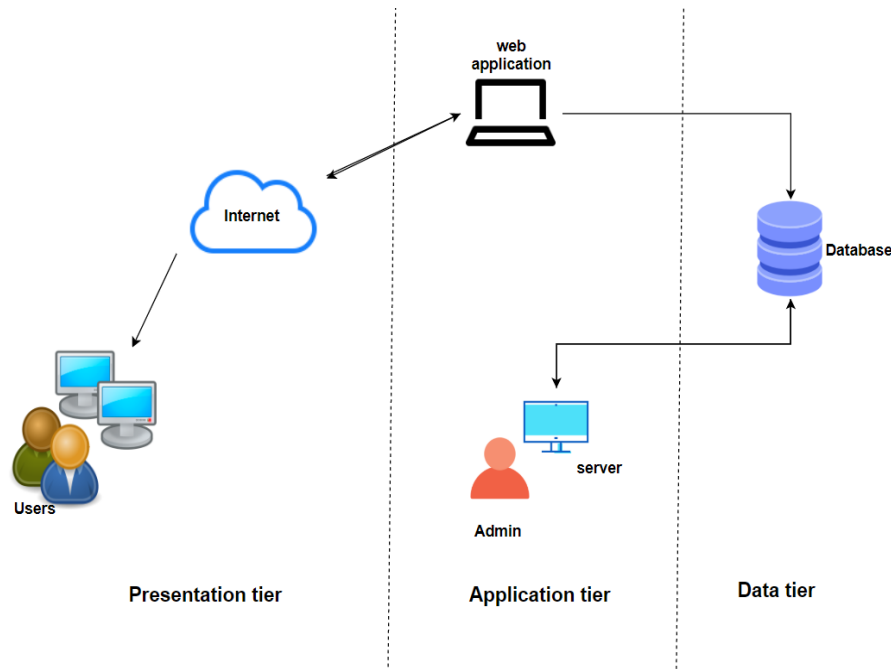
The final subtitle is about the Interface Design. This contains the interface designs for various parts of the system with a brief description.

2.0 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;



2.1 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.

2.2 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 firebase 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.

2.3 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.

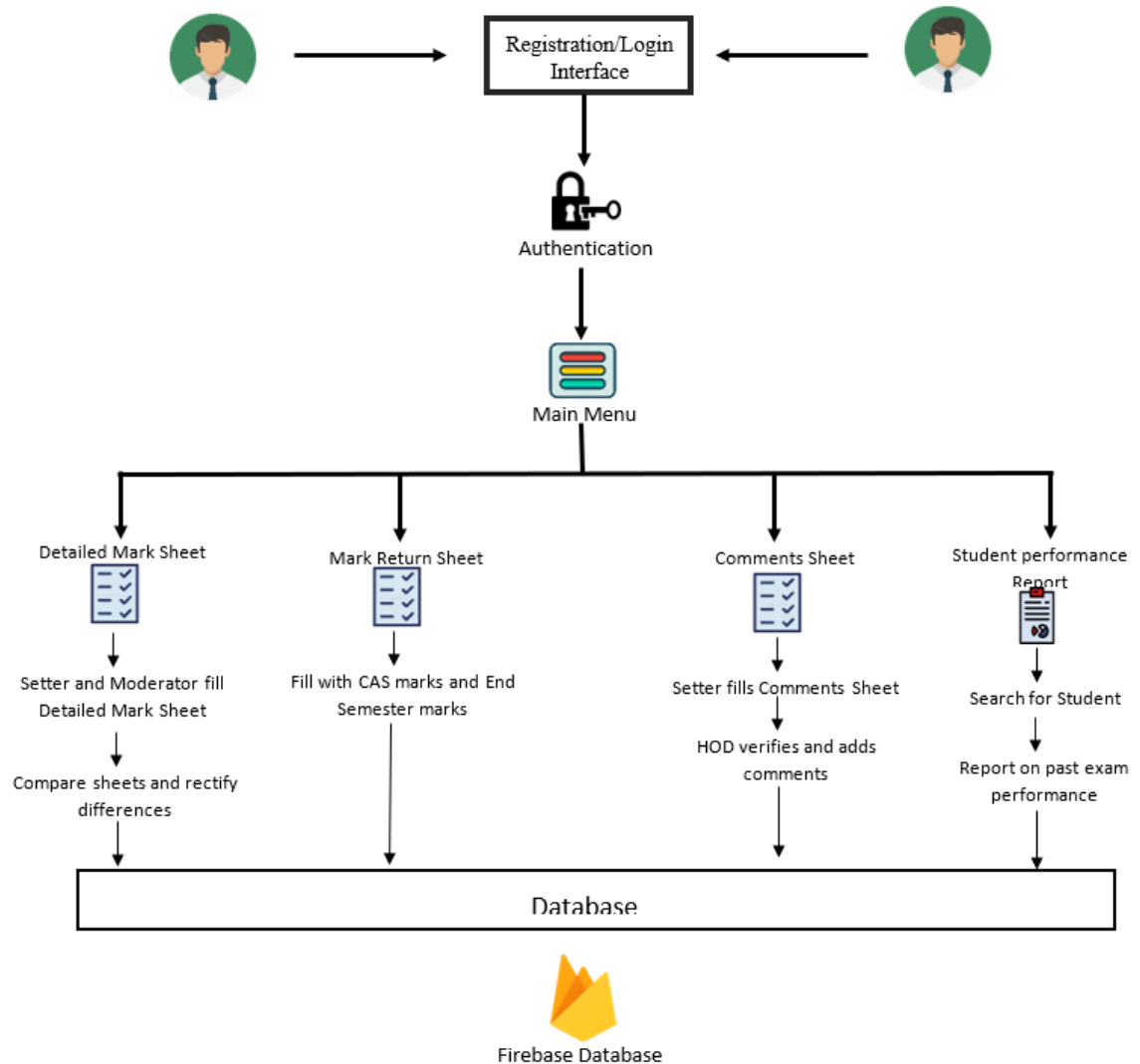
For an example when a user (lecturer, HOD, administrative staff) is trying to log into our system using login interface they have to enter their username and the password in the correct place we have provided by using text boxes and proceed with clicking login button, if user is available in the database 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.

3.0 Software Architecture

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.

3.1 Overall Software Architecture

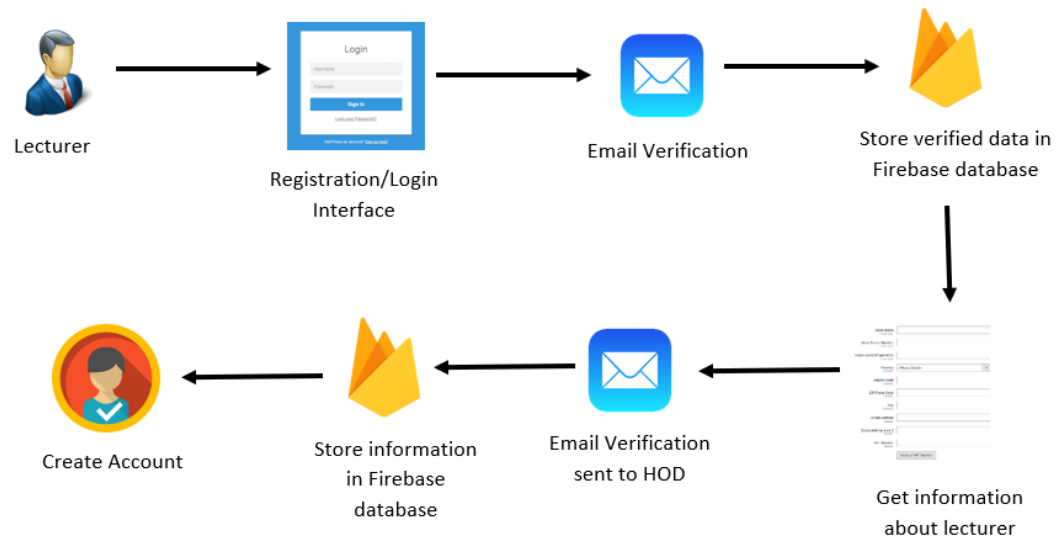
Following figure represents the overall system architecture of the developing system.



3.2 Module Architecture

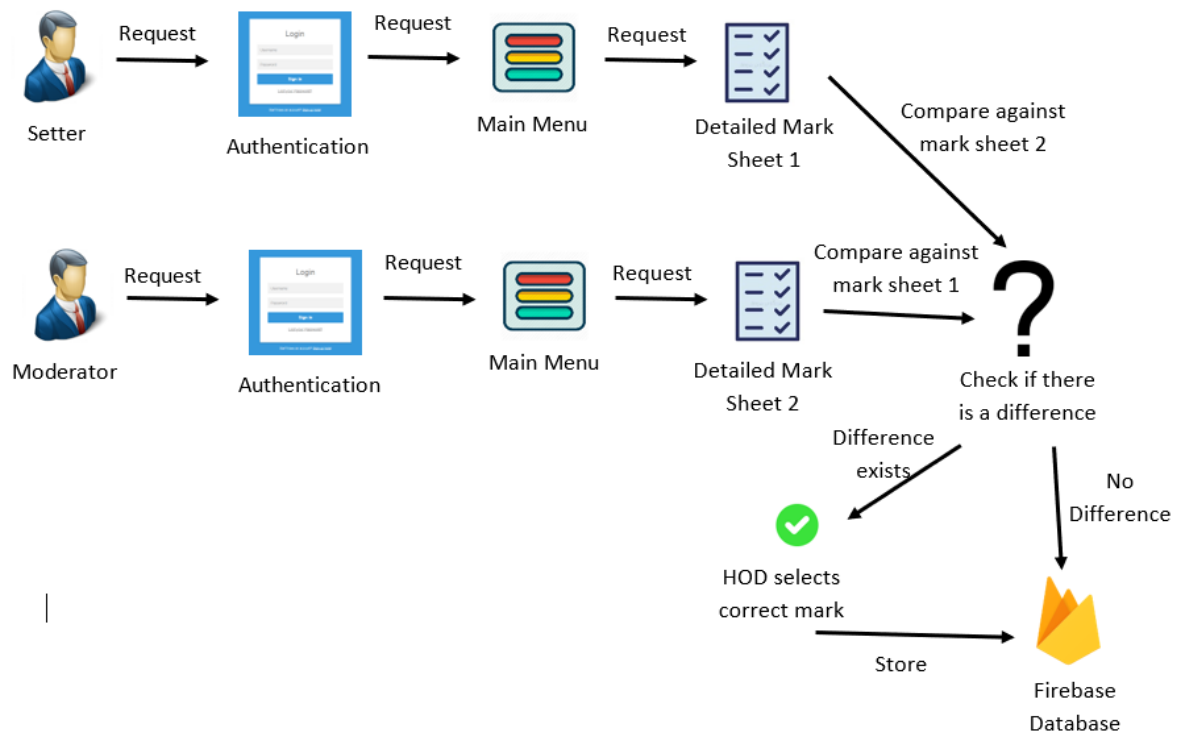
The developing of a computerized Results Management system contains several modules to make the complete system. This section will describe about the organization of the modules that it consists.

Module 1: Registration / Login Module



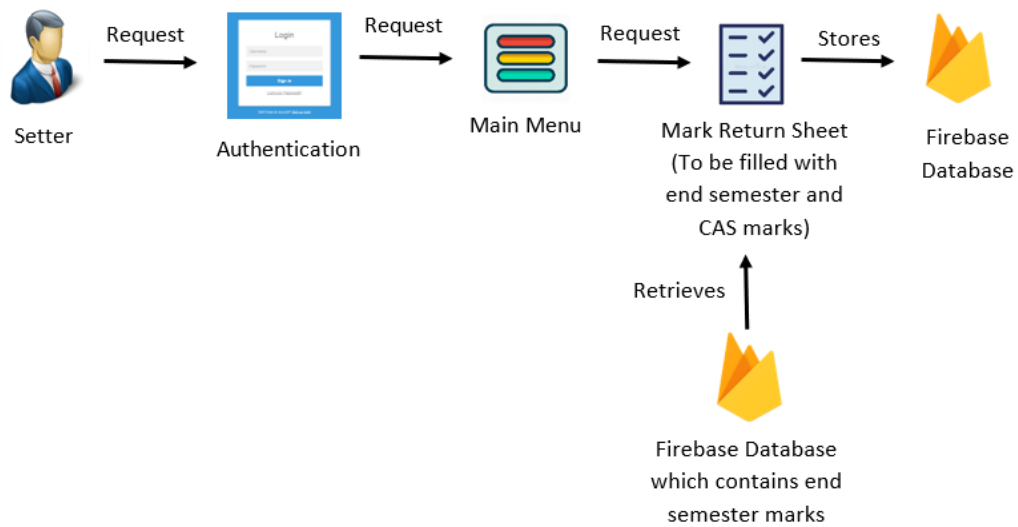
Lecturers have to register on the web application. An email verification will be sent to the email address given by the user. The account will then be verified and the user can log in using the username and password saved in the firebase database. Then user can then create their own profile by including their subjects and selecting if they are a moderator or setter. An email will be sent to the HOD to verify this information. Afterwards, their information will be stored in firebase database and an account will be created.

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



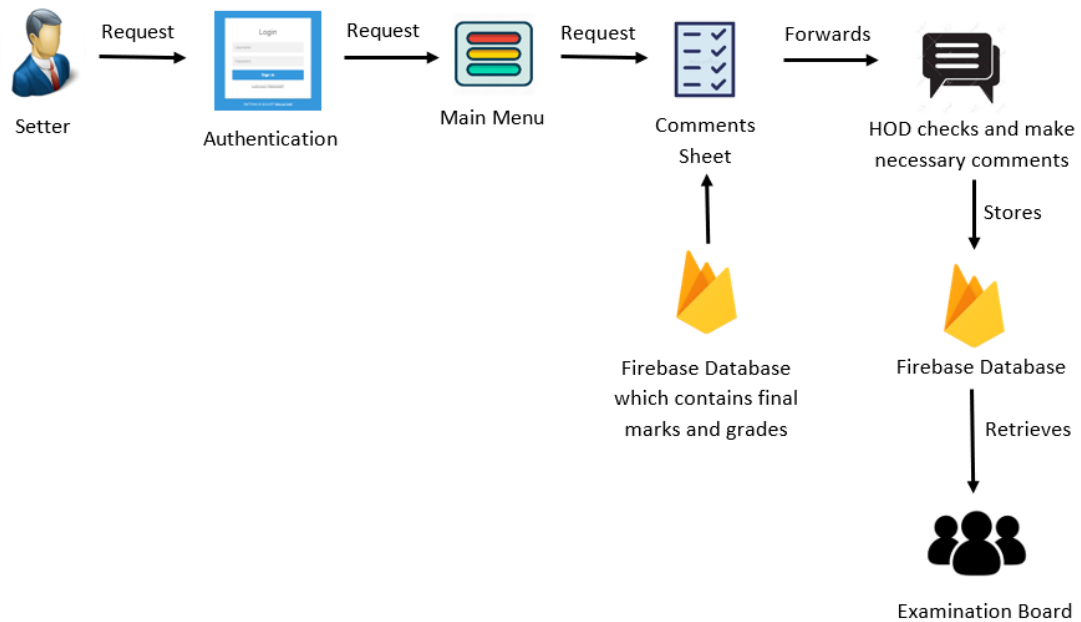
Both the setter and moderator of a subject will log in to the system and fill in two detailed mark sheets. The marks in the detailed mark sheets will be analyzed to find differences in marks between the two sheets. If there is a significant difference, it will be sent to the HOD for him to verify proper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

Module 3: Setter fills Mark Return sheet for a subject



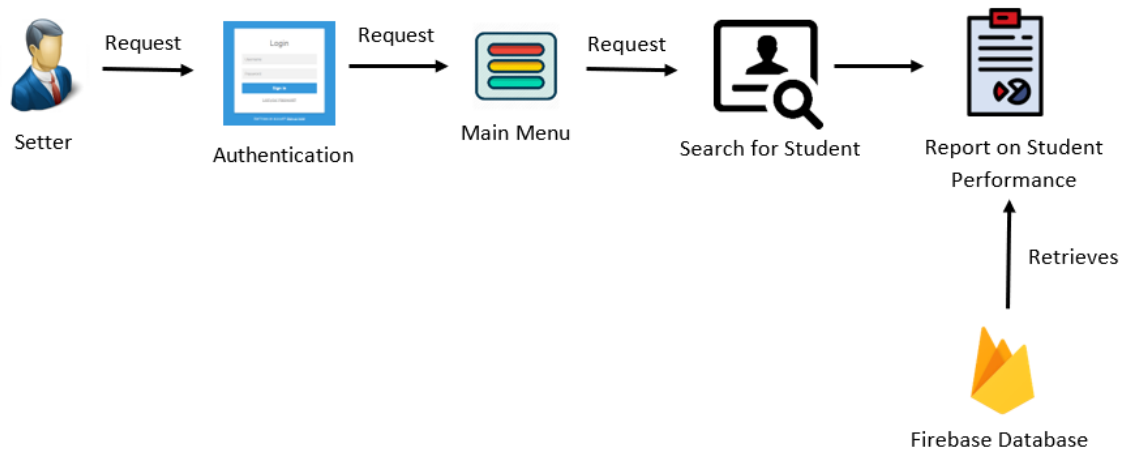
The setter will log in and fill the mark return sheet with both end semester and continuous assessment (CAS) marks. The end semester marks will autofill for each student as it can be retrieved from the database where it is saved from module 2 previously. Afterwards the information in the mark return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

Module 4: Setter fills Comments Sheet for a subject



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 Firebase database. All the databases from modules 2, 3 and 4 can be accessed by the examination board.

Module 5: Lecturer checks report on student's performance



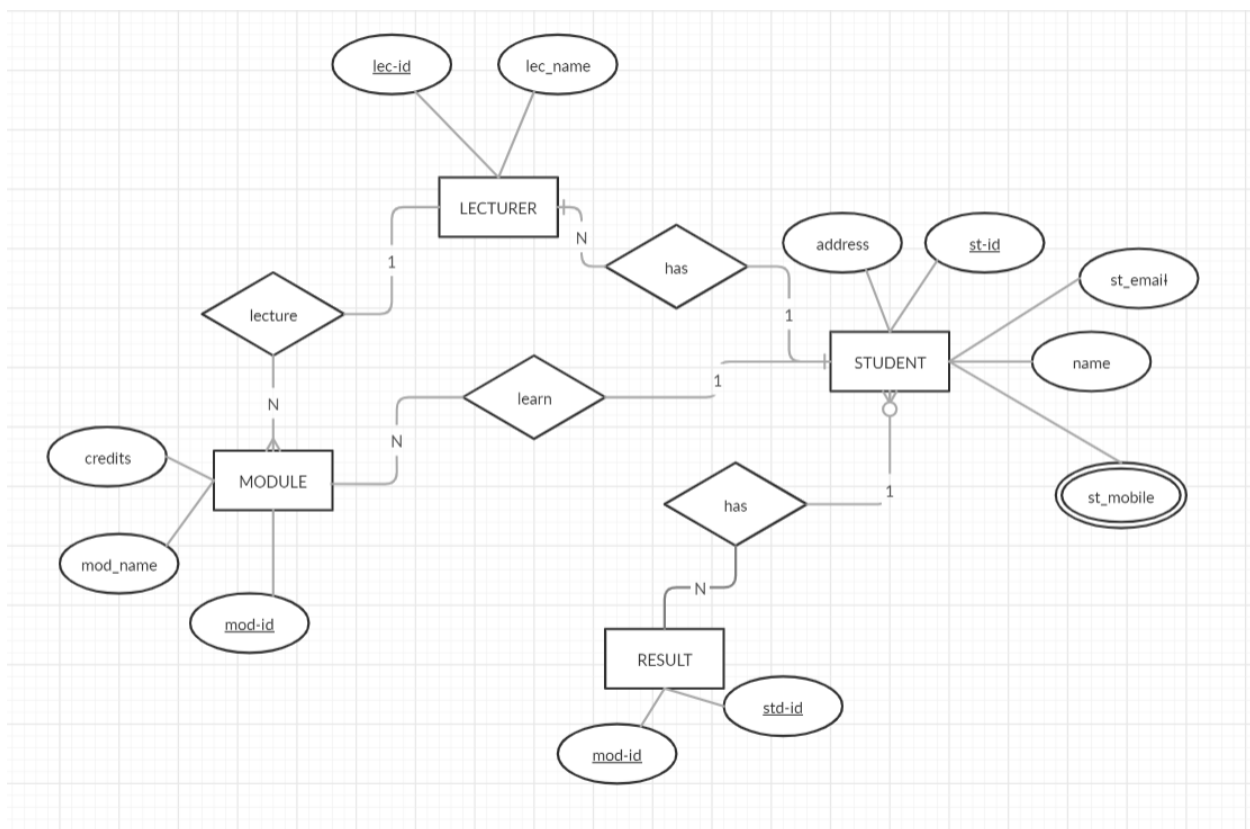
A lecturer will log in and search for a specific student's past examination performance. This information will be retrieved from the Firebase Database where it is stored in Modules 2,3 and 4. It will be displayed for the user in the form of a report.

4.0 Data Design

The Results Management System will have a one centralized database in the server. Firebase real-time Database 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.

4.1 Conceptual Database

The following figure shows the ER Diagram for the Result Management System.



4.2 Mapping of Logical Database to Relations

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 |

4.3 Data Type Design for the Database

| 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: MODULE

5.0 Interface Design

All the interfaces designed are responsive and mobile friendly, the interfaces are designed with Materialize CSS and few tweaks of angular material. The interfaces are designed with a consistency to make the system as minimal as to make the experience totally intuitive.

5.1 User Login Interface

Users require an authenticated email and a password, or if the authenticated user has a social account such as google, the user can access the RMS (Result management system). In that case first user needs must enter a valid email and a password to access the system. When submitting the email and password firebase authentication checks the validity of the given data and if the given data is correct then the user is redirected to the main dashboard. Following figure shows the interface of the login window.

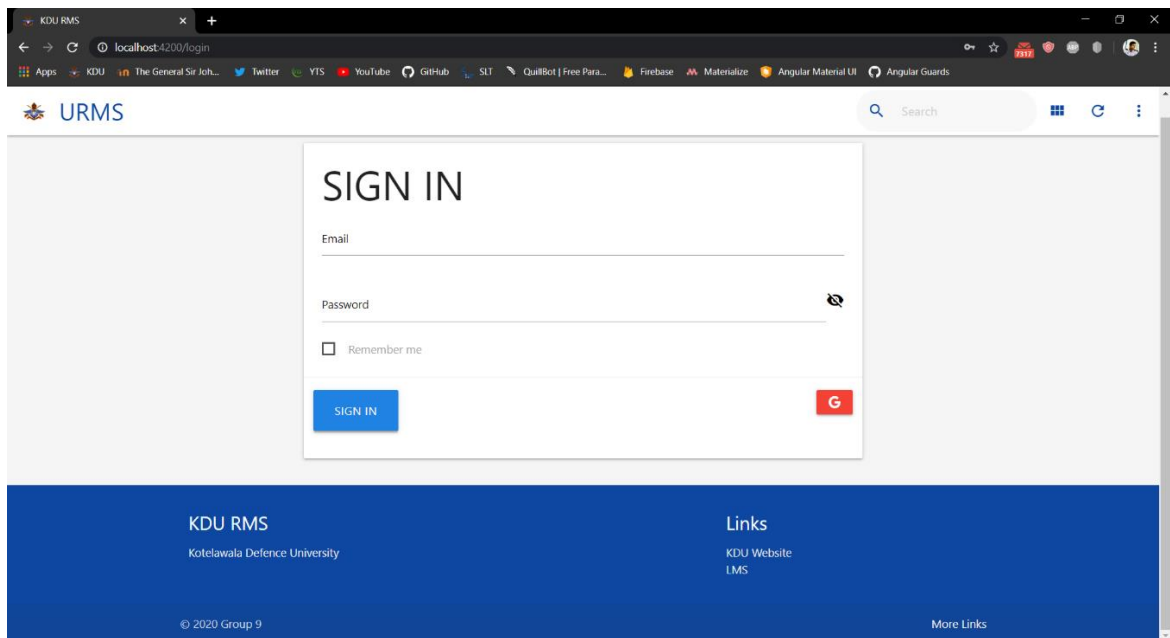


Figure 5.0.1 – User Login Interface – Role Based

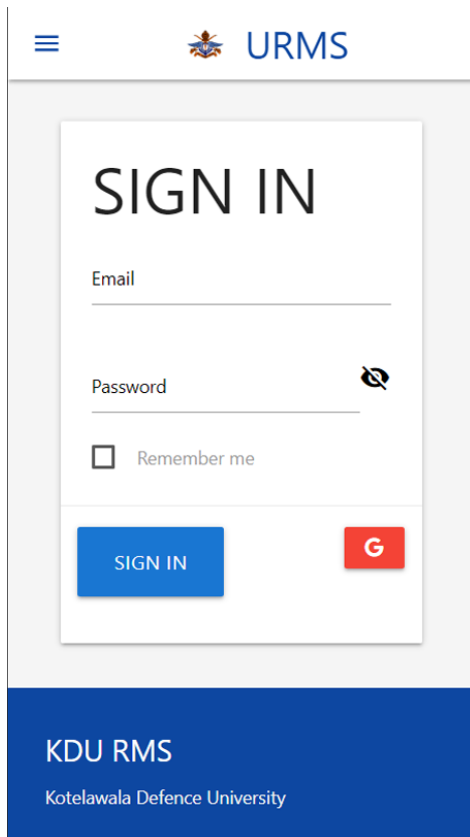


Figure 5.0.2 – User Login -Optimized for mobile

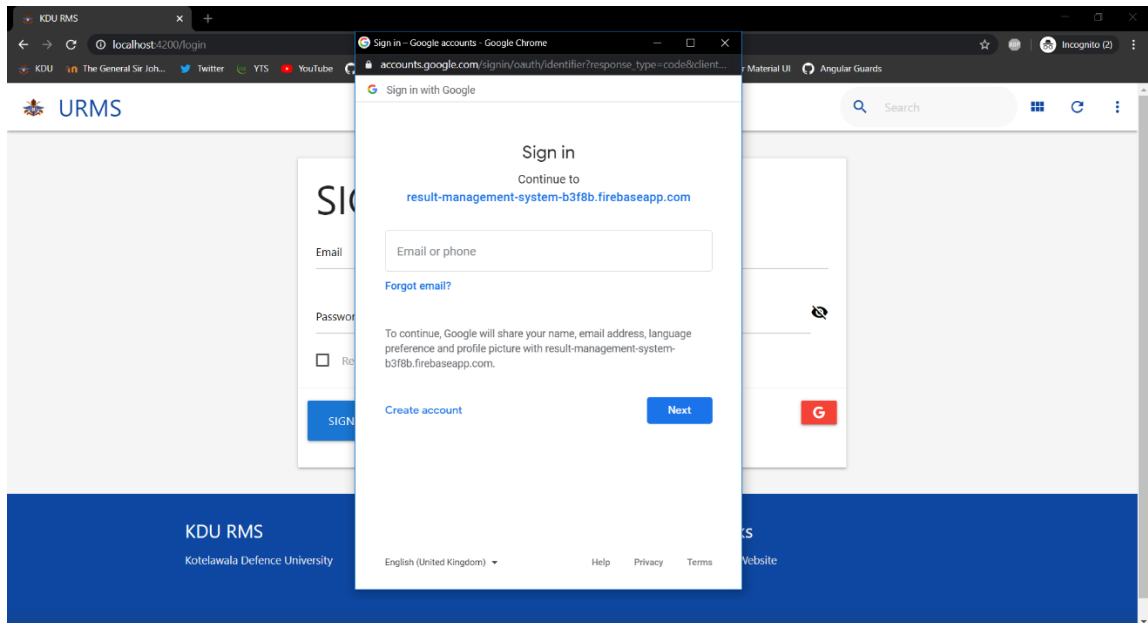
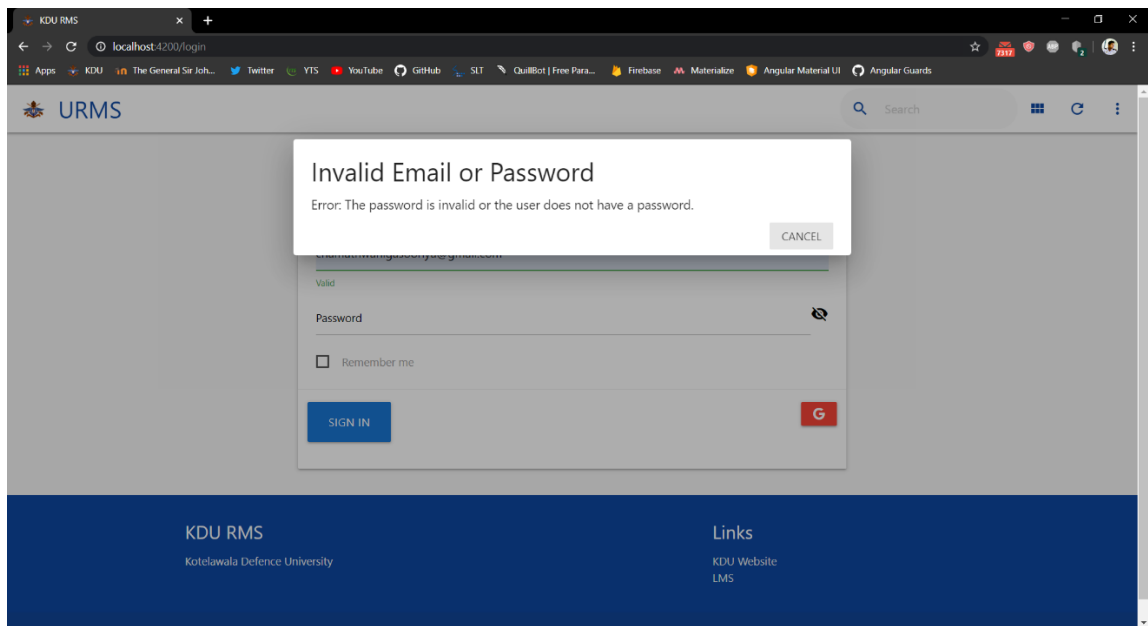


Figure 5.0.3 – Social account login for authenticated users using google’s popup authentication.



5.0.4 Validation for user login page.

5.2 Invalid URL Interface (Authentication Guard Interface)

In case were an unauthorized user tries to access a restricted area without permission or enters an invalid URL. The user is routed to a landing page notifying the user a to return to the Home Page. This provides an additional layer of security to the system.

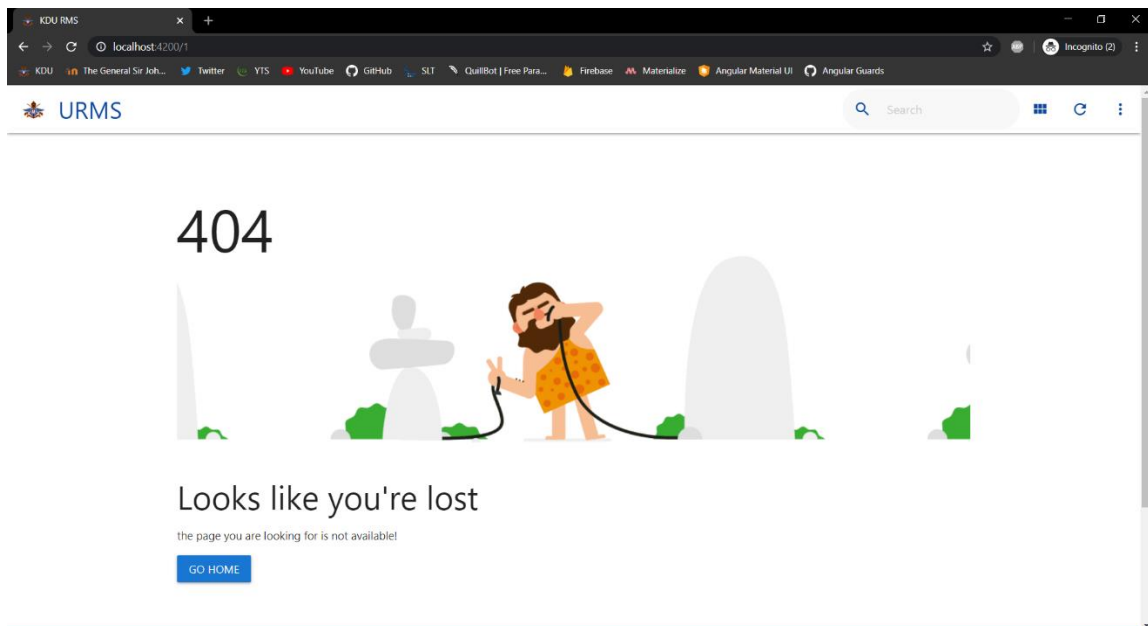


Figure 5.0.5 Invalid URL landing page

5.3 Dashboard for authorized users

As a user logs in he/she is redirected to a dashboard which is common to any user, the privileges are separated according to the user's firebase user ID or the Custom claims for each user's role.

Even though a lecturer which might be a setter or moderator logs in they are not able to access restricted areas such as Setter and Moderator Assigning. The finalized dashboard might contain charts the illustrates the result sets graphically.

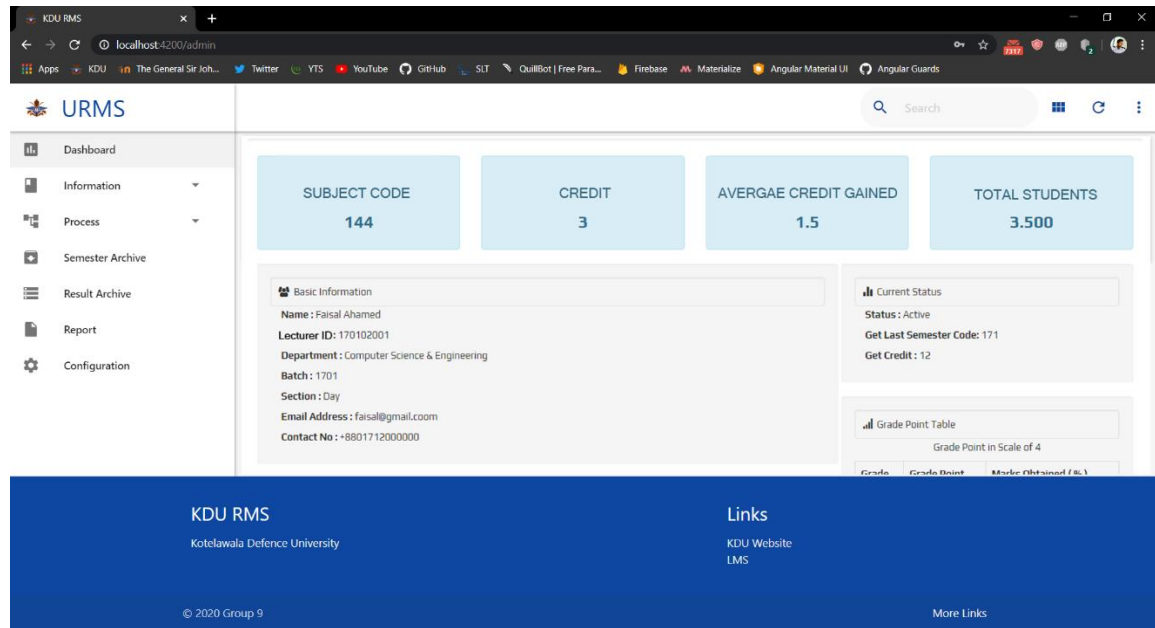


Figure 5.0.6 Default home page for authorized users

5.4 User Profile Management Interface

This profile interface is implemented for altering the required user credentials according to the user's needs.

The screenshot displays the KDU RMS User Profile Management Interface. The sidebar on the left contains the following navigation items: Dashboard, Information, Process, Assign Lecturer, Marksheet, Semester Archive, Result Archive, Report, and Configuration. The main content area shows a user profile form with the following fields: First Name (placeholder: Type your first name here), Last Name (placeholder: Type your last name here), Password (placeholder: Type your password here), and Email. An 'EDIT' button is located next to the profile picture placeholder. The footer of the interface includes the KDU RMS logo, the text 'Kotelawala Defence University', and a 'Links' section with 'KDU Website' and 'LMS'. The footer also contains the copyright notice '© 2020 Group 9' and a 'More Links' button.

Figure 5.0.7 User profile management interface

5.5 Marksheet Interface

When as authorized Moderator or Setter is Logged in the user is able to access the marksheet interface to update, insert or remove and then submit to the confirmation of the HOD for altering the marks.

The screenshot displays the KDU RMS Marksheet Interface. The sidebar on the left contains the following navigation items: Dashboard, Information, Process, Assign Lecturer, Marksheet, Semester Archive, Result Archive, Report, and Configuration. The main content area shows the Marksheet interface for Semester Code: 171. The interface includes a 'Get Credit: 12;' label and a table with the following data:

| Subject Code | Name | Credit | Point | GPA |
|--------------|---------------------|--------|-------|-----|
| SCE-203 | Data Structures | 3.0 | | |
| CSE-204 | Data Structures Lab | 1.5 | | |
| SCE-207 | Algorithm | 3.0 | | |
| SCE-208 | Algorithm LAB | 1.5 | | |
| CHE-101 | Chemistry | 3.0 | | |

The footer of the interface includes the KDU RMS logo, the text 'Kotelawala Defence University', and a 'Links' section with 'KDU Website' and 'LMS'. The footer also contains the copyright notice '© 2020 Group 9' and a 'More Links' button.

Figure 5.0.8 Marksheet Interface for authorized Moderators and Setters.

6.0 Summary

This Design Report contained information under 4 main sections: The Overall System Architecture, Software Architecture, Data Design and Interface Design.

Overall architecture of this system is divided in to 3 main layers, namely, Presentation Layer, Application Layer and Data Layer. Presentation layer focuses how the interface is represented for the user. Application layer builds the interconnection between the presentation layers. Data layer includes the database management applications.

Software architecture of the developing system will be based on a modularized approach where system is divided into different modules. The Results Management System will contain 4 modules: Registration/Login of Lecturer, Setter and Moderator fill in detailed mark sheet, Setter fills in mark return sheet, Setter fills in Comments sheet and obtaining a report of past student performance. Each module has its own unique functions.

Data design describes the databases and tables in the system. Our databases are maintained by Firebase. The databases contain several tables according to the tasks in the project. Relationships between these tables are also established according to the requirements.

The final section of Interface Design shows the interface designs for various parts of the system with a brief description.