

Mosque Management Database System

Auwais Rafiq
S17109723

BSc (Hons) Final Year Project
Supervisor: George Squires

May 2020

CMP6200/DIG6200
Individual Undergraduate Project

DIGITAL LIBRARY COPYRIGHT NOTICE

Every effort has been made to remove any material in this project / thesis where ownership of the copyright does not belong to the author. However, should you be aware of additional material that may require exclusion due to copyright restrictions, please contact DigitalLibrary@bcu.ac.uk or call 0121 331 5286.

The University and the Digital Library are not responsible for the inclusion of any third party copyright material contained in this project / thesis.

Use of this electronically archived project / thesis is restricted to educational purposes only.

Abstract

A database management system has been created using Oracle Apex. The database management system was created to record student attendance upon arrival to class. To ensure that the database management system was created to achieve the aims and objectives, critical research was carried out to determine the database system works for the audience's needs.

Acknowledgements

I would like to express my gratitude to my supervisor George Squires who has been amazing throughout this academic year, ensuring me to completing the project to the best of my ability. He has taken a considerable amount of his time to organize meetings and replying to emails to ensure the project is a success.

Furthermore, I would like to thank all the people that have helped throughout this academic year, my mother, my friends, and a special mention to Gerald who has been there when times were tough.

Table of Contents

Table of Contents

Chapter 1: Introduction	7
Background	7
Aim	7
Objectives	8
Rationale	8
Chapter 2: Literature Review	9
Literature Review	10
Methodology.....	11
Conclusion.....	14
Chapter 3:BackgroundResearch and Planning.....	16
Introduction	16
Questionnaire	16
Interview	19
Results.....	19
Conclusion.....	18
Chapter 4:Requirements.....	18
Introduction	18
Software Requirements	18
Hardware Requirements.....	18
Database Requirements.....	19
Conclusion.....	19
Chapter 5:Design.....	20
Chapter 6: Implementation	21
Introduction	21
Create Script.....	28
Insert Script.....	29
Drop Script	30
SQL Plus.....	30
Oracle Apex Application Express	30
Creating Application.....	30
Logging into Application	30
Authentication Scheme.....	31
Authorization Scheme.....	31

Creating Users	31
Conclusion.....	31
Chapter 7:Testing.....	32
Whitebox Testing	32
Black-Box Testing	33
Chapter 8:Evaluation	27
Chapter 9:Conclusion.....	30
References	31
Bibliography	32
Appendices.....	34
Appendix A – Results	34
Appendix B – SQL Scripts	35
Appendix C – SQL Plus	39
Appendix D – Oracle Apex	45
Appendix E – Testing.....	52

Chapter 1: Introduction

Background

Database Management systems were created and implemented to solve problems that you would associate with a traditional file system such as: storing, managing, accessing, securing, and auditing data (Raza, M 2018). Paper-based systems require more attention and can be time-consuming and inaccurate. Database management systems will provide a huge benefit to the mosque Eden Foundation.

Eden Foundation is an Islamic educational institution that provides a full Islamic curriculum which consists of ensuring the essential knowledge of Islam is taught correctly and effectively. Eden foundation offers an Islamic education system that starts with - Qaidah (to help learn Arabic), recitation of the Holy Quran, Manners, Fiqh (Islamic studies, and life about the beloved Prophet Muhammad. The focus is to teach good manners, discipline, and respect for all teachers and all of Allah's creation. In total there are six classes: Year 1 - 6. Each year the student will learn new topics and will be taught in more depth. When a student starts his mosque life the aim is to learn Arabic and then build upon this to be able to read the holy Quran. By year 6 the aim is for the student to finish the holy Quran. At the end of each academic year, the students will be tested with their oral reading and examinations depending on what topics they were taught throughout the year, to progress to the next year, the student is ought to pass the examinations. To help boost student morale, rewards are given to the top three students from each year.

Database management systems offer a new approach where it is possible to manage the database via an interface for users and running other workloads when accessing databases via apps. (Raza, M 2018). Database management systems are very effective, it offers staff the ability to update the database from time to time, in each category. Fees are taken monthly, so at the end of month staff can log student records so it's clear which student has outstanding fees to pay. On the other hand, a paper-based system wouldn't suit the mosque because paper base information can be lost or stolen and this can be very risky and critical, however, a database management system is very secure because the data can be regularly backed up. This results in a safe and secure database.

Currently, Staff has their paper-based register which they fill in every day to log student attendance. This is a very useful tool for staff however, there are two main flaws; When the teacher doesn't attend the session, they will log the student records the next day, this can be hard because they won't know which student attended the previous day. The second flaw is a major one when the year is complete, staff will have to go back to month one and tally up the student's total days of attendance. As a result of this a DBMS will be created so that it can provide information instantly and other staff can record data for the staff who is not available on the day.

Aim

The aim for this project is to develop a Database management system for the mosque

Objectives

- Background research of DBMS
- Design the database management system
- Implement the database management system
- Test the database management system
- Evaluate the database management system

Rationale

The database management system benefits the mosque because it will help the mosque improve its security and efficiency. All staff members will have access to the Database management system they can edit and add information daily. Each teacher can update attendance records and student progress, that parents will have access to. As a result of this, this will ease paperwork such as attendance books and student logbooks which can result in, inaccurate data or loss of data. In addition to this, staff will have access to data faster. For example, the academic year has finished and the headteacher wants to breakdown the average attendance per class, the Database system will provide the average attendance per class and each student records such as grades, attendance, and any further information. This can be done when the staff members use the search function. They can search for any student on the database or class using the class id. This will save staff a lot of time rather than filling in sheets. This can enable them to focus on the task on hand, students. Furthermore, the database system will help reduce costs and time management. Security measures will be in place if the worse were to occur. The mosque Amir (head) will oversee the DBMS to make sure everything is up to date rather than all staff playing around with it. Also, the database management system will have more storage since the paperwork took up a lot of storage.

Chapter 2: Literature Review

Introduction

Technology is growing faster than ever, the use of database management systems has increased, from storing data to controlling users and managing certain areas of the database. In chapter two, the information gathered in this study will be used to analyze, how the database management system will affect the mosque and whether there are any advantages to using database management systems in the education industry. All factors will be reviewed such as the risks associated with database systems and what potential threats can be identified. Information gathered will be considered when implementing the database management system.

Literature Review

Database management systems have evolved, technology is ever growing, the use of DBMS has been popular in each industry to store information and control the database. The information gathered will be used to analyze whether DBMS is effective in the education sector, what risks will be involved and what advantages they have. ICTs are being used to help meet education objectives (Durnali. M 2013).

In a world where technology is expanding, many educational institutions across the globe have existing ICT infrastructures and have these opportunities and it is appropriate that a country like Turkey has these opportunities and at least have basic ICT infrastructures to use ICT components across primary and secondary schools in Turkey. (Durnali. M 2013). Database management systems have had a huge impact in education where the institution can implement their database management system and review student progress. In the early stages it was quite hard to analyze student progress and keeping it up to date. It must have been a tough option as well because of the cost efficiency and guarantee, but DBMS has proved to be an integral part of educational institution.

The writer focuses the education system and that it did not have a database system and they could have a huge benefit if they did so, Furthermore, the lack of technology is discussed regarding education. It is noted that previously student data wasn't filed electronically at the center. This results in inaccurate data. (Durnali. m 2013). This shows how important database management systems are and how they impact educational institutions. Analyzing data, Student records and constant updates of data are characteristics that can be implemented to a database which can help the institution monitor student progress and enhance their aims and objectives.

Conventional systems are now replaced by database management systems as they provide more efficiency and are more effective (Raghu Ramakrishnan, 2002). Paper-based systems are simple; however, they are very time consuming and can lead to human errors being made through calculations and workload. By using a database management system less time will be consuming leading to success. For example, a paper-base system could lead it to be lost or stolen, this will be huge blow however, a database management system provides backups and protection. information can be retrieved when required and it can also be updated when needed.

Database management systems have become more popular in educational institutes because they have many advantages and are very popular however they have disadvantages as well such as the security issues that emerge. (Thiru, 2017) mentions " Given the fact that database systems hold crucial company data that are accessed from multiple sources, security issues must be assessed constantly". The security risks that are attached with databases are a major concern to educational institutes because they store private information and they must take a lot of security measures to prevent anything negative from happening such as data being stolen.

To prevent this from happening it is vital to identify the threats to a database system and how to amend them. Database security is very important and to tackle the threats that come from it, it is important to identify threats that are posed to the database management systems. Excessive database privileges are a key concern. What is Database Excessive privileges?

These are privileges provided to authorized users given too much control which they may abuse. One of the key principles to have good computer security is to provide users with least privilege; - a user should have no more access to the system or data than what is required for their task. (Seltzer, L 2013). A survey was conducted "80 percent of respondents believe that it's at least somewhat likely that employees access sensitive or confidential data out of curiosity". (Seltzer, L 2013). This is a big threat, trusting people whom they take advantage of and abuse the data. The statistic on the survey shows "80%" of the attacks on the company or institute are usually done by employees or employees who left. Different people are involved in using the database management system and their input which in most cases intentionally is written to damage or violate the database components and code. This then provides a host of problems such as viruses, worms, trojans and code issues.

A very strong authentication method is required to authenticate the valid users of the database system. (Sharma, P 2016). Access control mechanisms are implemented through two models: Discretionary Access Control Model and Mandatory Access Control Model. The Discretionary Access Control Model focuses on two factors, identity of the user and rules and guidelines of the organization. Access is given to users, but they are subject to discretionary rules as mentioned. The authorization is monitored and can be revoked at any time. The Mandatory Access Control Model focuses the data object and users. This model priorities on categorization which focuses on access class which has multiple groups and security levels. 'No write down' and 'No read-up' are both factors that intervene in this model.

Methodology

It is very important to know what methods will be used for example how the database will be designed and created. A key part of this is choosing the correct methodology. Many methods can be used; however, the best-suited method should be used so the database can be implemented correctly and according to the design.

Two main aspects are the entities, these are defined as tables that contain data such as the staff information, student information. The second main concept is the relationships that show the relationship between each of the entities. Also known as the interactions between the entities. It is important to know the difference between the Entity, entity set, and the Entity type. An entity is related to the real world which has a life that can be differentiated such as an entity can be an object with physical existence, for example a footballer, a lecturer, a teacher. Entities can be classified based on their strengths and weaknesses. An entity that is separated from all other related entities is known as a strong entity such as the Primary key.

The primary key is the strong point of the entity and is usually on the top of the table to show this. A table without a foreign key is a strong entity however a table that contains a foreign which contains a null value is a strong entity. On the other hand, an entity is weak if the entity exists already and it's dependent on it. Things to note when designing the ERD diagram are that Primary keys and Foreign keys are not the same and they do not depend on another entity to work.

More effective database design tools have been required for transactions and information related activity. Another model which could have been undertaken for the design concept could have been the relational model.

A Relational model (RM) presents the relations in a database as a collection. Values in a table are nothing but called relations. Each row contains data which are collated as related data values. However as (Thiru, 2017) mentions "The relational model was quite the upgrade over models like network and hierarchical. However, it lacks features that could make a visual representation of an effective database design". This is so technology has advanced and practically database designers prefer a tool that would picture them managing their entities and relationships. As a result of this to conclude (Thiru, 2017) mentions "Thus, the entity-relationship model in DMBS, or ER Model in DBMS, has become a widely accepted standard for data modeling". Graphical representations are required to model database components, and these are represented in the form of an ERD diagram.

Entity-relationship diagrams describe the relationship amongst the attributes and the entities. Advantages of the Entity Relationships Diagram include it is very simple, because if the relationships are identified at the beginning then the ER Diagram can be drawn easily. ER diagram representation is very clear, this is shown by the data listed in the tables with proper headings. This helps with the effective flow and communication. The readers can easily understand the relationship between different fields. The information is represented via different symbols (Dreams, P 2016). Another key point is that the ER diagram is very easy to understand and when done correctly beginners can understand the concept of the design and what the ER diagram represents. However, there are some potential drawbacks, the ER Diagram could contain limited constraints and specifications which could result in a loss of information content. Some entities could have a limited representation of relationships, this is where the ER model could be compared to the relationship model.

One of the first process models to be introduced was the waterfall model diagram, also known as a linear-sequential life cycle model. The waterfall model is very simple to use and easy to understand. the waterfall model consists of different phases, where each phase must be completed before moving on to the next phase. Usually a review is undertaken at the end of each phase to see whether the project is on the right track. The waterfall model blends well with my project and it is aligned with my objectives to design, implement, test, and evaluate the database management system. Furthermore, the waterfall model suits projects which have requirements where no changes are expected, this is why a literature review and research will be undertaken to have a better understanding of database systems and what the mosque require, so the waterfall model will be easy to manage with a sequential approach which helps the project flow in a good manner.

However, when reviewing other methodologies such as agile, this has an advantage over the waterfall model because it is flexible and easy to adjust. However, with the Agile software development methodology, it is very time consuming and more commitment is required. More demands are required, and the project will keep adjusting leading to falling off track.

Other methodologies were reviewed, such as the Spiral model. This model has more impact placed on the risk analysis and it is very similar to the Agile and Waterfall models. There are four stages in this model, however, from the 3 methodologies reviewed Waterfall seems the best for the current project. The Spiral model can be a very costly model to use and the risk analysis requires high expertise and its usually good for long projects.

Primary research will be conducted in two ways. A questionnaire will be undertaken with the staff of Eden Foundation and an interview will take place with the headteacher of the mosque. The research will provide both qualitative and quantitative data. Qualitative data will be provided through the interview as the head of the mosque can provide his insight regarding the database and system.

This research will allow me to have a better understanding of the mosque's vision, what the database can include, and what can be applied in the designing stage of the project. Also, this method of research allows you to ask questions that are appropriate and essential to the project rather than short questions and responses. Focus groups were an option however, staff members may not want to share their views in front of their colleagues. To conclude, a decision was made to have an interview with the headteacher of the mosque and questionnaires undertaken with the staff. Quantitative data will be provided from the questionnaires, as a result of this substantial data could be collected in less time.

The focus of these questionnaires is the staff, they can provide quick responses, and data can be formed into graphs and charts efficiently.

Easy to complete without assistance. It is generally suggested that self-completion questionnaires be shorter than those administered during interviews and contain mostly closed-ended questions (Bouraque and Fielder, 1995). The data provided from these questionnaires can enable the researcher to create the database for their needs. Part of my primary research, to conclude, interviews and questionnaires would be the best form of research and this can be used when designing the database.

For the literature search methodology, a variety of literature will be analyzed and reviewed in the education sector and how it could affect the mosque. The completion of a literature review prior to developing the database system will ensure a better understanding of database systems and opinions from experts who have worked in this field or in need of a database system. Additionally, this review provides a better understanding of how a database system is developed and managed and what is required when designing the ER model to help develop the database management system. The knowledge that has been gained from this review will result in a better final product which will be beneficial to Eden Foundation. This will allow me to achieve my first objective. Furthermore, this research will provide me with a better insight into the process of the design, development, and implementation of the database. A solid foundation will be built which will ensure a better final product is created and it will help the mosque increasing in efficacy, achieving their aims and objectives, and reducing costs.

The third and fourth objective is to implement and test the database management system. This is a vital process when completing this project. Once the database is created, scripts will be running in SQL plus to see if the code ran correctly without any errors occurring. If any errors do occur, they would be manually corrected using notepad++ before running the script again. Once all errors are amended if there are any, an application can be created in Oracle Application express to which Eden Foundation can access.

Finally, the third and fourth objectives deal with testing and evaluating the implemented database management system. these two objectives are very crucial because the testing will provide necessary feedback to whether the database system is working correctly, data can be accessed correctly, and whether staff can log in. However, if there are some issues for example with code, then this will need to be resolved before uploading scripts and creating the application in Oracle Apex.

The testing phase will be done in two ways; White-box testing will be used to test internally within the database, to check whether all scripts are running firmly and are all correct without any error. The second phase of testing will include; Black-box testing, this includes testing the database application system to check whether all incoming data values are correct and are running well.

The purpose of the Black-box testing to check the Database management system is working on all fronts, whether the user and admin can log in, whether Staff and student records appear, whether student records can be filtered and the most important feature whether student records can be logged for attendance. White-box testing includes the input that will be done internally within the database, this includes every script ran, such as the, drop script to drop each table, the create script to create all tables, and the insert script to input all data in each table.

The final objective and the final process of this project is the evaluation, this will be an integral part of the project because this will critically review the database management system which has been implemented. This process will include analyzing database advantages and outcomes. As mentioned by (Paul, S 2008) "a look at the various performance evaluation techniques that are employed to database systems, some of the key techniques used in practice in the industry and some open-source benchmarking schemes available for use in the public domain". The evaluation will provide support to improve in certain areas where the database can evolve and improve and get ready for publication.

Conclusion

In conclusion database management systems have evolved and have had a huge impact on the education system (Durnali, M 2013) Mentions. (Raghu Ramakrishnan, 2002) summarizes how conventional systems are now replaced by database management systems and how effective they are. (Durnali, M, 2013) also mentions how previously student data wasn't recorded and analyzed correctly which led to inaccurate results. This specifies how important Database management systems are and how useful they can come with the ever-growing technology.

Database systems have their own advantages and disadvantages. One of the main threats including security (Thiru, 2017) explains "Given the fact that database systems hold crucial company data that are accessed from multiple sources, security issues must be assessed constantly". There is a lot of information that databases store, such as employee information, customer information, student information, and credit/debit card details. Security is the main issue that needs to be address so data is not stolen or shared, however (Seltzer, L 2013) mentions "80% of the attacks on the company or institute are usually done by employees or employees who left".

Other threats that can be posed to the database management system are when a host of users, input their work into the system and make changes to the system which could violate the database component and code. This causes a huge outbreak because there is a whole host of problems that come with this such as viruses, worms, and trojans. (Ravi, S 2014) observes "By this technique, he has characterized the security breach as incorrect data modification, unauthorized data observation, and data unavailability". To avoid this issue, users who are added to the database management system should be given specific roles and permissions. Permissions such as editor, contributor, and the reader can be useful in the database management system.

Overall, key lessons have been addressed and these will be applied when implementing the database in later stages. A database system must address risks and threats because they cause big problems. Security should be the biggest factor when implementing the database, the database should be secured with a password and backed up. Only staff in the mosque should be users to only contribute to the system and specific roles should be allocated.

Chapter 3: Background Research and Planning

Introduction

Two types of research were carried out to find out the essential problems that existed in the mosque. A questionnaire was conducted to all the staff members and a structured interview with the head of the mosque was held to seek information and the aims and objectives of the mosque.

Questionnaire

The questionnaire was conducted between 7 staff members who were available, and they were questioned on their teaching methods, student's attendance and homework. Below is the sample of the questionnaire handed out to staff.

Staff Questionnaire

Dear Staff: _____

Questions about your class:

1. How many students are expected to attend the classroom?
2. If you could change anything in the class, what would that be? (You could tick more than one)

Teaching Methods

Types of activities

Other

3. How often do you encourage your students in class?

Yes, all the time

Most of the time

Sometimes

No, Never

4. Do the Students complete homework on time? If No, why?

Yes

No

5. How much time is each student expected to spend on homework?

<1 Hours

2-3 Hours

3-4 Hours

>5 Hours

6. Do you agree with this statement: "As a teacher the in-class rules should be fair and extremely impartial."

Strongly Agree

Agree

Neutral

Disagree

Strongly Disagree

7. What was the average score of students in the last term exam?

8. Using the grade sheets, what is the average attendance in class?

Sign: _____

Date: _____

Interview

The qualitative part of my primary research included an interview with the head of the mosque to discuss the current problems that exist and what is going to happen moving forward.

- As part of my research I would like to ask what the mosque wants to achieve?
- Is the mosque heading in the right direction?
- Do you agree with having a DBMS to track and update student data?
- Any further comments?

Results

(Appendix A, Figure 1)

(Appendix A, Figure 2)

(Appendix A, Figure 3)

The questionnaires conducted with the staff provided an insight into the current problem at the Eden Foundation. Figure 1 shows that throughout the seven classes the highest mark average per class. As shown in the chart the class with the highest mark average is class five, which is abysmal. The lowest average score per class is class six. As known previously all these results are not accurate results. However, it is important to note that it's a common theme whether it is results or attendance, Eden foundation requires its student to be punctual to achieve good marks.

Figure 3 demonstrates the underlying problem which is attendance. From classes 1 to 7 attendance is very low and needs to be addressed. Class five ended with the lowest average attendance which was 40 and class two had the highest average attendance. Previously it was noted that class five had the best average mark last term, this means there are a few students letting class five down which brings the overall attendance very low.

The Questionnaire was based on student progress such as; attendance, homework, and marks. The staff was asked whether students completed homework on time, again a negative result. 71.4% of students do not complete their homework on time, whereas 28.6 manage to stick to the curriculum and complete their tasks. (Appendix A, Figure 2).

A structured interview was held with the headteacher of the Eden Foundation to evaluate the current situation of the mosque and what could be done to improve the situation. This method of research allows you to ask questions that are appropriate and essential to the project rather than short questions and responses. In the interview four questions were asked, the headteacher pointed out the mosque's vision and aims. The headteacher has made it clear his concern for the attendance being below 60%. The student tracking system is advised because there is no system in place to log any data. The last question asked to the headteacher was if he agreed with having a Database Management System, his quick response was that it was a brilliant idea and most of the educational institutes have these currently in place. (Appendix A, Figure 4)

Conclusion

The results showed areas for concern, the staff results provided quantitative research and currently all the figures are negative for Eden Foundation. Qualitative research proved to be important because it shows where the mosque is heading. What it aims to do next and what their ambitions are. From this research and previous research from literature, it shows that the mosque needs a database system to help track student progress. This will enable the mosque to keep a record of student attendance and take action when required.

Chapter 4: Requirements

Introduction

The database management system will have a front-end user interface, this will allow the staff of the madrassah to log student records such as attendance and fees. This will be straightforward, and they will be able to access their data. The database will have two parts to it; the first part will store the student records such as attendance and punctuality so the information of the students and staff will be stored along with the table which they are assigned to. The second part will include a filtering option where if the mosque wants to search for any specific student, then it is possible. This will be useful because it will show how the student is currently attending.

Software Requirements

Requirement	Extra Information
Notepad	SQL scripts are created for the database.
SQL Plus	Interactive program which executes SQL Statements created from notepad
Internet Browser	Internet Browser to access Oracle APEX
Oracle Apex	Web Application tool to develop Database Management System

Hardware Requirements

Requirement	Extra Information
Laptop/Computer	To access the software and build Database System
USB Drive.	To create backup of Database, in case of an emergency

After creating the SQL Scripts from notepad and executing them on SQL Plus error-free, the software chosen to create the Database is Oracle APEX. When deciding which software to use to create and implement the database software such as Microsoft Access was considered. However, two main factors were taken into consideration when deciding which software to use. Oracle Apex has an electronic application builder that creates an application from scratch, and you can import SQL scripts to make pages. Whereas in Microsoft Access, you are required to input data into raw tables, this can be time-consuming, and you could end up having errors that can lead to the program crashing or file is corrupted. Which can result in starting the database again? The intelligent data manager in Oracle Apex allows you to upload scrips, build an application, and add users witch specific roles without much complication. For this reason, I have decided to use Oracle Apex to create the Database Management System.

Database Requirements

Functional

Requirement	Extra Information
Data can be viewed easily	User can view data from all tables
Any new staff members should be assigned to the system	User can add new staff to the system
Guests should be able to view the system	Reader can view system
Ability to filter results in the system	User can filter through Student records
Ability to record student progress.	User can record student attendance

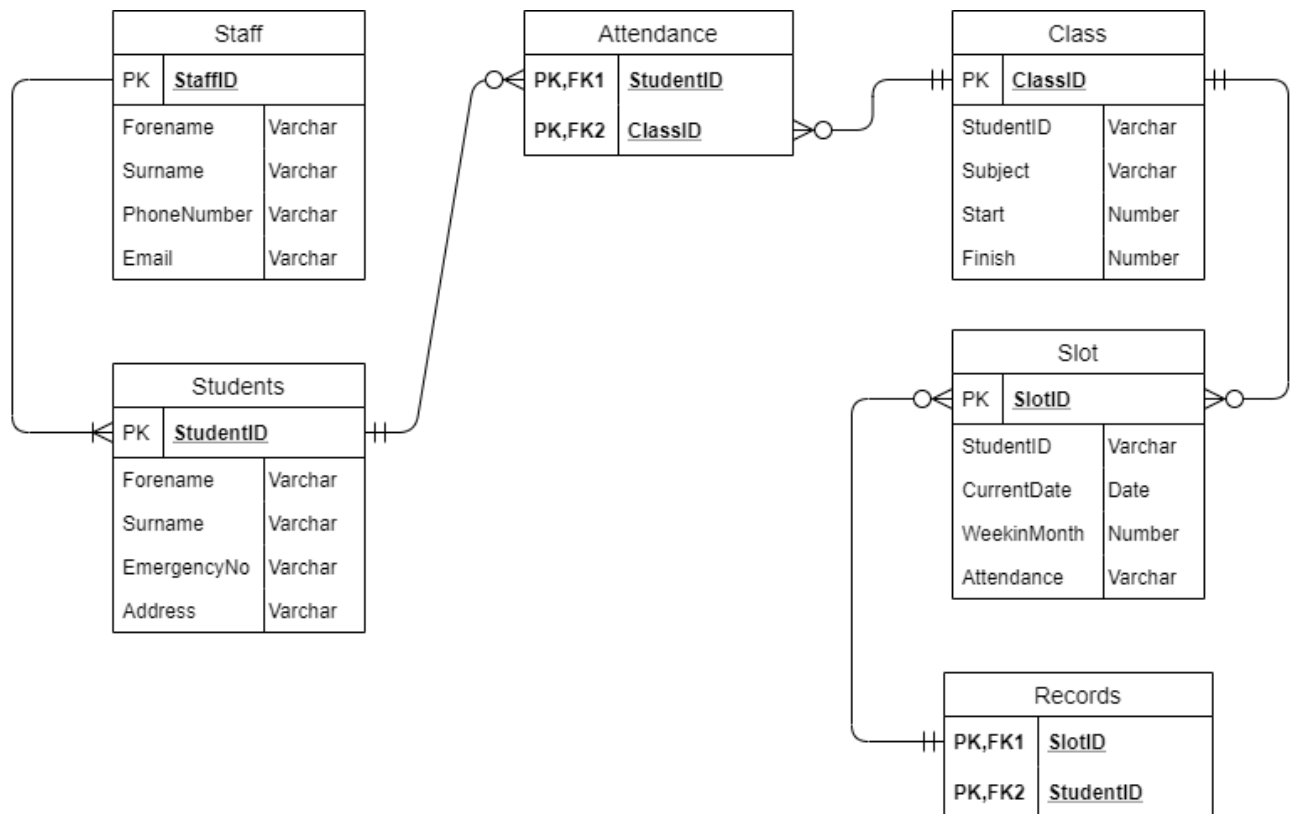
Non-Functional

Requirement	Extra Information
GUI must be user friendly	GUI should be easy for the user to use.
Interface must be responsive	Interface must be quick and responsive
System changes must be instant	Any changes made to the DBMS, should be responsive and made instantly.

Conclusion

In chapter 4 key requirements such as Hardware, Software and Database requirements were identified and reviewed. The Database Management System will have a frontend user interface and the application will be made on Oracle Apex.

Chapter 5:Design



Entity-Relationship Model (ERD) displays the relationships of entities stored in a database. However, ER Diagram includes many specialized symbols, and its meanings make this model unique. The purpose of the ER Diagram is to represent the entity framework infrastructure (Guru, 2020).

An ERD Representation of the Mosque Database system is shown above. An ERD diagram displays the relationship of entities in the database, for example the relationship between a teacher and a student is one too many. A teacher can have many students, this is shown in the ERD diagram. In the diagram six tables are shown, these are the tables that will be created in the database system. The terms 'PK' and 'FK' are known as Primary keys and Foreign keys. The Primary key constraint identifies every record in the table. As seen above there is only one PK per table this results in a table that can only have one primary key and can consist of single or multiple fields an example of this is shown in the attendance table. Primary keys cannot contain NULL values however they must contain unique values. As seen in the Attendance table and the Records table a foreign key is used. Foreign keys are used to link two tables together for example the table containing the foreign key is called the attendance table and this table refers to the primary key in another table such as the Student ID. The Foreign Key constraint helps keep links between tables and from invalid data being used which can cause errors.

Chapter 6: Implementation

Introduction

Following the design stage of the project that had been completed, chapter six was underway. In chapter 4 the requirements for the database system had been addressed, using notepad the SQL scripts were written and were created. Below are the scripts that were written:

- Create Script
- Insert Script
- Drop Script

Create Script

The create script was used to create the tables for the database, these were the tables that had entities in them from the ER Diagram. The Create Table statement was used to create the tables required for the database. In total there were six tables that were created: Staff table, Students table, Attendance table, Class table, Slot table and Records table. As seen in the ER diagram in the design stage, each entity has a data type next to it such as varchar, number and date. These are required so the data size and length are specified. An example of this is:

```
CREATE TABLE Staff (  
StaffID int NOT NULL,  
Forename varchar (30)
```

'CREATE TABLE staff ' this script is to create the staff table. 'StaffID' is the column name, A NOT NULL constraint was added, and this was used so the database dosent accept any null values. 'Forename varchar (30)' another column has been added for the forename with the data type being 'VARCHAR' and the maximum length that can be used is 30.

```
CREATE TABLE Staff (  
StaffID int NOT NULL,  
Forename varchar (30),  
Surname varchar (30),  
PhoneNumber Varchar (11),  
Email varchar (30),  
CONSTRAINT PK_StaffID PRIMARY KEY (StaffID)  
);
```

The above SQL script is the full script for the Staff table, the primary key is an important field when creating the table; such as the Primary key for this table is the (StaffID). The staff would have a unique id assigned to them on the database. When creating the students table the students will have their own unique (StudentID) assigned to them and that would be the primary key for that table. The primary key constraint uniquely identifies each record in the database table (w3Schools, 2020). The Primary key constraint identifies every record in the table. Primary keys cannot contain NULL values however they must contain unique values.

As mentioned in the ER Diagram, a foreign key is used to link two tables together. It is a field or a collection of fields in one table that refers to the PRIMARY KEY in another table (w3Schools, 2020). For example, in the Class table, a foreign key field is assigned and has been used to refer to the primary key; 'StudentID' from the Students table. (Appendix B, Figure 5)

Insert Script

The Insert script was used to continue filling data into the tables created in the database. The Insert Into statement was used to fill data in each table in the required field. Values that were given to the columns in the table, in the create script must be corresponding so that insert statement would work correctly. (Appendix B, Figure 6)

```
INSERT INTO Staff (StaffID, Forename, Surname, PhoneNumber, Email)
VALUES (1, 'Futubala', 'Khom', '07547365388', 'Futu@outlook.com');
```

Above is an example of the 'INSERT INTO' statement, each value is assigned to the columns from the tables created from the CREATE SCRIPT.

```
CREATE TABLE Staff (
StaffID int NOT NULL,
Forename varchar (30),
Surname varchar (30),
PhoneNumber Varchar (11),
Email varchar (30),
CONSTRAINT PK_StaffID PRIMARY KEY (StaffID)
);
```

The Create script for the Staff table is above and under Forename, Surname, PhoneNumber and Email the datatype Varchar is listed with a certain value. If the 'INSERT INTO' statement was written again as shown below the code wouldn't execute correctly because it's exceeding its limit stated when creating the table. It is important to stay within the datatypes listed when creating the tables. These can be edited if they need changing but it is important to stay accurate with the datatypes and numbers given to them. For example, a PhoneNumber has the datatype Varchar (11), if the PhoneNumber is above 11 digits the code wouldn't execute correctly, and an error will be shown.

```
INSERT INTO Staff (StaffID, Forename, Surname, PhoneNumber, Email)
VALUES (1, 'Futubala', 'Khom', '07547362225388888888',
'Futuddddddd@ouuuuuuuutloooooook.com');
```

This code wouldn't execute correctly since the PhoneNumber and Email are exceeding the limit. Another key point to note is that if the datatype is number or date and word or number isn't represented then this would result in another error. The datatype 'Varchar' must be written in quotation.

Drop Script

The drop script is used in the case the code has already been executed and the program has crashed, and you would like to continue where you left off or you would like to edit the code. The Drop script command could be used, and it would drop all the tables and you could insert the Create Table and Insert Into statements again. For example, if the tables already exist and you try running the Create script again it will cause an error, and this may damage or ruin the code syntax.

(Appendix B, Figure 7) An example of the Drop Script is below:

Drop table attendance;

This command would drop the attendance table.

Drop table Staff cascade constraints;

This command is used to manage referential integrity constraints so the 'Drop table' command would drop the table and the 'CASCADE CONSTRAINTS' command would drop the other objects that depend on the table.

SQL Plus

SQL stands for standard query language and SQL Plus is an interactive program that is used to communicate with the oracle server. SQL plus allows you to run and execute SQL statements that were modified from notepad. The SQL scripts created from notepad were copied and input into SQL plus to check whether it contained any errors. (Appendix C, Figure 8) Appendix C is a representation that all the SQL queries modified in notepad were executed correctly and the tables were created successfully, and the Insert statements were inserted correctly.

Oracle Apex Application Express

After running the SQL scripts on SQL plus, it is now time to create the Database Management system this can only be done via Oracle APEX. After creating an Oracle Application Express workspace account. Using the SQL workshop, SQL scripts were uploaded. Each of the scripts was split up into different.txt files. First the Create script was uploaded then it was ran to make sure there were no errors. (Appendix D, Figure 9). The appendix shows that the Create script was uploaded successfully and there was no issue with the SQL script and tables were created successfully in the server. Soon to follow the Insert.txt file was uploaded and ran to make sure no errors occurred in the code. (Appendix D, Figure 10) shows that all the .txt files were uploaded successfully.

Creating Application

After uploading all the SQL scripts successfully and running them without any errors. It is time that the application building process begins. When choosing between Microsoft Access and Oracle Apex, the interactive rapid application development tool had the edge over Microsoft access. Thus, when creating a new application, there are several features to select and choose from. The appearance to begin with is the first feature to choose from, there are four options to choose from and a custom theme if required. Another important feature is to check all the features below, if this is not checked then Access control becomes disabled. (Appendix D, Figure 11) To create pages the 'Add page' button was selected, and a bunch of options appear, for each table a different option is chosen. For the Staff table and Students table an interactive report is chosen.

When choosing the type of page, you require, you can select the uploaded queries from the SQL Workshop. (Appendix D, Figure 12).

For the Class table an Interactive grid was chosen so student records can be filtered, and interactive searches can be made. The most important page for the database is the logs page because this is where the student records are logged by staff. (Appendix D, Figure 13) shows the final representation before creating the application.

Logging into Application

(Appendix D, Figure 14) is a visual representation of the Database front end-user interface. The login details are the same when logging into the workspace. The home page of the Database Management System is a representation of the pages created. They are hyperlinked, once clicked it navigates you to the page. (Appendix D, Figure 15, 16, 17, 18, 19). All the pages were a success the student and staff pages provide data about the staff and students recorded in the Insert into queries. The Class Data page shows a live representation of student data. In the testing stage a test will be carried out whether you could filter results and make a search on a specific student or class. The logs page is a form page for the staff to fill in for the students in their class. Another test will be carried out whether a student log can be made. (Appendix D, Figure 20) shows all the pages that have been created in the Database Management system.

Authentication Scheme

When the literature review was carried out, security was one of the disadvantages DBMS included. The security risks that are attached to databases are a major concern to educational institutes because they store private information and they must take a lot of security measures to prevent anything negative from happening such as data being stolen. The authentication scheme is a scheme that helps to bypass this and adds more security to the application. The authentication scheme was developed to ensure validity was instore for users. This scheme requires a user to enter a username and password when entering the database. Users are added when the administrator creates a new user. Each user will be given a specific role, so security is under control. An application express accounts scheme was validated so accounts can be created within the application express account. (Appendix D, Figure 21)

Authorization Scheme

The authorization scheme within Oracle Apex is a way to assign users specific roles. Roles such as admin rights, contributor rights, and reader rights. When creating a user assignment, a specific role must be assigned. For instance, if this assignment is deleted and a user is created, the user won't be able to access the database. (Appendix D, Figure 22)

Creating Users

After specific roles have been assigned and adjusted in the authentication scheme, user assigned is completed, an example of this is shown (Appendix D, Figure 23) a staff member 'Habib' is being assigned to the authentication scheme and this user has been given contributor rights. (Appendix D, Figure 24) shows that two users have been assigned: 'Futubala' and 'Habib'. Currently the users that have been assigned just have a specific role, however, they can't log in because they need to have a user created to log in. Under the settings tab, 'Manage users and groups' This tab allows you to manage the users who have been added onto the system or to add users to the system. So currently two members of staff have been assigned contributor roles, but they require a user to be created for them to log into the database system. (Appendix D, Figure 25) this is the form that is required to be filled in, to create the user. The users, username, the password is assigned according to the system with the username being the staff name and password that has been assigned to the staff. Other details are added which were put into the Insert into statements.

(Appendix D, Figure 26) Figure 26 shows that the users have been created and staff could now log into the system with contributor rights.

Conclusion

In chapter six the implementation stage began, an application was made on Oracle Apex, the Database management system was implemented into Oracle. Pages were added from the scripts that were uploaded previously. Users were given specific roles and were given access to the database management system.

Chapter 7:Testing

Introduction

Database testing is very important, it is the fourth objective in this project. "database testing is necessary to ensure that the values that an application is retrieving or storing into the database are accurate or not" (Triangle, T 2012). In this chapter two testing methods will be carried out: Whitebox testing and Blackbox testing. Whitebox testing includes, testing whether all SQL worked successfully and whether any errors occurred on the database. Blackbox testing includes, testing within the database to make sure all features are working correctly. For example; whether a member of staff can log into the database management system.

Whitebox Testing

Test No	Description	Exp Outcome	Actual Outcome
1	Run the drop script file in SQL Plus.	All tables should be dropped in SQL plus (Appendix C, Figure 8)	All tables were dropped in SQL Plus Successfully. (Appendix C, Figure 8)
2	To run the create script file from notepad into SQL plus	All the tables from the txt file should be created. (Appendix C, Figure 8)	All tables were created successfully. (Appendix C, Figure 8)
3	To run the insert script file into SQL plus	All the INSERT INTO statements should be done successfully. (Appendix C, Figure 8)	All statements were inserted correctly without any errors, (Appendix C, Figure 8)
4	To upload Scripts to Oracle APEX	Scripts should be successfully uploaded. (Appendix D, Figure 10)	All scripts should be uploaded correctly and ran successfully without any errors. (Appendix D, Figure 9) (Appendix D, Figure 10)

Black-Box Testing

Test No	Description	Exp Outcome	Actual Outcome
1	Admin tries to login into the Database system	Admin should successfully be able to log into the system (Appendix E, Figure 27)	Admin successfully logged into the Database system. (Appendix E, Figure 28)
2	Staff user logs into the database system	Staff user should be able to login since a user was created and a role was assigned. (Appendix E, Figure 29)	Staff successfully logged into the Database system. (Appendix E, Figure 30)
3	A user that hasn't been assigned to the system shouldn't be able to log in	Staff user whom account has been created or assigned a role shouldn't be able to login. (Appendix E, Figure 31)	User can't log in as expected. (Appendix E, Figure 32)
4	Staff page checked to see if it works correctly	Staff page should be an interactive page with all staff details. (Appendix D, Figure 16)	Staff page up and running with live results of all staff that currently work with Eden Foundation. (Appendix D, Figure 16)
5	Students page checked to see if it works correctly	Students page should be an interactive page with all student details. (Appendix D, Figure 17)	Data of students is live, and a list of student appears on screen. (Appendix D, Figure 17)
6	The class data page should be working, and the user should be able to filter a search within the page.	The class data page should be running interactively, and a search could be made within the page. (Appendix D, Figure 18) (Appendix E, Figure 33)	The class data page is running interactively, and results can be filtered. (Appendix E, Figure 33)
7	A student record should be made within the page.	The logs page should be working correctly, and a form should be able to be done correctly. (Appendix E, Figure 34) (Appendix E, Figure 35)	The logs page is working fine, and the form can be accessed and filled. (Appendix E, Figure 34) (Appendix E, Figure 35)

Usability testing

After the Blackbox and Whitebox testing was undertaken, a usability test was conducted with the 10 members of staff at Eden Foundation. This was done after they had used the Database system, logged in and able to use the system without requiring assistance. A small questionnaire was undertaken to see the feedback from the staff, it is illustrated below. Ratings were given with 1 being the lowest score and 10 being the highest.

Question		Yes	No	Maybe
<i>Were you able to log on to the database system?</i>	8	0	2	
<i>Was the User Interface easy to navigate?</i>	10	0	0	
<i>Do you think the database system is easy to use?</i>	7	1	2	
<i>Do you believe the database system can help Eden Foundation?</i>	8	0	2	

Conclusion

In this chapter, two testing methods were carried out. Both testing methods were carried out successfully and both show that the SQL Scripts and code were implemented correctly and ran successfully and that the Database system is a secure system, which works correctly, and only specific users can login to the system.

Chapter 8: Evaluation

Introduction

In this chapter an evaluation will take place of the product and process of creating a database management system for Eden foundation using a web-based software called Oracle Apex. In the last chapter different types of testing took place which showed that the database management system works correctly. The Database management system allows the user to update student records, filter results, and log student attendance. the database could be populated more so more pages can be made.

Evaluation of Product and Process

The aims and objectives that were set before creating this product have been met, the database management system is an example of that. The database system stores information of Staff, Student, Class, and Attendance Records. The database management system can be used to add more staff and students to the system. The Database Management system can be used to search for a specific student or make a search regarding a certain class. The most important part of this Database system is the Logs page because it requires the staff to log each student's attendance record. The set objectives were accomplished in order. In the methodology it was stated that the waterfall methodology will be used for this project, looking back at that decision it seems like a wise approach for the project as a whole because this methodology helped prepare each stage, so it was conducted and taken seriously before moving onto the next stage.

Consistency is a very key aspect when doing a project and this was the key to success. the set objectives were in the order of the Waterfall Model approach, each chapter and stage were given a certain timeframe and each stage was completed on due course. The whole process began in Stage 1, where the research was carried out, on the history of database management systems, advantages, and disadvantages. The research was carried out in the education sector to find out how educational institutes use technology. Disadvantages were looked so no problems would occur when completing the project. More research was carried out with Eden Foundation, two stakeholders were chosen, Staff members and the Headteacher. A questionnaire was conducted, and a structured interview was undertaken. The results and research made my choice to create a database management web-based application, a great decision because it was able to provide a structure to Eden foundation, where teachers and staff are listed and their roles. The aim of getting a page where staff can log students' progress was achieved on the Logs page.

The literature review carried out prior to completing any work before was crucial, this allowed me to have a better understanding of database systems and how they work. The requirements of a database management system, how it works, and what potential threats there are?

The findings from the research had been implemented and carried out onto the database system. For example, in the literature review 'security' was a serious threat, to nullify this threat the Authentication scheme was used, and the Authorization scheme was used in Oracle apex. This meant that users could only log in if they had a username and password assigned to them, not only a user created for them, but a specific role had to be assigned as well, such as a contributor, reader, or admin.

The users for the database were the staff and they were given contributor rights so they could log into the database system and put their input in the 'Logs' page where they could log student attendance, which was the purpose of this project.

Although the research was undertaken, it was required to have a better understanding of the requirements that are needed for the database. An example of this is, Research was undertaken on how questionnaires are undertaken and what use they have. The process of building the database system began by creating an ER Diagram. it was important to identify key relationships between the entities and what each entity required in each table. The research was undertaken on the Primary and Foreign key, what they meant and how important they were when writing up the script in notepad. The targets that were set for each process were very achievable and were met throughout each process. However, a relational model or a UML model could have been created to gain more knowledge and help further in the implementation of the database management system but due to time constraints this wasn't possible.

After the research was completed and the design phase was completed the implementation stage began. This began with the creation of SQL queries into scripts on Notepad. once these were written up the SQL scripts were running on SQL Plus to insure, no errors occurred, and all of the code worked correctly. This was very important because if these were uploaded to Oracle APEX, and they contained errors then this would have made this stage more time consuming and the database system would have contained faults. The option to choose Oracle Application express was a good decision because the interactive feature in Oracle had the advantage over Microsoft Access and the way my scripts were written it was easy to implement my Scripts into Oracle apex and build an application.

As represented in chapter 7, the testing shows that the database works correctly in Oracle APEX. Another test that was carried out was the Usability test where staff had undertaken a mini survey about the Database system. As seen in Chapter 7, all the staff could log in, 2 were unsure but with practice in due course they should be able to log in. All the staff found the user interface easy to navigate through and found no difficulties. Staff also think the database is easy to use. the best compliment was that all staff believed that the database management system can help Eden foundation.

Conclusion

Overall, the project is a success however it could have been improved in many ways from the research stage to the final stage. more time could have been given to research about Database Systems and Oracle. this would have provided me with the opportunity to add more features to the application and more pages. However, the way each phase was conducted it allowed me to have a successful application to be produced which co align with the aims and objectives that were set before the application was produced. These improvements would have made the application look better; however, they would have not changed it much, well in due course more implementation can be done in the future while improving the current system.

Chapter 9: Conclusion

This project was to create a database management system for a mosque where the staff can record student data and log their attendance. Chapters one and two were required because background research was necessary, and it was important to identify the threats that are attached to database systems. The Methodology, and literature review carried out in these two chapters, provided me with essential information so less time was taken out when it came to designing the Database and implementing it, the database was provided to the audience it was catered for.

Chapter three and four was a continuation of chapter 2 where the methodology was carried out. The research was undertaken with two stakeholders from the mosque. Primary research was conducted in the way of questioners providing quantitative data and Secondary research was done in the way of a structured interview with the headteacher. The two stakeholders gave a big boost because it was important to identify the existing problem at Eden Foundation. The results provided this information to be correct from Chapter one that attendance was the problem. Chapter 4 identified the requirements for the database system. The requirements were already outlined once the research was undertaken in chapter 2. It was clear that the database will have a front-end user interface and the program that will be used was Oracle Application Express. The SQL scripts were edited in notepad and ran in SQL plus. Chapter five outlines the design of the database management system. This chapter was very important because it was important to understand the different relationships that the entities had. This stage helped me with the Implementation phase because it was clear what tables were going to be created and what fields were going to be in them.

Chapter six involved in implementing SQL code from notepad into SQL plus onto the SQL workshop in Oracle Apex. Chapter six involved in creating the Database application and adding users with the responsibility of assigning roles. Chapter seven included in testing the product and checking whether any errors were found when carrying out certain tests. Tests included in checking whether the admin and staff could log in after they were assigned a username and password with given roles. Users who weren't added were checked to see if they could log in and that was important to ensure security was in store. The usability test provided a great feeling to know how the audience felt towards the product.

Improvements could be made as mentioned previously in chapter eight, improvements could be made to the final product to make it look better and have more data within the database. A recommendation is to have another page regarding student exams and when exams are completed, they are recorded too. A summary page could be added where you filter results about certain students and their summary pop up. More security could be implemented into the Database Management system, so it is more secure, however, there wasn't enough time.

References

Bourque, L. B., & Fielder, E. P. (1995). How to conduct self-administered and mail surveys, [http://www.scirp.org/\(S\(351jmbntvnsjt1aadkposzje\)\)/reference/ReferencesPapers.aspx?ReferenceID=94964](http://www.scirp.org/(S(351jmbntvnsjt1aadkposzje))/reference/ReferencesPapers.aspx?ReferenceID=94964)

Raza, M. (2018) What are Database Management Systems? DBMS Explained. *BmcBlogs*. Available at: <https://www.bmc.com/blogs/dbms-database-management-systems/> [Accessed 27 November 2019].

Durnali, M. (2013) The Contributions of E-School, a Student Information Management System, to the Data Processes, Environment, Education, and Economy of Turkey. *In the Asian Conference on Technology in the Classroom 2013, At Osaka, JAPAN*, pp. 170-184. Available at: https://www.researchgate.net/publication/318969303_The_Contributions_of_E-School_a_Student_Information_Management_System_to_the_Data_Processes_Environment_Education_and_Economy_of_Turkey

Raghu Ramakrishnan (2002). Database Management Systems. Pg 7-9.

Thiru. (2017) What is DBMS? Advantages and Disadvantages of Database Management System(DBMS). *My Reading Room*. Available at: http://www.myreadingroom.co.in/notes-and-studymaterial/65-dbms/462-advantages-and-disadvantages-of-dbms.html#disqus_thread. [Accessed 27 November 2019].

Seltzer, L (2013). Excess privilege makes companies and data insecure. Available at: <https://www.zdnet.com/article/excess-privilege-makes-companies-and-data-insecure/#:~:targetText=One%20of%20the%20most%20important,and%20excessive%20access%20to%20data>

Sandhu, R (2005), Database Security—Concepts, Approaches, and Challenges, *IEEE transactions on dependable and secure computing*. 2(1). Available at: <https://profsandhu.com/journals/ieee-depend-dbsec-05.pdf>

Sharma, P (2016). Database Security: Attacks and Techniques. *International Journal of Scientific & Engineering Research*. 7(12). Available at: <https://www.ijser.org/researchpaper/Database-Security--Attacks-and-Techniques.pdf>

Thiru. (2017) Entity Relationship Model in DBMS (DBMS). *My Reading Room*. Available at: <http://www.myreadingroom.co.in/notes-and-studymaterial/65-dbms/471-the-entity-relationship-model.html>. [Accessed 07 May 2020].

Gurv. ER Diagram Tutorial in DBMS (with Example) <https://www.guru99.com/er-diagram-tutorial-dbms.html>

Dreams, p (2016) key benefits of using entity relationship diagrams. *Key benefits of using entity relationship diagrams*. Available at: <https://pcdreams.com.sg/key-benefits-of-using-entity-relationship-diagrams/> [accessed 07 may 2020].

Paul, S (2008) Database Systems Performance Evaluation Techniques. Available at: <https://www.cse.wustl.edu/~jain/cse567-08/ftp/db/index.html> [Accessed 07 May 2020].

W3schools. (2020). SQL PRIMARY KEY Constraint. Available: https://www.w3schools.com/sql/sql_primarykey.asp. [Last accessed 8th May 2020]

W3schools. (2020). SQL FOREIGN KEY Constraint. Available: https://www.w3schools.com/sql/sql_foreignkey.asp [Last accessed 8th May 2020]

Triangle, T (2012) Database Testing. Available: <http://www.testtriangle.ie/en/database-testing> [Last accessed 8th May 2020]

Bibliography

Bourque, L. B., & Fielder, E. P. (1995). How to conduct self-administered and mail surveys, [http://www.scirp.org/\(S\(351jmbntvnsjt1aadkposzje\)\)/reference/ReferencesPapers.aspx?ReferenceID=94964](http://www.scirp.org/(S(351jmbntvnsjt1aadkposzje))/reference/ReferencesPapers.aspx?ReferenceID=94964)

Raza, M. (2018) What are Database Management Systems? DBMS Explained. *BmcBlogs*. Available at: <https://www.bmc.com/blogs/dbms-database-management-systems/> [Accessed 27 November 2019].

Durnali, M. (2013) The Contributions of E-School, a Student Information Management System, to the Data Processes, Environment, Education, and Economy of Turkey. *In The Asian Conference on Techology in the Classroom 2013, At Osaka, JAPAN*, pp. 170-184. Available at: https://www.researchgate.net/publication/318969303_The_Contributions_of_E-School_a_Student_Information_Management_System_to_the_Data_Processes_Environment_Education_and_Economy_of_Turkey

Raghu Ramakrishnan (2002). Database Management Systems. Pg 7-9.

Thiru. (2017) What is DBMS? Advantages and Disadvantages of Database Management System(DBMS). *My Reading Room*. Available at: http://www.myreadingroom.co.in/notes-and-studymaterial/65-dbms/462-advantages-and-disadvantages-of-dbms.html#disqus_thread. [Accessed 27 November 2019].

Seltzer, L (2013). Excess privilege makes companies and data insecure. Available at: <https://www.zdnet.com/article/excess-privilege-makes-companies-and-data-insecure/#:~:targetText=One%20of%20the%20most%20important,and%20excessive%20access%20to%20data>

Sandhu, R (2005), Database Security—Concepts, Approaches, and Challenges, *IEEE transactions on dependable and secure computing*. 2(1). Available at: <https://profsandhu.com/journals/ieee-depend-dbsec-05.pdf>

Sharma, P (2016). Database Security: Attacks and Techniques. *International Journal of Scientific & Engineering Research*. 7(12). Available at: <https://www.ijser.org/researchpaper/Database-Security--Attacks-and-Techniques.pdf>

Thiru. (2017) Entity Relationship Model in DBMS (DBMS). *My Reading Room*. Available at: <http://www.myreadingroom.co.in/notes-and-studymaterial/65-dbms/471-the-entity-relationship-model.html>. [Accessed 09 May 2020].

Gurv. ER Diagram Tutorial in DBMS (with Example) <https://www.guru99.com/er-diagram-tutorial-dbms.html>

Dreams, p (2016) key benefits of using entity relationship diagrams. *Key benefits of using entity relationship diagrams*. Available at: <https://pcdreams.com.sg/key-benefits-of-using-entity-relationship-diagrams/> [accessed 07 may 2020].

Paul, S (2008) Database Systems Performance Evaluation Techniques. Available at: <https://www.cse.wustl.edu/~jain/cse567-08/ftp/db/index.html> [Accessed 07 May 2020].

W3schools. (2020). SQL PRIMARY KEY Constraint. Available: https://www.w3schools.com/sql/sql_primarykey.asp. [Last accessed 8th May 2020]

W3schools. (2020). SQL FOREIGN KEY Constraint. Available: https://www.w3schools.com/sql/sql_foreignkey.asp [Last accessed 8th May 2020]

Triangle, T (2012) Database Testing. Available: <http://www.testtriangle.ie/en/database-testing> [Last accessed 8th May 2020]

Appendices

Appendix A - Results

Marks scored last term per class

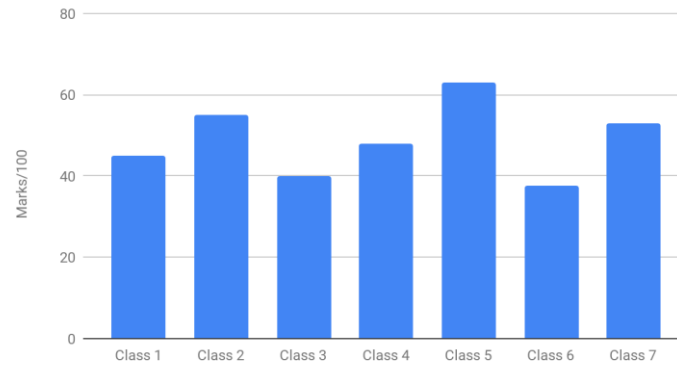


Figure 1- Student Marks last term

Attendance % last term per class

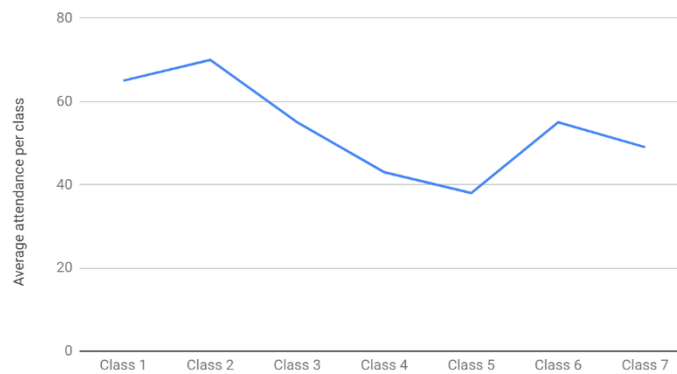


Figure 2- Attendance (In accurate data via grade sheet)

Do Students complete homework on time?

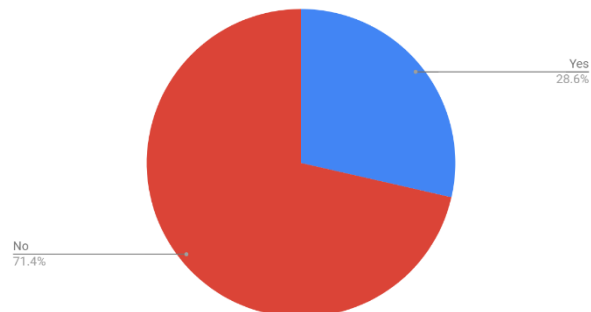


Figure 3- Homework

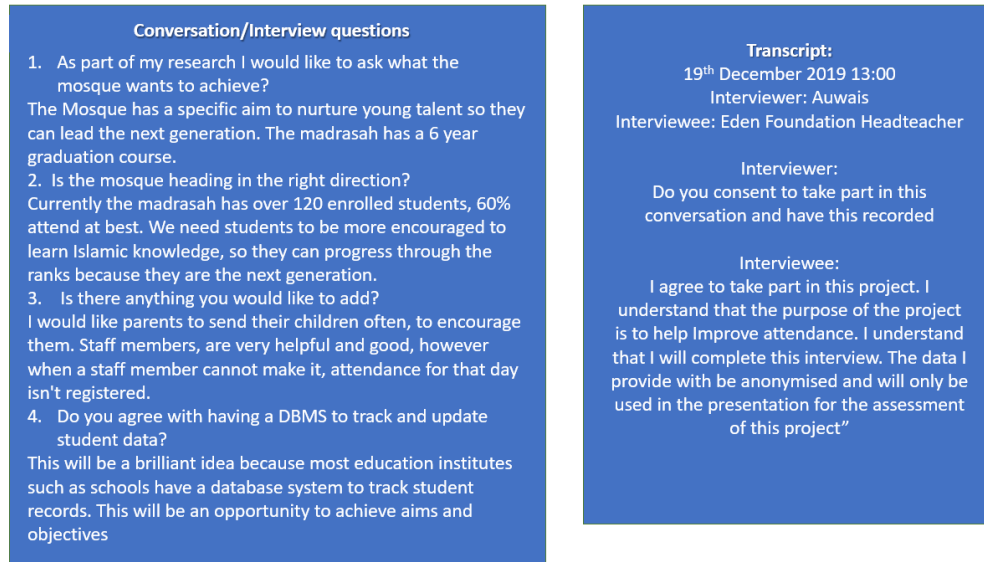


Figure 4- Structured Interview

Appendix B - SQL Scripts

```
Create.txt - Notepad
File Edit Format View Help
CREATE TABLE Staff (
StaffID int NOT NULL,
Forename varchar (30),
Surname varchar (30),
PhoneNumber Varchar (11),
Email varchar (30),
CONSTRAINT PK_StaffID PRIMARY KEY (StaffID)
);

CREATE TABLE Students (
StudentID int NOT NULL,
Forename varchar (30),
Surname varchar (30),
EmergencyNo Varchar (30),
Address varchar (11),
CONSTRAINT PK_StudentID PRIMARY KEY (StudentID)
);

CREATE TABLE Attendance (
ClassID int NOT NULL,
StudentID int NOT NULL,
PRIMARY KEY (StudentID,ClassID)
);

Show User;
CREATE TABLE Class (
ClassID int NOT NULL,
StudentID int,
Subject Varchar (10),
Classstart varchar (10),
Finish Varchar (30),
PRIMARY KEY (ClassID),
CONSTRAINT FK_StudentID FOREIGN KEY (StudentID)
REFERENCES Students (StudentID)
);

CREATE TABLE Slot (
SlotID int NOT NULL,
StudentID int,
Currentdate date,
WeekinMonth Number (10),
Attendance Varchar (30),
PRIMARY KEY (SlotID,StudentID)
);

Create Table Records (
SlotID int NOT NULL,
StudentID int NOT NULL,
PRIMARY KEY (StudentID,SlotID)
);
```

Figure 5- Create Scripts

```
Insert - Notepad
File Edit Format View Help
INSERT INTO Staff (StaffID, Forename, Surname, PhoneNumber, Email)
VALUES (1, 'Futubala', 'Khom', '07547365388', 'Futu@outlook.com');

INSERT INTO Staff (StaffID, Forename, Surname, PhoneNumber, Email)
VALUES (2, 'Balasuni', 'Beta', '07446565890', 'Balas@gmail.com');

INSERT INTO Staff (StaffID, Forename, Surname, PhoneNumber, Email)
VALUES (3, 'Foisha', 'Soni', '07548652885', 'Foisha@outlook.com');

INSERT INTO Staff (StaffID, Forename, Surname, PhoneNumber, Email)
VALUES (4, 'Tot', 'Abai', '07345489921', 'Abai@gmail.com');

INSERT INTO Staff (StaffID, Forename, Surname, PhoneNumber, Email)
VALUES (5, 'Michael', 'Mowdud', '07477878838', 'Abu@Icloud.com');

INSERT INTO Staff (StaffID, Forename, Surname, PhoneNumber, Email)
VALUES (6, 'Tuti', 'Khalil', '01632960735', 'Khalil@outlook.com');

INSERT INTO Staff (StaffID, Forename, Surname, PhoneNumber, Email)
VALUES (7, 'Apple', 'Apple', '07848105000', 'Apple@Icloud.com');

INSERT INTO Staff (StaffID, Forename, Surname, PhoneNumber, Email)
VALUES (8, 'Abdul', 'Fini', '07543700420', 'Abdul@outlook.com');

INSERT INTO Staff (StaffID, Forename, Surname, PhoneNumber, Email)
VALUES (9, 'Shakira', 'Shakira', '07548239921', 'Shak@gmail.com');

INSERT INTO Staff (StaffID, Forename, Surname, PhoneNumber, Email)
VALUES (10, 'Habib', 'Fut', '01633276532', 'Fut@Icloud.com');

INSERT INTO Students (StudentID, Forename, Surname, EmergencyNo, Address)
VALUES (100, 'David', 'Ali', '07548665882', 'Queen Road');

INSERT INTO Students (StudentID, Forename, Surname, EmergencyNo, Address)
VALUES (101, 'Ushta', 'Dimu', '07732552878', 'Wood Road');

INSERT INTO Students (StudentID, Forename, Surname, EmergencyNo, Address)
VALUES (102, 'Ada', 'Rosh', '07132876541', 'Rock Lane');

INSERT INTO Students (StudentID, Forename, Surname, EmergencyNo, Address)
VALUES (103, 'Ismail', 'Bal', '07743288312', 'Shed Road');

INSERT INTO Students (StudentID, Forename, Surname, EmergencyNo, Address)
VALUES (104, 'Amar', 'Fut', '07343321345', 'Ash Road');
```

Figure 6- Insert Scripts

```
Insert - Notepad
File Edit Format View Help

INSERT INTO Students (StudentID, Forename, Surname, EmergencyNo, Address)
VALUES (104, 'Amar', 'Fut', '07343321345', 'Ash Road');

INSERT INTO Students (StudentID, Forename, Surname, EmergencyNo, Address)
VALUES (105, 'Bilal', 'Mor', '07838276521', 'Wil Road');

INSERT INTO Students (StudentID, Forename, Surname, EmergencyNo, Address)
VALUES (106, 'Adil', 'Ali', '07521432541', 'Ring Road');

INSERT INTO Students (StudentID, Forename, Surname, EmergencyNo, Address)
VALUES (107, 'Lal', 'Din', '07576543218', 'Hall Road');

INSERT INTO Students (StudentID, Forename, Surname, EmergencyNo, Address)
VALUES (108, 'Lecu', 'Miah', '07323654432', 'Hall Road');

INSERT INTO Students (StudentID, Forename, Surname, EmergencyNo, Address)
VALUES (109, 'Khay', 'Mor', '07321765121', 'Mary Road');

INSERT INTO Students (StudentID, Forename, Surname, EmergencyNo, Address)
VALUES (110, 'Ali', 'Mani', '07456321983', 'Shed Road');

INSERT INTO Attendance (ClassID, StudentID)
VALUES (200, 100);

INSERT INTO Attendance (ClassID, StudentID)
VALUES (201, 101);

INSERT INTO Attendance (ClassID, StudentID)
VALUES (202, 102);

INSERT INTO Attendance (ClassID, StudentID)
VALUES (203, 103);

INSERT INTO Attendance (ClassID, StudentID)
VALUES (204, 104);

INSERT INTO Attendance (ClassID, StudentID)
VALUES (205, 105);

INSERT INTO Attendance (ClassID, StudentID)
VALUES (206, 106);

INSERT INTO Attendance (ClassID, StudentID)
VALUES (207, 107);
```

Insert - Notepad

File Edit Format View Help

```
INSERT INTO Attendance (ClassID, StudentID)
VALUES (207, 107);
```

```
INSERT INTO Attendance (ClassID, StudentID)
VALUES (208, 108);
```

```
INSERT INTO Attendance (ClassID, StudentID)
VALUES (209, 109);
```

```
INSERT INTO Attendance (ClassID, StudentID)
VALUES (210, 110);
```

```
INSERT INTO Class (ClassID, StudentID, Subject, Classstart, Finish)
VALUES (200, 100, 'Hifz', '17:00', '19:30');
```

```
INSERT INTO Class (ClassID, StudentID, Subject, Classstart, Finish)
VALUES (201, 101, 'Year1', '17:03', '19:27');
```

```
INSERT INTO Class (ClassID, StudentID, Subject, Classstart, Finish)
VALUES (202, 102, 'Year1', '16:58', '19:37');
```

```
INSERT INTO Class (ClassID, StudentID, Subject, Classstart, Finish)
VALUES (203, 103, 'Hifz', '17:12', '19:35');
```

```
INSERT INTO Class (ClassID, StudentID, Subject, Classstart, Finish)
VALUES (204, 104, 'Year2', '16:45', '19:20');
```

```
INSERT INTO Class (ClassID, StudentID, Subject, Classstart, Finish)
VALUES (205, 105, 'Hifz', '17:15', '19:30');
```

```
INSERT INTO Class (ClassID, StudentID, Subject, Classstart, Finish)
VALUES (206, 106, 'Year3', '17:11', '19:33');
```

```
INSERT INTO Class (ClassID, StudentID, Subject, Classstart, Finish)
VALUES (207, 107, 'Hifz', '17:30', '19:34');
```

```
INSERT INTO Class (ClassID, StudentID, Subject, Classstart, Finish)
VALUES (208, 108, 'Year4', '17:02', '19:45');
```

```
INSERT INTO Class (ClassID, StudentID, Subject, Classstart, Finish)
VALUES (209, 109, 'Hifz', '17:01', '19:34');
```

```
INSERT INTO Class (ClassID, StudentID, Subject, Classstart, Finish)
VALUES (210, 110, 'Year5', '17:00', '19:37');
```

Insert - Notepad

File Edit Format View Help

```
INSERT INTO Slot (SlotID, StudentID, CurrentDate, WeekinMonth, Attendance)
VALUES (300, 100, '12-Sep-19', '2', 'Absent');
```

```
INSERT INTO Slot (SlotID, StudentID, CurrentDate, WeekinMonth, Attendance)
VALUES (301, 101, '12-Sep-19', '2', 'Present');
```

```
INSERT INTO Slot (SlotID, StudentID, CurrentDate, WeekinMonth, Attendance)
VALUES (302, 102, '12-Sep-19', '2', 'Absent');
```

```
INSERT INTO Slot (SlotID, StudentID, CurrentDate, WeekinMonth, Attendance)
VALUES (303, 103, '12-Sep-19', '2', 'Present');
```

```
INSERT INTO Slot (SlotID, StudentID, CurrentDate, WeekinMonth, Attendance)
VALUES (304, 104, '12-Sep-19', '2', 'Present');
```

```
INSERT INTO Slot (SlotID, StudentID, CurrentDate, WeekinMonth, Attendance)
VALUES (305, 105, '12-Sep-19', '2', 'Present');
```

```
INSERT INTO Slot (SlotID, StudentID, CurrentDate, WeekinMonth, Attendance)
VALUES (306, 106, '12-Sep-19', '2', 'Absent');
```

```
INSERT INTO Slot (SlotID, StudentID, CurrentDate, WeekinMonth, Attendance)
VALUES (307, 107, '12-Sep-19', '2', 'Absent');
```

```
INSERT INTO Slot (SlotID, StudentID, CurrentDate, WeekinMonth, Attendance)
VALUES (308, 108, '12-Sep-19', '2', 'Present');
```

```
INSERT INTO Slot (SlotID, StudentID, CurrentDate, WeekinMonth, Attendance)
VALUES (309, 109, '12-Sep-19', '2', 'Present');
```

```
INSERT INTO Slot (SlotID, StudentID, CurrentDate, WeekinMonth, Attendance)
VALUES (310, 110, '12-Sep-19', '2', 'Absent');
```

```
INSERT INTO Records (SlotID, StudentID)
VALUES (300, 100);

INSERT INTO Records (SlotID, StudentID)
VALUES (301, 101);

INSERT INTO Records (SlotID, StudentID)
VALUES (302, 102);

INSERT INTO Records (SlotID, StudentID)
VALUES (303, 103);

INSERT INTO Records (SlotID, StudentID)
VALUES (304, 104);

INSERT INTO Records (SlotID, StudentID)
VALUES (305, 105);

INSERT INTO Records (SlotID, StudentID)
VALUES (306, 106);

INSERT INTO Records (SlotID, StudentID)
VALUES (307, 107);

INSERT INTO Records (SlotID, StudentID)
VALUES (308, 108);

INSERT INTO Records (SlotID, StudentID)
VALUES (309, 109);

INSERT INTO Records (SlotID, StudentID)
VALUES (310, 110);
```

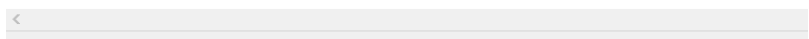



Figure 7- Drop Scripts

 Drop.txt - Notepad
File Edit Format View Help
drop table Staff cascade constraints;
drop Table Students cascade constraints;
drop table attendance;
drop table Class cascade constraints;
drop table Slot;
drop table records;|

Appendix C - SQL Plus

```
C:\SQLPlus\instantclient_19_6\sqlplus.exe

Connected to:
Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.3.0.0.0

SQL> drop table Staff cascade constraints;

Table dropped.

SQL> drop Table Students cascade constraints;

Table dropped.

SQL> drop table attendance;

Table dropped.

SQL> drop table Class cascade constraints;

Table dropped.

SQL> drop table Slot;

Table dropped.

SQL> drop table records;

Table dropped.

SQL>
```

```
C:\SQLPlus\instantclient_19_6\sqlplus.exe

SQL>
SQL>
SQL> CREATE TABLE Students (
  2 StudentID int NOT NULL,
  3 Forename varchar (30),
  4 Surname varchar (30),
  5 EmergencyNo Varchar (30),
  6 Address varchar (11),
  7 CONSTRAINT PK_StudentID PRIMARY KEY (StudentID)
  8 );

Table created.

SQL>
SQL>
SQL> CREATE TABLE Attendance (
  2 ClassID int NOT NULL,
  3 StudentID int NOT NULL,
  4 PRIMARY KEY (StudentID,ClassID)
  5 );

Table created.

SQL>
SQL> Show User;
USER is "SYS"
SQL> CREATE TABLE Class (
  2 ClassID int NOT NULL,
  3 StudentID int,
  4 Subject Varchar (10),
  5 Classstart varchar (10),
  6 Finish Varchar (30),
  7 PRIMARY KEY (ClassID),
  8 CONSTRAINT FK_StudentID FOREIGN KEY (StudentID)
  9 REFERENCES Students (StudentID)
  10 );

Table created.

SQL>
SQL>
SQL> CREATE TABLE Slot (
  2 SlotID int NOT NULL,
  3 StudentID int,
  4 Currentdate date,
  5 WeekinMonth Number (10),
  6 Attendance Varchar (30),
  7 PRIMARY KEY (SlotID)
  8 );
```

```
SQL>
SQL> Create Table Records (
  2 SlotID int NOT NULL,
  3 StudentID int NOT NULL,
  4 PRIMARY KEY (StudentID,SlotID)
  5 );

Table created.

SQL>
```

Table created.

```
SQL> INSERT INTO Staff (StaffID, Forename, Surname, PhoneNumber, Email)
      2 VALUES (1, 'Futubala', 'Khom', '07547365388', 'Futu@outlook.com');
```

1 row created.

SQL>

```
SQL> INSERT INTO Staff (StaffID, Forename, Surname, PhoneNumber, Email)
      2 VALUES (2, 'Balasuni', 'Beta', '07446565890', 'Balas@gmail.com');
```

1 row created.

SQL>

```
SQL> INSERT INTO Staff (StaffID, Forename, Surname, PhoneNumber, Email)
      2 VALUES (3, 'Foisha', 'Soni', '07548652885', 'Foisha@outlook.com');
```

1 row created.

SQL>

```
SQL> INSERT INTO Staff (StaffID, Forename, Surname, PhoneNumber, Email)
      2 VALUES (4, 'Tot', 'Abai', '07345489921', 'Abai@gmail.com');
```

1 row created.

SQL>

```
SQL> INSERT INTO Staff (StaffID, Forename, Surname, PhoneNumber, Email)
      2 VALUES (5, 'Michael', 'Mowdud', '07477878838', 'Abu@Icloud.com');
```

1 row created.

SQL>

```
SQL> INSERT INTO Staff (StaffID, Forename, Surname, PhoneNumber, Email)
      2 VALUES (6, 'Tuti', 'Khalil', '01632960735', 'Khalil@outlook.com');
```

1 row created.

SQL>

```
SQL> INSERT INTO Staff (StaffID, Forename, Surname, PhoneNumber, Email)
      2 VALUES (7, 'Apple', 'Apple', '07848105000', 'Apple@Icloud.com');
```

1 row created.

SQL>

```
SQL> INSERT INTO Staff (StaffID, Forename, Surname, PhoneNumber, Email)
      2 VALUES (8, 'Abdul', 'Finii', '07543700420', 'Abdul@outlook.com');
```

1 row created.

SQL>

```
SQL> INSERT INTO Staff (StaffID, Forename, Surname, PhoneNumber, Email)
      2 VALUES (9, 'Shakira', 'Shakira', '07548239921', 'Shak@gmail.com');
```

1 row created.

SQL>

```
SQL> INSERT INTO Staff (StaffID, Forename, Surname, PhoneNumber, Email)
      2 VALUES (10, 'Habib', 'Fut', '01633276532', 'Fut@Icloud.com');
```

1 row created.

SQL>

SQL>

```
SQL> INSERT INTO Students (StudentID, Forename, Surname, EmergencyNo, Address)
      2 VALUES (100, 'David', 'Ali', '07548665882', 'Queen Road');
```

1 row created.

SQL>

```
SQL> INSERT INTO Students (StudentID, Forename, Surname, EmergencyNo, Address)
      2 VALUES (101, 'Ushta', 'Dimu', '07732552878', 'Wood Road');
```

1 row created.

SQL>

```
SQL> INSERT INTO Students (StudentID, Forename, Surname, EmergencyNo, Address)
      2 VALUES (102, 'Ada', 'Rosh', '07132876541', 'Rock Lane');
```

1 row created.

SQL>

```
SQL> INSERT INTO Students (StudentID, Forename, Surname, EmergencyNo, Address)
      2 VALUES (103, 'Ismail', 'Bal', '07743288312', 'Shed Road');
```

1 row created.

SQL>

```
SQL> INSERT INTO Students (StudentID, Forename, Surname, EmergencyNo, Address)
      2 VALUES (104, 'Amar', 'Fut', '07343321345', 'Ash Road');
```

1 row created.

SQL>

```
SQL> INSERT INTO Students (StudentID, Forename, Surname, EmergencyNo, Address)
      2 VALUES (105, 'Bilal', 'Mor', '07838276521', 'Wil Road');
```

1 row created.

C:\SQLPlus\instantclient_19_6\sqlplus.exe

```
SQL>
SQL> INSERT INTO Students (StudentID, Forename, Surname, EmergencyNo, Address)
      2 VALUES (106, 'Adil', 'Ali', '07521432541', 'Ring Road');

1 row created.

SQL>
SQL> INSERT INTO Students (StudentID, Forename, Surname, EmergencyNo, Address)
      2 VALUES (107, 'Lal', 'Din', '07576543218', 'Hall Road');

1 row created.

SQL>
SQL> INSERT INTO Students (StudentID, Forename, Surname, EmergencyNo, Address)
      2 VALUES (108, 'Lecu', 'Miah', '07323654432', 'Hall Road');

1 row created.

SQL>
SQL> INSERT INTO Students (StudentID, Forename, Surname, EmergencyNo, Address)
      2 VALUES (109, 'Khay', 'Mor', '07321765121', 'Mary Road');

1 row created.

SQL>
SQL> INSERT INTO Students (StudentID, Forename, Surname, EmergencyNo, Address)
      2 VALUES (110, 'Ali', 'Mani', '07456321983', 'Shed Road');

1 row created.

SQL>
SQL>
SQL> INSERT INTO Attendance (ClassID, StudentID)
      2 VALUES (200, 100);

1 row created.

SQL>
SQL> INSERT INTO Attendance (ClassID, StudentID)
      2 VALUES (201, 101);

1 row created.

SQL>
SQL> INSERT INTO Attendance (ClassID, StudentID)
      2 VALUES (202, 102);

1 row created.
```

C:\SQLPlus\instantclient_19_6\sqlplus.exe

```
SQL>
SQL> INSERT INTO Attendance (ClassID, StudentID)
      2 VALUES (203, 103);

1 row created.

SQL>
SQL> INSERT INTO Attendance (ClassID, StudentID)
      2 VALUES (204, 104);

1 row created.

SQL>
SQL> INSERT INTO Attendance (ClassID, StudentID)
      2 VALUES (205, 105);

1 row created.

SQL>
SQL> INSERT INTO Attendance (ClassID, StudentID)
      2 VALUES (206, 106);

1 row created.

SQL>
SQL> INSERT INTO Attendance (ClassID, StudentID)
      2 VALUES (207, 107);

1 row created.

SQL>
SQL> INSERT INTO Attendance (ClassID, StudentID)
      2 VALUES (208, 108);

1 row created.

SQL>
SQL> INSERT INTO Attendance (ClassID, StudentID)
      2 VALUES (209, 109);

1 row created.

SQL>
SQL> INSERT INTO Attendance (ClassID, StudentID)
      2 VALUES (210, 110);

1 row created.

SQL>
SQL>
```

C:\SQLPlus\instantclient_19_6\sqlplus.exe

```
SQL>
SQL>
SQL> INSERT INTO Class (ClassID, StudentID, Subject, Classstart, Finish)
  2 VALUES (200, 100, 'Hifz', '17:00', '19:30');

1 row created.

SQL>
SQL> INSERT INTO Class (ClassID, StudentID, Subject, Classstart, Finish)
  2 VALUES (201, 101, 'Year1', '17:03', '19:27');

1 row created.

SQL>
SQL> INSERT INTO Class (ClassID, StudentID, Subject, Classstart, Finish)
  2 VALUES (202, 102, 'Year1', '16:58', '19:37');

1 row created.

SQL>
SQL> INSERT INTO Class (ClassID, StudentID, Subject, Classstart, Finish)
  2 VALUES (203, 103, 'Hifz', '17:12', '19:35');

1 row created.

SQL>
SQL> INSERT INTO Class (ClassID, StudentID, Subject, Classstart, Finish)
  2 VALUES (204, 104, 'Year2', '16:45', '19:20');

1 row created.

SQL>
SQL> INSERT INTO Class (ClassID, StudentID, Subject, Classstart, Finish)
  2 VALUES (205, 105, 'Hifz', '17:15', '19:30');

1 row created.

SQL>
SQL> INSERT INTO Class (ClassID, StudentID, Subject, Classstart, Finish)
  2 VALUES (206, 106, 'Year3', '17:11', '19:33');

1 row created.

SQL>
SQL> INSERT INTO Class (ClassID, StudentID, Subject, Classstart, Finish)
  2 VALUES (207, 107, 'Hifz', '17:30', '19:34');

1 row created.

SQL>
```

C:\SQLPlus\instantclient_19_6\sqlplus.exe

```
SQL>
SQL> INSERT INTO Class (ClassID, StudentID, Subject, Classstart, Finish)
  2 VALUES (208, 108, 'Year4', '17:02', '19:45');

1 row created.

SQL>
SQL> INSERT INTO Class (ClassID, StudentID, Subject, Classstart, Finish)
  2 VALUES (209, 109, 'Hifz', '17:01', '19:34');

1 row created.

SQL>
SQL> INSERT INTO Class (ClassID, StudentID, Subject, Classstart, Finish)
  2 VALUES (210, 110, 'Year5', '17:00', '19:37');

1 row created.

SQL>
SQL>
SQL> INSERT INTO Slot (SlotID, StudentID, CurrentDate, WeekinMonth, Attendance)
  2 VALUES (300, 100, '12-Sep-19', '2', 'Absent');

1 row created.

SQL>
SQL> INSERT INTO Slot (SlotID, StudentID, CurrentDate, WeekinMonth, Attendance)
  2 VALUES (301, 101, '12-Sep-19', '2', 'Present');

1 row created.

SQL>
SQL> INSERT INTO Slot (SlotID, StudentID, CurrentDate, WeekinMonth, Attendance)
  2 VALUES (302, 102, '12-Sep-19', '2', 'Absent');

1 row created.

SQL>
SQL> INSERT INTO Slot (SlotID, StudentID, CurrentDate, WeekinMonth, Attendance)
  2 VALUES (303, 103, '12-Sep-19', '2', 'Present');

1 row created.

SQL>
SQL> INSERT INTO Slot (SlotID, StudentID, CurrentDate, WeekinMonth, Attendance)
  2 VALUES (304, 104, '12-Sep-19', '2', 'Present');

1 row created.

SQL>
```

```
SQL>
SQL> INSERT INTO Slot (SlotID, StudentID, CurrentDate, WeekinMonth, Attendance)
  2  VALUES (305, 105, '12-Sep-19', '2', 'Present');

1 row created.

SQL>
SQL> INSERT INTO Slot (SlotID, StudentID, CurrentDate, WeekinMonth, Attendance)
  2  VALUES (306, 106, '12-Sep-19', '2', 'Absent');

1 row created.

SQL>
SQL> INSERT INTO Slot (SlotID, StudentID, CurrentDate, WeekinMonth, Attendance)
  2  VALUES (307, 107, '12-Sep-19', '2', 'Absent');

1 row created.

SQL>
SQL> INSERT INTO Slot (SlotID, StudentID, CurrentDate, WeekinMonth, Attendance)
  2  VALUES (308, 108, '12-Sep-19', '2', 'Present');

1 row created.

SQL>
SQL> INSERT INTO Slot (SlotID, StudentID, CurrentDate, WeekinMonth, Attendance)
  2  VALUES (309, 109, '12-Sep-19', '2', 'Present');

1 row created.

SQL>
SQL> INSERT INTO Slot (SlotID, StudentID, CurrentDate, WeekinMonth, Attendance)
  2  VALUES (310, 110, '12-Sep-19', '2', 'Absent');

1 row created.

SQL>
SQL>
SQL> INSERT INTO Records (SlotID, StudentID)
  2  VALUES (300, 100);

1 row created.

SQL>
SQL> INSERT INTO Records (SlotID, StudentID)
  2  VALUES (301, 101);

1 row created.

SQL>
```

```
C:\SQLPlus\instantclient_19_6\sqlplus.exe
SQL> INSERT INTO Records (SlotID, StudentID)
      2  VALUES (302, 102);

1 row created.

SQL>
SQL> INSERT INTO Records (SlotID, StudentID)
      2  VALUES (303, 103);

1 row created.

SQL>
SQL> INSERT INTO Records (SlotID, StudentID)
      2  VALUES (304, 104);

1 row created.

SQL>
SQL> INSERT INTO Records (SlotID, StudentID)
      2  VALUES (305, 105);

1 row created.

SQL>
SQL> INSERT INTO Records (SlotID, StudentID)
      2  VALUES (306, 106);

1 row created.

SQL>
SQL> INSERT INTO Records (SlotID, StudentID)
      2  VALUES (307, 107);

1 row created.

SQL>
SQL> INSERT INTO Records (SlotID, StudentID)
      2  VALUES (308, 108);

1 row created.

SQL>
SQL> INSERT INTO Records (SlotID, StudentID)
      2  VALUES (309, 109);

1 row created.

SQL>
SQL> INSERT INTO Records (SlotID, StudentID)
      2  VALUES (310, 110);
```

```
1 row created.

SQL>
SQL> INSERT INTO Records (SlotID, StudentID)
      2  VALUES (309, 109);

1 row created.

SQL>
SQL> INSERT INTO Records (SlotID, StudentID)
      2  VALUES (310, 110);

1 row created.

SQL>
SQL>
SQL>
SQL>
SQL>
SQL>
```

Figure 8- SQL Scripts

Appendix D - Oracle Apex

The screenshot shows the Oracle APEX SQL Scripts Results page. The script 'Create.txt.txt' is complete, with 15 rows processed. The table below lists the statements and their feedback.

Number	Elapsed	Statement	Feedback	Rows
1	0.07	CREATE TABLE Staff (StaffID int NOT NULL, Forename varchar	Table created.	0
2	0.05	CREATE TABLE Students (StudentID int NOT NULL, Forename var	Table created.	0
3	0.04	CREATE TABLE Attendance (ClassID int NOT NULL, StudentID in	Table created.	0
4	0.06	CREATE TABLE Class (ClassID int NOT NULL, StudentID int, Su	Table created.	0
5	0.05	CREATE TABLE Slot (SlotID int NOT NULL, StudentID int, Curr	Table created.	0
6	0.04	Create Table Records (SlotID int NOT NULL, StudentID int NO	Table created.	0

Summary: 6 Statements Processed, 6 Successful, 0 With Errors.

Figure 9- Uploading Scripts

The screenshot shows the Oracle APEX SQL Scripts list. It displays a table of scripts with columns for Edit, Owner, Name, Created, Updated By, Updated, Bytes, Results, and Run. The scripts are Drop.txt.txt, Insert.txt, and Create.txt.txt, all uploaded by AUWAIS.RAFIQ7@GMAIL.COM.

Edit	Owner	Name	Created	Updated By	Updated	Bytes	Results	Run
	AUWAIS.RAFIQ7@GMAIL.COM	Drop.txt.txt	2 minutes ago	AUWAIS.RAFIQ7@GMAIL.COM	2 minutes ago	181	1	
	AUWAIS.RAFIQ7@GMAIL.COM	Insert.txt	5 minutes ago	AUWAIS.RAFIQ7@GMAIL.COM	5 minutes ago	6,985	2	
	AUWAIS.RAFIQ7@GMAIL.COM	Create.txt.txt	19 minutes ago	AUWAIS.RAFIQ7@GMAIL.COM	19 minutes ago	1,022	2	

Figure 10- Scripts Uploaded

The screenshot shows the Oracle APEX 'Create an Application' wizard. The application name is 'Eden Foundation Database Management System'. The appearance is 'Vita - Slate, Side Menu'. The pages section shows a 'Home' page. The features section shows various options like 'About Page', 'Access Control', 'Activity Reporting', 'Configuration Options', 'Feedback', and 'Theme Style Selection'.

Create an Application

Name: Eden Foundation Database Management System

Appearance: Vita - Slate, Side Menu

Pages

- Home (Blank)

Features

- ☒ About Page: Add about this application page
- ☒ Access Control: Enable role-based user authorization
- ☒ Activity Reporting: Include user activity and error reports
- ☒ Configuration Options: Enable or disable application features
- ☒ Feedback: Allow users to provide feedback
- ☒ Theme Style Selection: Update default application look and feel

Create Application

Figure 11- Creating Application

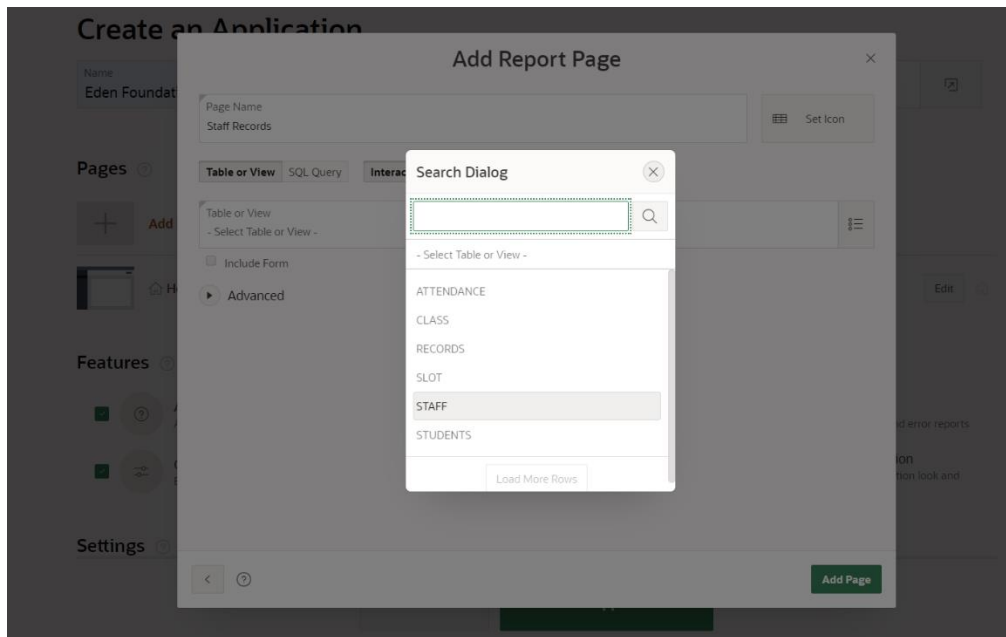


Figure 12- Adding Pages

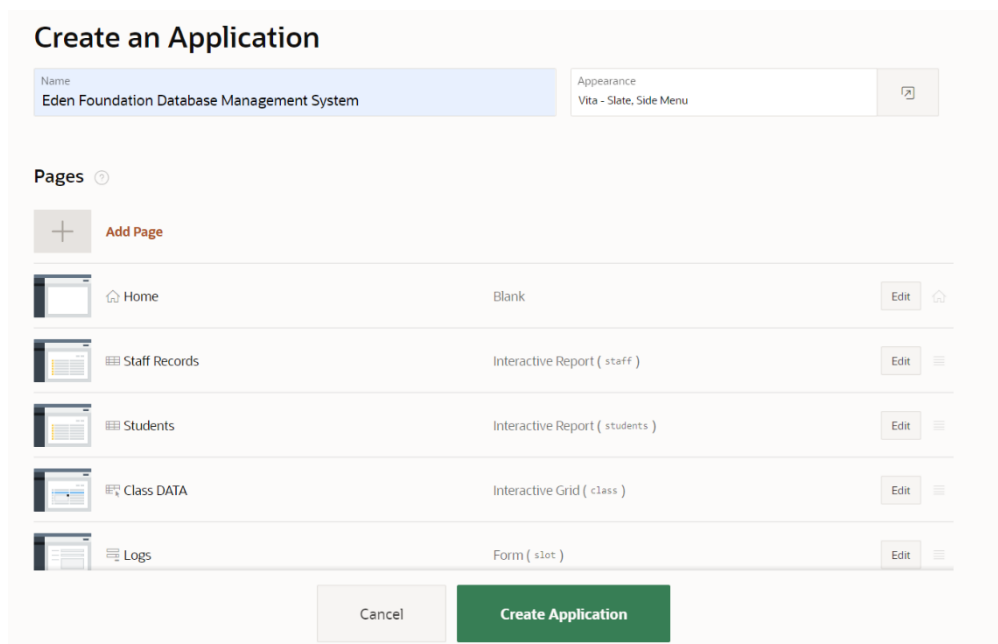


Figure 13- Finalizing Application

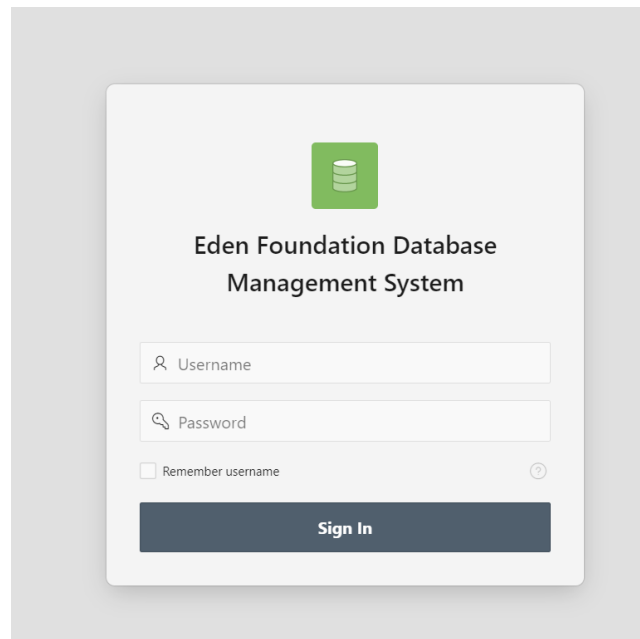


Figure 14- Logging into Database

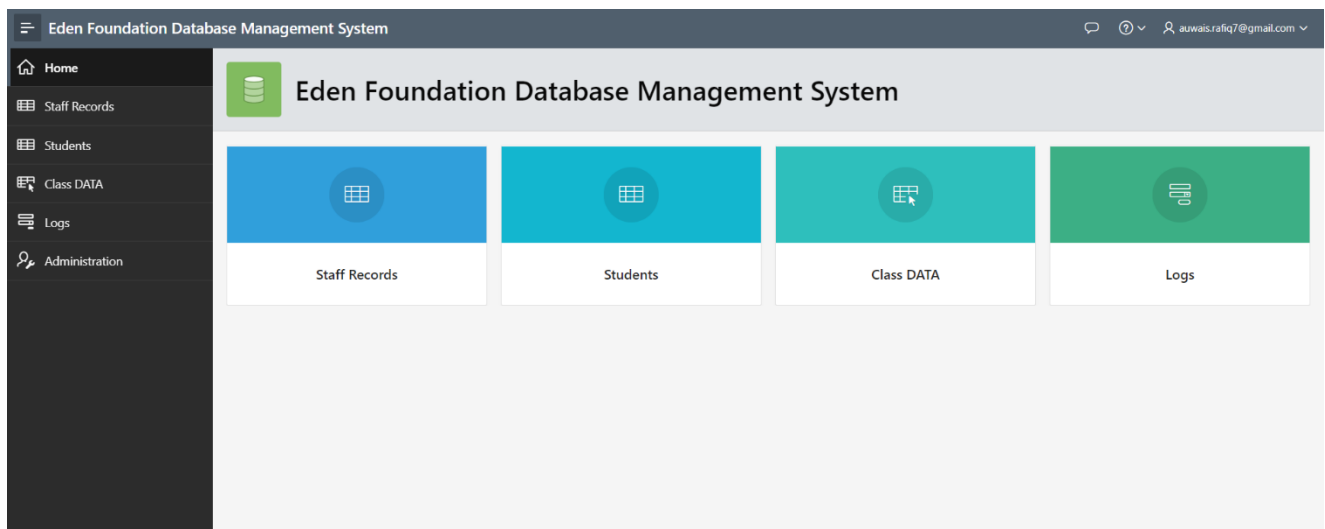


Figure 15- Database

Eden Foundation Database Management System

Home Staff Records Students Class DATA Logs Administration

Staff Records

Q Go Actions Reset

Forename	Surname	Phonenumber	Email
Abdul	Fini	07543700420	Abdul@outlook.com
Apple	Apple	07848105000	Apple@icloud.com
Balasuni	Beta	07446565890	Balas@gmail.com
Foisha	Soni	07548652885	Foisha@outlook.com
Futubala	Khom	07547365388	Futu@outlook.com
Habib	Fut	01633276532	Fut@icloud.com
Michael	Mowdud	07477878838	Abu@icloud.com
Shakira	Shakira	07548239921	Shak@gmail.com
Tot	Abai	07345489921	Abai@gmail.com
Tuti	Khalil	01632960735	Khalil@outlook.com

1 - 10

Release 1.0 Home Application 1375 Edit Page 2 Session View Debug Debug Page Info Quick Edit Theme Roller

Figure 16- Staff Records

Eden Foundation Database Management System

Home Staff Records Students Class DATA Logs Administration

Students

Q Go Actions Reset

Forename	Surname	Emergencyno	Address
Ada	Rosh	07132876541	Rock Lane
Adil	Ali	07521432541	Ring Road
Ali	Mani	07456321983	Shed Road
Amar	Fut	07343321345	Ash Road
Bilal	Mor	07838276521	Will Road
David	Ali	07548665882	Queen Road
Ismail	Bal	07743288312	Shed Road
Khay	Mor	07321765121	Mary Road
Lal	Din	07576543218	Hall Road
Lecu	Miah	07323654432	Hall Road
Ushta	Dimu	07732552878	Wood Road

1 - 11

Figure 17- Student Data

Eden Foundation Database Management System

Home Staff Records Students Class DATA Logs Administration

Class DATA

Q Search: All Text Columns Go Actions Edit Save Add Row Reset

<input type="checkbox"/>	Studentid	Subject	Classstart	Finish
<input checked="" type="checkbox"/>	David	Hifz	17:00	19:30
<input type="checkbox"/>	Ushta	Year1	17:03	19:27
<input type="checkbox"/>	Ada	Year1	16:58	19:37
<input type="checkbox"/>	Ismail	Hifz	17:12	19:35
<input type="checkbox"/>	Amar	Year2	16:45	19:20
<input type="checkbox"/>	Bilal	Hifz	17:15	19:30
<input type="checkbox"/>	Adil	Year3	17:11	19:33
<input type="checkbox"/>	Lal	Hifz	17:30	19:34
<input type="checkbox"/>	Lecu	Year4	17:02	19:45
<input type="checkbox"/>	Khay	Hifz	17:01	19:34
<input type="checkbox"/>	Ali	Year5	17:00	19:37

1 rows selected Total 11

Figure 18- Class Data

Eden Foundation Database Management System

Home Staff Records Students Class DATA **Logs** Administration

Logs

Slot

Studentid

Currentdate

Weekinmonth

Attendance

Cancel Create

Figure 19- Student Log (Teacher Requirement)

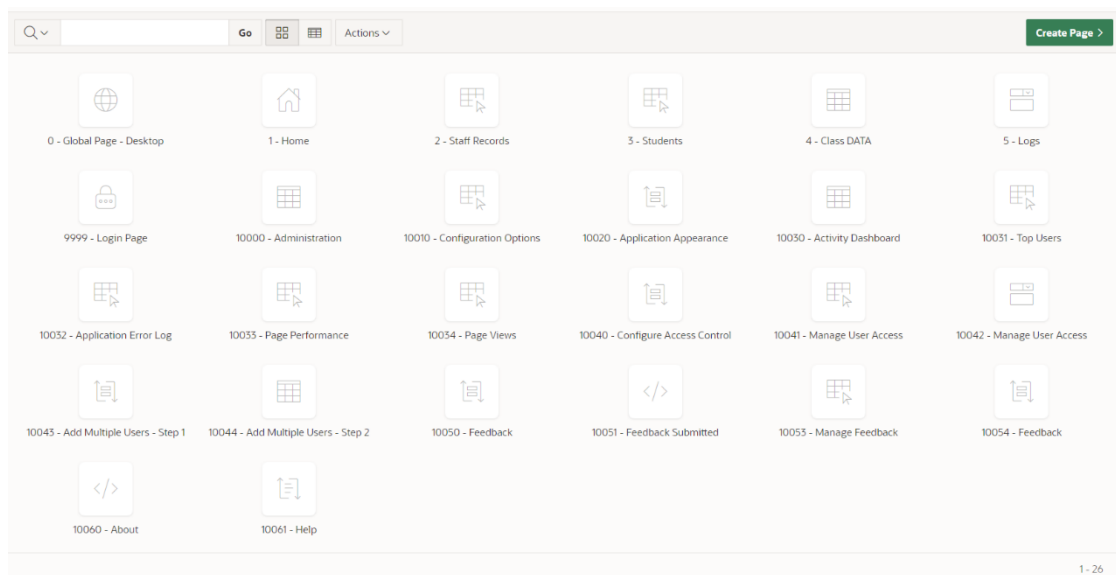


Figure 20- Pages Created

APEX

App Builder

SQL Workshop

Team Development

App Gallery

Application 1375

Shared Components

Authentication Schemes

Authentication Schemes

Subscription

History

Q

Go

Actions

Reset

Create

Name	Scheme Type	Subscribed From	Subscribers
Application Express Authentication - Current	Application Express Accounts		

Figure 21- Authentication Scheme

APEX

App Builder

SQL Workshop

Team Development

App Gallery

Application 1375

Shared Components

Authorization Schemes

Authorization Schemes

Subscription

by Component

Utilization

History

Q

Go

Actions

Copy

Reset

Create

Name	Type	Caching	Subscribed From	Subscribers	Updated
Administration Rights	Is In Role or Group	Once per page view			114 minutes ago
Contribution Rights	Is In Role or Group	Once per page view			114 minutes ago
Reader Rights	PL/SQL Function Returning Boolean	Once per session			114 minutes ago

1 - 3

Figure 22- Authorization Scheme

User Assignment

About Application Users

Application users are not exported as part of your application. When you deploy your application you will need to manually manage your user to role assignments. Roles are exported as part of an application export and imported with application imports.

* User Name

HABIB

Application Role

☐ Administrator

☒ Contributor

☐ Reader

Cancel

Create Assignment

Figure 23- Adding Staff

Application Access Control

Show AllRolesUser Role Assignments

Q ▾

Go

Actions ▾

Add Role >

Role	Static Identifier	Users	Description
Administrator	ADMINISTRATOR	1	Role assigned to application administrators.
Contributor	CONTRIBUTOR	2	Role assigned to application contributors.
Reader	READER	0	Role assigned to application readers.

1 - 3

User Role Assignments

Q ▾

Go

Actions ▾

Add User Role Assignment >

User Name ↑	Roles
AUWAIS,RAFIQ7@GMAIL.COM	Administrator
FUTUBALA	Contributor
HABIB	Contributor

1 - 3

Figure 24- Two Users Added

APEX

App Builder

SQL Workshop

Team Development

App Gallery

Manage Users and Groups
Create User

Create User

Cancel

Create and Create Another

Create User

Show All
User Identification
Account Privileges
Password
Group Assignments

User Identification

Username

Email Address

First Name

Last Name

Description

Default Date Format

Account Privileges

Default Schema

AUWAIS7

Accessible Schemas (null for all)

Figure 25- Creating User

APEX App Builder SQL Workshop Team Development App Gallery					
Manage Users and Groups					
User created.					
Users Groups Group Assignments					
<input type="text"/> <input type="button" value="Go"/> <input type="button" value="Reset"/> <input type="button" value="View Dashboard"/> <input type="button" value="Create Multiple Users"/> <input type="button" value="Create User"/>					
User	Email	Account Type	Locked	Builder Last Login	Created
AUWAIS.RAFIQ7@GMAIL.COM	auwais.rafiq7@gmail.com	Workspace Administrator	No	28 minutes ago	2 days ago
FUTUBALA	Futu@outlook.com	End User	No	-	Now
HABIB	Fut@icloud.com	End User	No	-	10 minutes ago
1 - 3					

Figure 26- User Completion

Appendix E - Testing

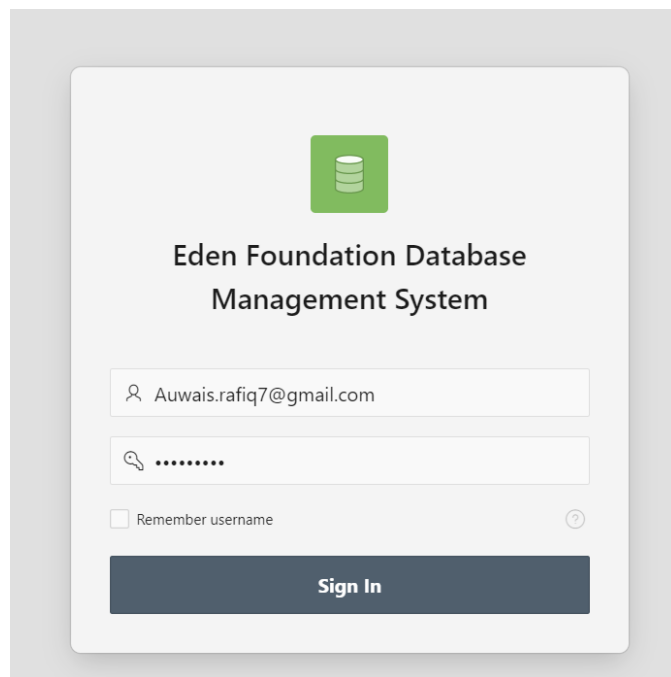


Figure 27 - Admin Login

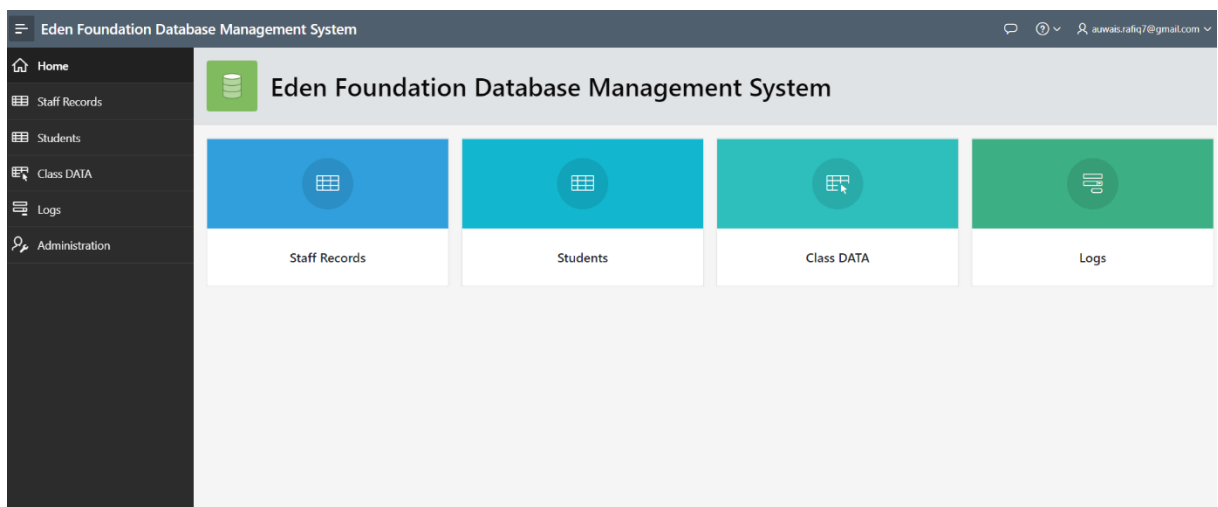
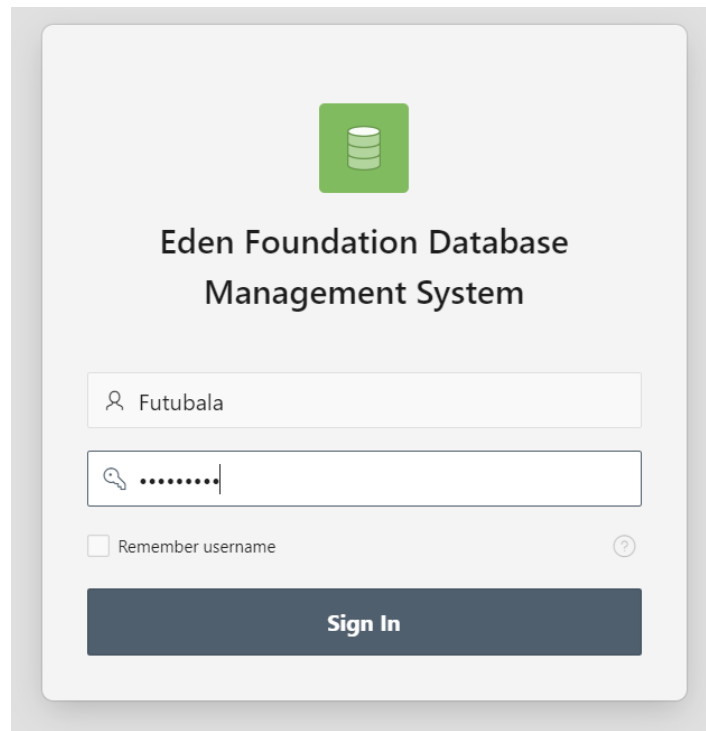


Figure 28 – Admin Successfully Logged In



The login screen features a green database icon at the top center. Below it, the title "Eden Foundation Database Management System" is displayed in a bold, black font. The login form consists of two input fields: the first for the username "Futubala" and the second for the password, which is masked with dots. Below the password field is a checkbox labeled "Remember username" and a small circular help icon with a question mark. A dark blue "Sign In" button is positioned at the bottom of the form.

Figure 29 - Staff Login

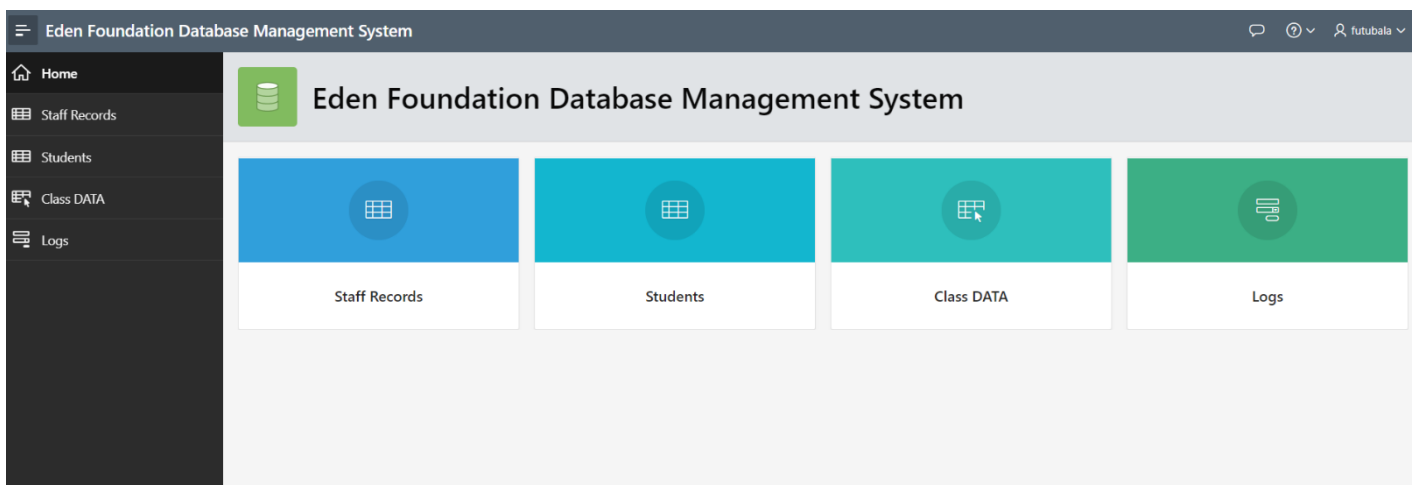


Figure 30 – Staff Successfully Logged In

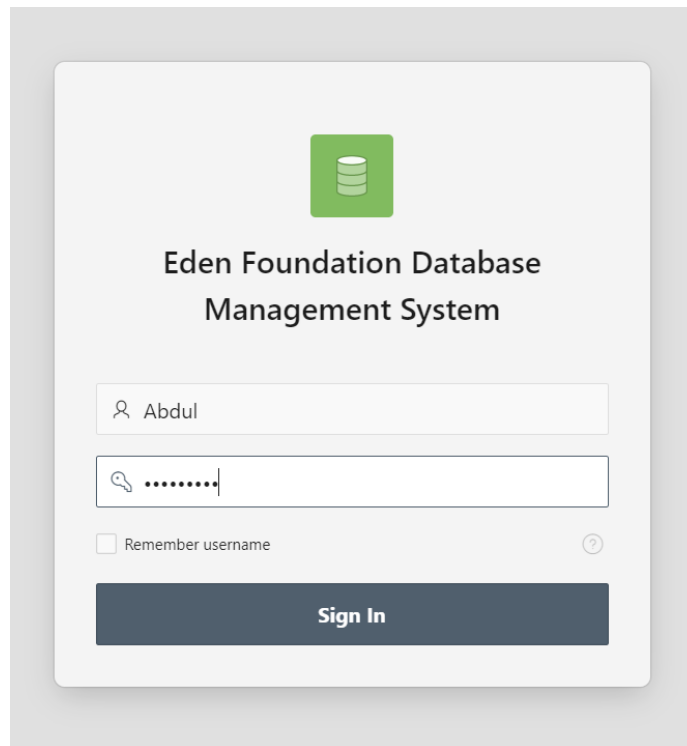


Figure 31- Attempted login by user without rights

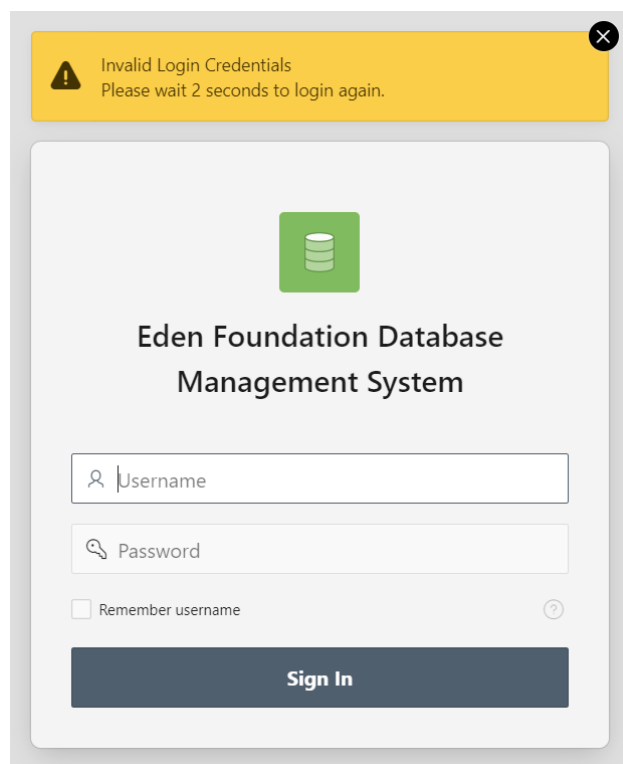


Figure 32- User unable to login

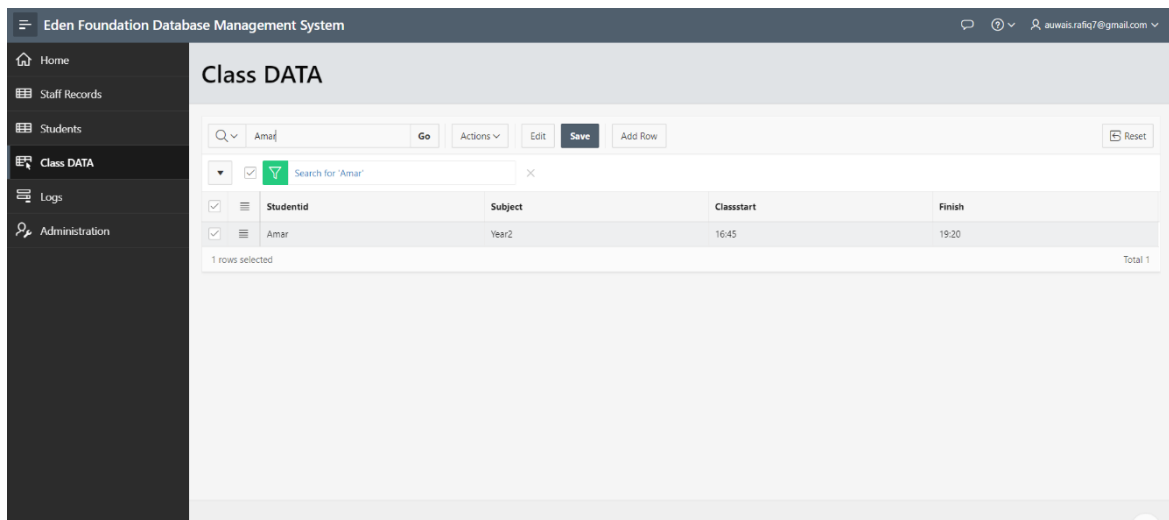


Figure 33 – Filtering Results Successfully

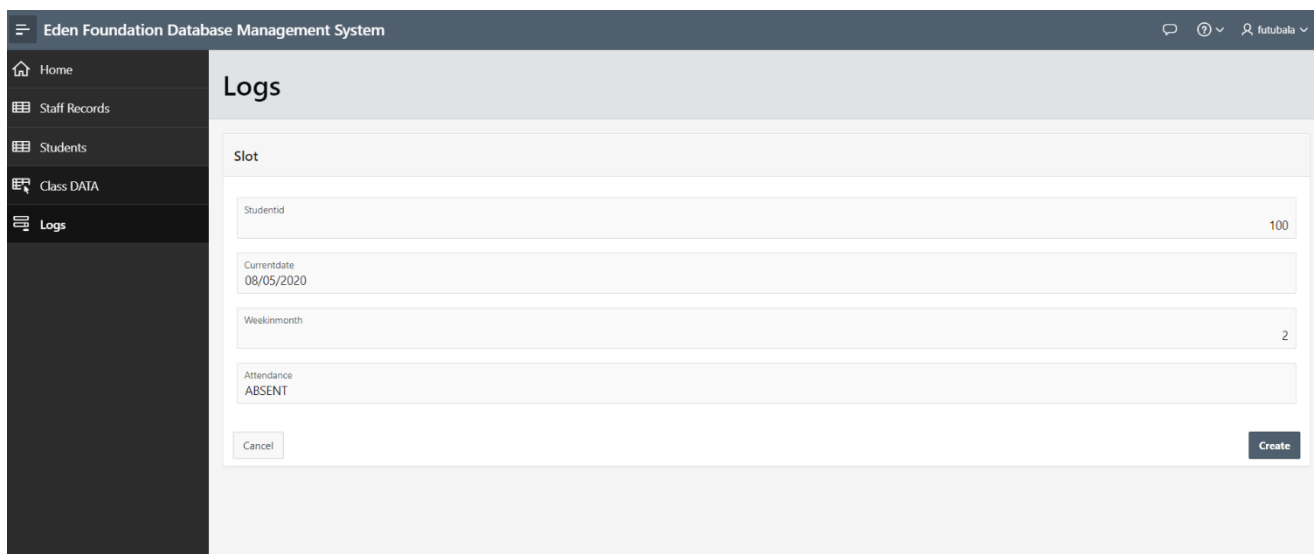


Figure 34 - Testing Student Logs

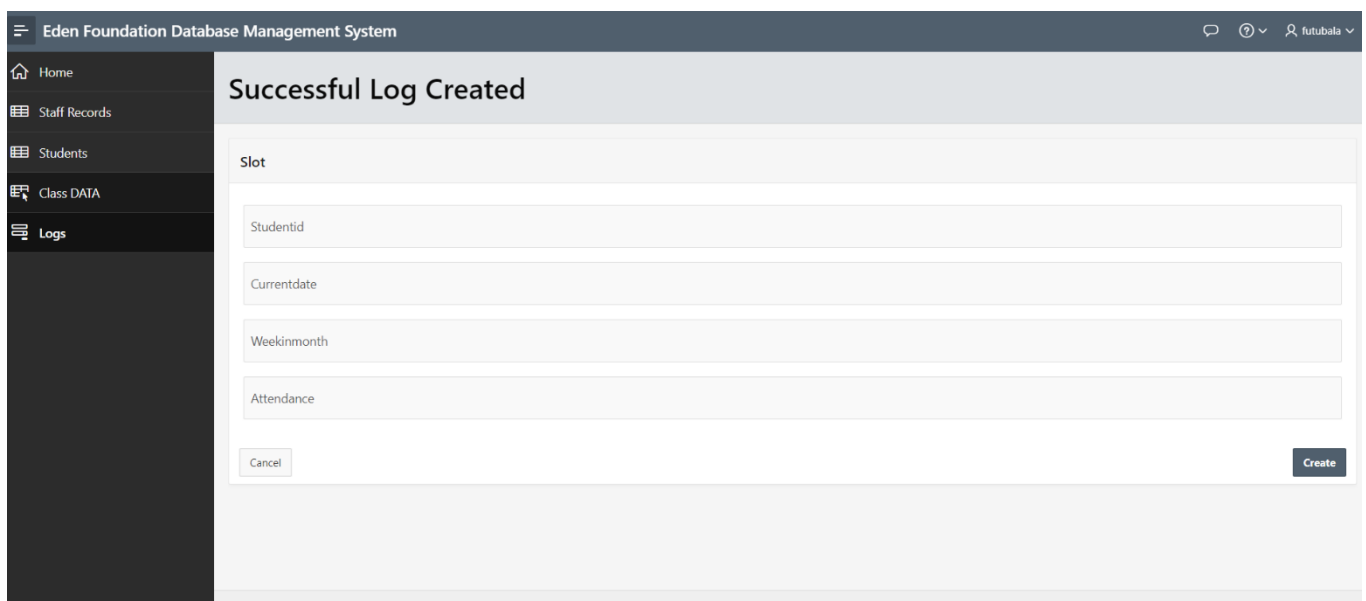


Figure 35 – Successful Log