
**King Fahd University of Petroleum and Minerals**
**Information and Computer Science Department**

# ICS 324: Database Systems

## Term 201

# KCDBS

## Project Phase 3:
## Implementation (Application Program)
## 12th December 2020

## Group #15



| Name | ID |
|---|---|
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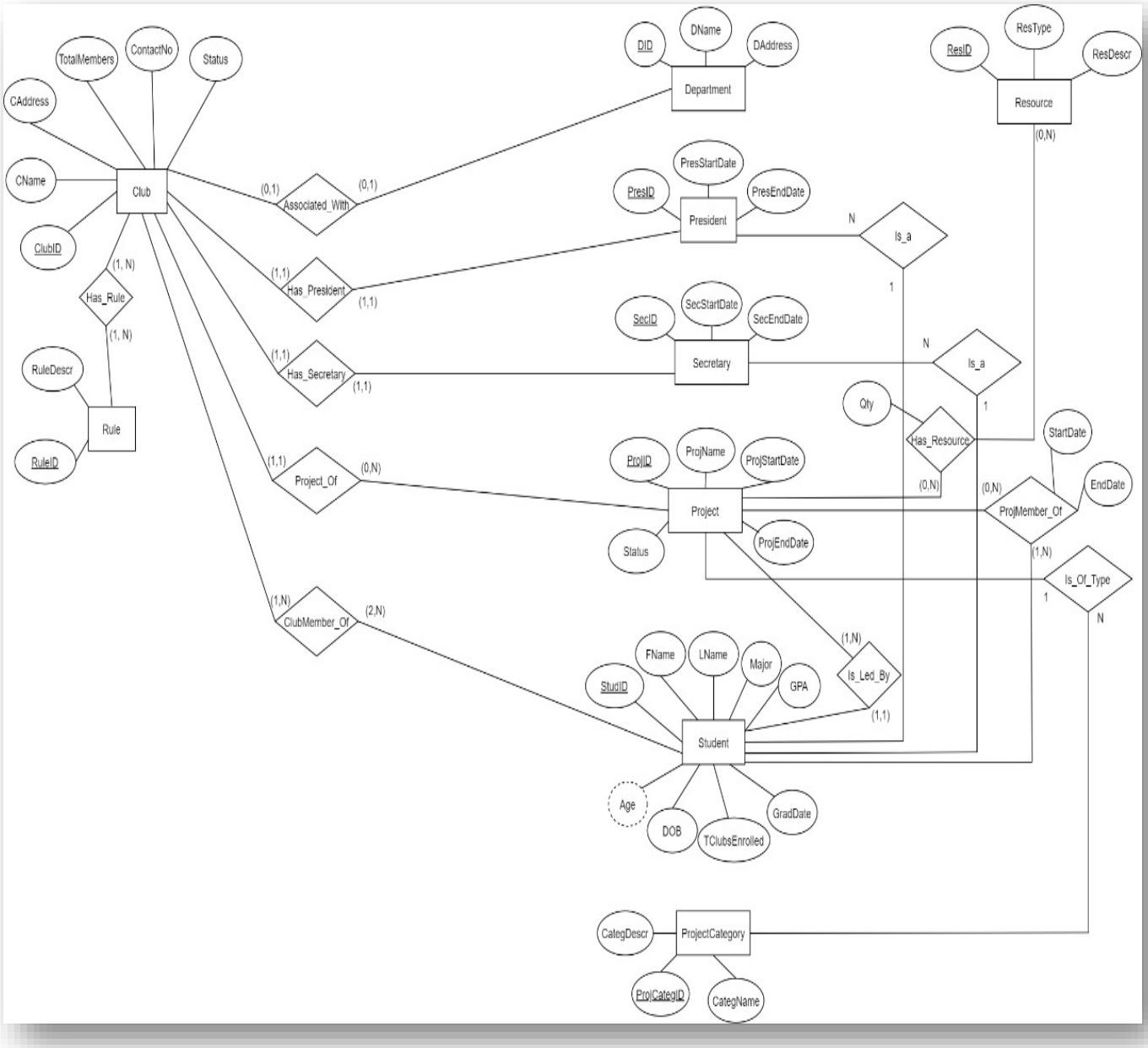
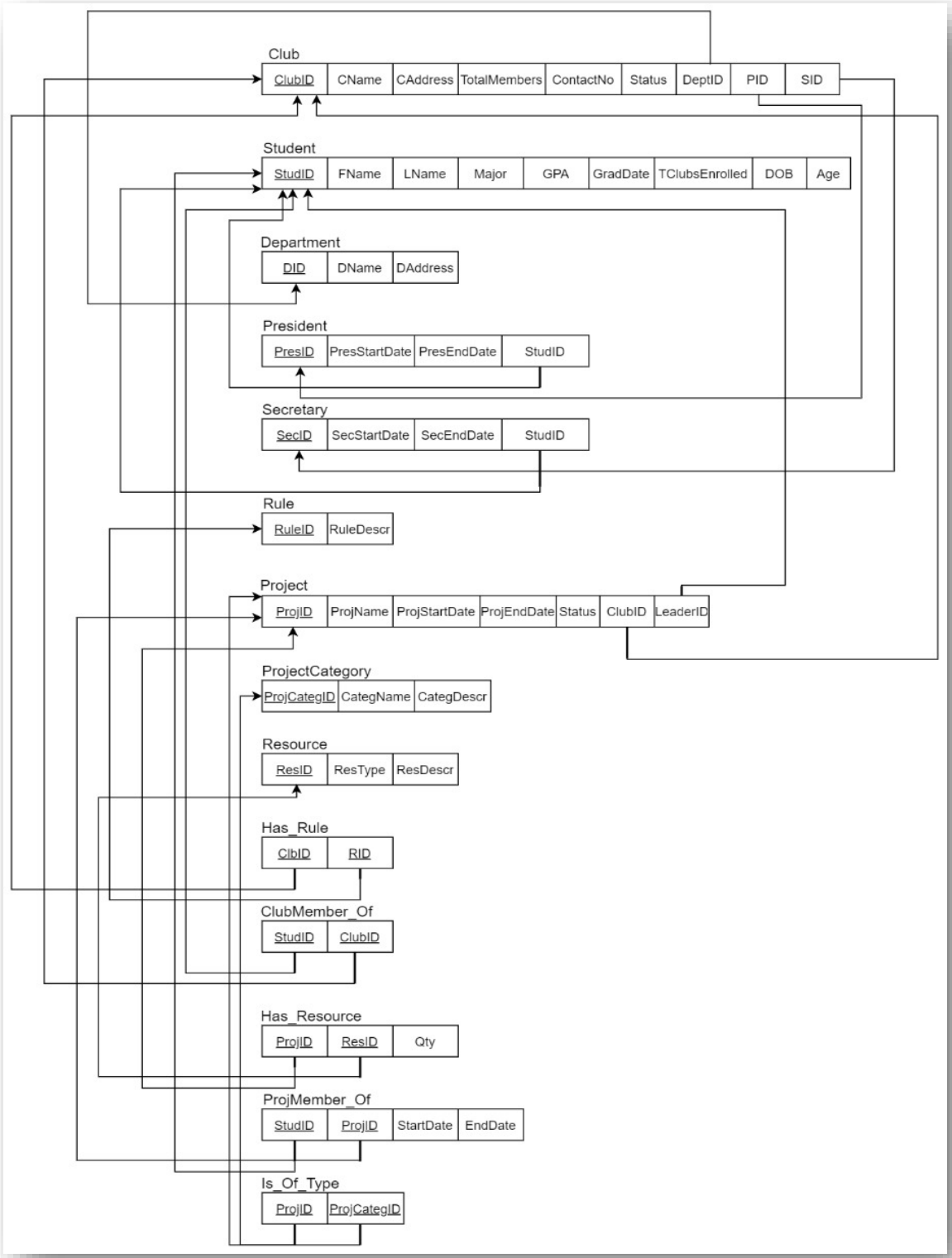
# Phase 1:

# Conceptual Design (ERD)



# Logical Design (RDM)



# Assumptions

We have assumed the following:

1) Two or more clubs will not cooperate in a single project.
2) A club will not be associated with more than one department.
3) A department will not be associated with more than one club.
4) Each club will follow at least one rule.
5) A president or secretary of a club may not act as the secretary or president of another club at the same time.
6) It is mandatory for a club to have a president and a secretary.
7) A project member may join a project or leave it at any time.
8) Rules are assigned IDs and are self-contained.
9) Every resource associated with a project is quantified.
10) Every club is assigned a status.
11) Every club president and secretary are assigned a unique ID associated with the club ID.
12) Projects can be of multiple categories.

# Contribution

| | ERD | RDM | Documentation |
|---|---|---|---|
| **Farhan** | 35% | 30% | 35% |
| **Amaan** | 35% | 35% | 30% |
| **AbdulJawad** | 30% | 35% | 35% |

# Phase 2:

# SQL PROGRAM

```
CREATE TABLE DEPARTMENT
 ( ID                    INT             NOT NULL,
   NAME                  VARCHAR(30)     NOT NULL,
   PHONE                 CHAR(9)         NOT NULL,
   EMAIL                 VARCHAR(30)     NOT NULL,

   PRIMARY KEY (ID),
   UNIQUE(NAME),
   UNIQUE(EMAIL)
 );

CREATE TABLE STATUSTYPE
 (
   ID                    INT             NOT NULL,
   NAME                  VARCHAR(30),
   DESCR                 VARCHAR(100),

   PRIMARY KEY (ID),
   UNIQUE (NAME)
 );

CREATE TABLE STATUSES
 (
   ID                    INT             NOT NULL,
   STATUSTYPEID          INT             NOT NULL,
   NAME                  VARCHAR(30),
   DESCR                 VARCHAR(100),

   PRIMARY KEY (ID),
   FOREIGN KEY (STATUSTYPEID) REFERENCES STATUSTYPE(ID)
```

```
);


CREATE TABLE STUDENT
 (
  ID                    INT             NOT NULL,
  FNAME                 VARCHAR(20)     NOT NULL,
  LNAME                 VARCHAR(20)     NOT NULL,
  PHONE                 CHAR(9),
  STATUSID              INT             NOT NULL,

  PRIMARY KEY (ID),
  FOREIGN KEY (STATUSID) REFERENCES STATUSES(ID)
 );

 CREATE TABLE CLUB
 (
   ID                   INT             NOT NULL,
   NAME                 VARCHAR(30)     NOT NULL,
   ADDRESS              VARCHAR(30)     NOT NULL,
   PHONE                CHAR(9),
   DESCR                VARCHAR(99),
   DEPARTMENTID         INT             NOT NULL,
   STATUSID             INT,

  PRIMARY KEY (ID),
  FOREIGN KEY (DEPARTMENTID) REFERENCES     DEPARTMENT(ID),
  FOREIGN KEY (STATUSID)     REFERENCES     STATUSES(ID)
 );

 CREATE TABLE CLUBMEMBER (
  CLUBID                INT             NOT NULL,
  STUDENTID             INT             NOT NULL,
  FROMDATE              DATE            NOT NULL,
  TODATE                DATE,
  STATUSID              INT             NOT NULL,

  PRIMARY KEY (CLUBID, STUDENTID, FROMDATE),
```

```
  FOREIGN KEY (CLUBID)          REFERENCES    CLUB(ID),
  FOREIGN KEY (STUDENTID)       REFERENCES    STUDENT(ID),
  FOREIGN KEY (STATUSID)        REFERENCES    STATUSES(ID)
 );
```

**CREATE** TABLE **CLUBADMIN**

```
  (
  CLUBID                INT             NOT NULL,
  STUDENTID             INT             NOT NULL,
  FROMDATE              DATE            NOT NULL,
  TODATE                DATE,
  ROLE                  VARCHAR(20),

  PRIMARY KEY (CLUBID, STUDENTID, FROMDATE),
  FOREIGN KEY (CLUBID)          REFERENCES    CLUB(ID),
  FOREIGN KEY (STUDENTID)       REFERENCES    STUDENT(ID)
 );
```

**CREATE** TABLE **RULE**

```
(
  ID                    INT             NOT NULL,
  NAME                  VARCHAR(20)     NOT NULL,
  CLUBID                INT             NOT NULL,
  DESCR                 VARCHAR(100),
  STATUSIDINT                           NOT NULL,
  PRIMARY KEY (ID),
  UNIQUE (NAME),
  FOREIGN KEY (CLUBID)  REFERENCES      CLUB(ID),
  FOREIGN KEY (STATUSID) REFERENCES     STATUSES(ID)
);
```

**CREATE** TABLE **PROJECTTYPE**

```
(
 ID                     INT             NOT NULL,
 NAME                   VARCHAR(20)     NOT NULL,
 DESCR                  VARCHAR(100),
```

```
 PRIMARY KEY (ID)
);
```

```
CREATE TABLE PROJECT
(
 ID                    INT             NOT NULL,
 NAME                  VARCHAR(20)     NOT NULL,
 PROJECTTYPEID         INT             NOT NULL,
 CLUBID                INT             NOT NULL,
 DESCR                 VARCHAR(50),
 STARTDATE             DATE,
 ENDDATE               DATE,
 STATUSID              INT             NOT NULL,

 PRIMARY KEY (ID),
 FOREIGN KEY (PROJECTTYPEID)  REFERENCES  PROJECTTYPE(ID)
);
```

```
CREATE TABLE WORKSON
(
  STUDENTID            INT             NOT NULL,
  PROJECTID            INT             NOT NULL,
  FROMDATE             DATE            NOT NULL,
  TODATE               DATE,
  ROLE                 VARCHAR(20),

  PRIMARY KEY (STUDENTID, PROJECTID, FROMDATE),
  FOREIGN KEY (STUDENTID)     REFERENCES   STUDENT(ID),
  FOREIGN KEY (PROJECTID)     REFERENCES   PROJECT(ID)
);
```

```
CREATE TABLE RESOURCETYPE
(
 ID                    INT             NOT NULL,
 NAME                  VARCHAR(20)     NOT NULL,
```

```
 DESCR                    VARCHAR(50),

 PRIMARY KEY (ID)
);
```

```
CREATE TABLE RESOURCE
(
 ID                       INT              NOT NULL,
 NAME                     VARCHAR(20)      NOT NULL,
 RESOURCETYPEID           INT              NOT NULL,
 DESCR                    VARCHAR(50),
 STATUSID                 INT              NOT NULL,

 PRIMARY KEY (ID),
 FOREIGN KEY (RESOURCETYPEID) REFERENCES RESOURCETYPE(ID)
);
```

```
CREATE TABLE PROJECTRESOURCE
(
 PROJECTID                INT          NOT NULL,
 RESOURCEID               INT          NOT NULL,
 FROMDATE                 DATE,
 TODATE                   DATE,

 PRIMARY KEY (PROJECTID, RESOURCEID),
 FOREIGN KEY (PROJECTID) REFERENCES PROJECT(ID),
 FOREIGN KEY (RESOURCEID) REFERENCES RESOURCE(ID)
);

SET FOREIGN_KEY_CHECKS=0;
```

**INSERT** INTO **DEPARTMENT VALUES**(1, "Computer Science", "8601111", "ics-dept@kfupm.edu.sa");
**INSERT** INTO **DEPARTMENT VALUES**(2, "Computer Engineering", "8601112", "coe-dept@kfupm.edu.sa");
**INSERT** INTO **DEPARTMENT VALUES**(3, "Mechanical Engineering", "8602111", "mech-dept@kfupm.edu.sa");
**INSERT** INTO **DEPARTMENT VALUES**(4, "Mathematics", "8603111", "math-dept@kfupm.edu.sa");

**INSERT** INTO **STATUSTYPE** VALUES(1, "Type-1", "Active for 3 months");
**INSERT** INTO **STATUSTYPE** VALUES(2, "Type-2", "Halted");
**INSERT** INTO **STATUSTYPE** VALUES(3, "Type-3", "Halted for one season");

**INSERT** INTO **STATUSES** VALUES(1, 2, "N1", "Hello-World");
**INSERT** INTO **STATUSES** VALUES(2, 2, "N2", "To-be-filled");
**INSERT** INTO **STATUSES** VALUES(3, 1, "N34", "No President");

**INSERT** INTO **STUDENT** VALUES(1001, "ABDULJAWAD", "MOHAMMED", "50345431", 1);
**INSERT** INTO **STUDENT** VALUES(1002, "AMAAN", "IZHAAR", "50234129", 2);
**INSERT** INTO **STUDENT** VALUES(1003, "FARHAN", "ABDULQADIR", "50505012", 3);

**INSERT** INTO **CLUB** VALUES(123, "PROGRAMMING CLUB", "BLD 22, KFUPM", "504353277", "CLUB FOR LEARNING PROGRAMMING FUNDAMENTALS", 1, 1);
**INSERT** INTO **CLUB** VALUES(132, "FLUID MECHANICS CLUB", "BLD 63, KFUPM", "523130989", "A CLUB DEDICATED TO EXPLORING THE FIELD OF FLUIDS IN ENGINEERING.", 3, 1);
**INSERT** INTO **CLUB** VALUES(140, "FRACTAL CLUB", "BLD 6, KFUPM", "542193829", "LEARN MORE AND TAKE A PEEK INTO THE INFINITE WORLD OF FRACTALS.", 4, 3);

**INSERT** INTO **CLUBMEMBER** VALUES(123, 1002, '2019-02-27', NULL, 1);
**INSERT** INTO **CLUBMEMBER** VALUES(132, 1001, '2018-03-25', '2019-04-23', 2);
**INSERT** INTO **CLUBMEMBER** VALUES(140, 1003, '2018-04-20', NULL, 3);

**INSERT** INTO **RESOURCETYPE** VALUES(1, "PHYSICAL", "CAN BE INTERACTED WITH PHYSICALLY.");
**INSERT** INTO **RESOURCETYPE** VALUES(2, "DIGITAL", "SOFTWARE-RELATED RESOURCES.");

**INSERT** INTO **RESOURCE** VALUES(1, "TOOLKIT", 1, "A TOOLBOX", 1);
**INSERT** INTO **RESOURCE** VALUES(2, "SENSORS", 1, "VARIOUS SENSORS", 1);
**INSERT** INTO **RESOURCE** VALUES(3, "MATLAB CD", 2, "LICENSE KEY FOR MATLAB", 1);
**INSERT** INTO **RESOURCE** VALUES(4, "WATER", 1, "1 LITER BOTTLE", 1);
**INSERT** INTO **RESOURCE** VALUES(5, "SEEDS N SOIL", 1, "Planting pack", 1);
**INSERT** INTO **RESOURCE** VALUES(6, "JAVA SDK", 2, "JAVA pack", 2);

**INSERT** INTO **PROJECTRESOURCE** VALUES(10, 1, '2020-01-30', '2020-08-05');
**INSERT** INTO **PROJECTRESOURCE** VALUES(10, 2, '2020-01-30', '2020-08-05');
**INSERT** INTO **PROJECTRESOURCE** VALUES(10, 3, '2020-01-30', '2020-08-05');
**INSERT** INTO **PROJECTRESOURCE** VALUES(11, 4, '2020-03-20', NULL);
**INSERT** INTO **PROJECTRESOURCE** VALUES(11, 5, '2020-03-20', NULL);

**INSERT** INTO **CLUBADMIN** VALUES(123, 1002, '2019-02-27', NULL, "SECRETARY");
**INSERT** INTO **CLUBADMIN** VALUES(132, 1001, '2018-03-25', '2019-04-23', "SECRETARY");

**INSERT** INTO **CLUBADMIN** VALUES(140, 1003, '2018-04-20', NULL, "PRESIDENT");

**INSERT** INTO **RULE** VALUES(18, "LIMBER UP", 123, "STRETCH AND WARMUP BEFORE EXERCISES", 2);
**INSERT** INTO **RULE** VALUES(1, "DON'T BE LATE", 140, "SHOW UP FOR CLUB MEETINGS ON TIME", 1);
**INSERT** INTO **RULE** VALUES(2, "LAB COATS COMPULSORY", 132, "MEMEBERS WILL NOT PERMITTED TO ENTER THE LAB WITHOUT A LAB COAT", 3);

**INSERT** INTO **PROJECTTYPE** VALUES(1, "PRODUCTION", "PROJECT INVOLVING PRODUCING OR DEVELOPING.");
**INSERT** INTO **PROJECTTYPE** VALUES(2, "GENERAL", "PROJECT CONCERNED WITH GENERAL ACTIVITIES.");
**INSERT** INTO **PROJECTTYPE** VALUES(3, "RESEARCH", "PROJECT INVOLVING ADVANCED THEORETICAL AND/OR PRACTICAL RESEARCH.");

**INSERT** INTO **PROJECT** VALUES(10, "Robotic Sensors", 1, 1, "Make robotic sensors", '2020-01-01', '2020-01-15', 1);
**INSERT** INTO **PROJECT** VALUES(11, "Water Plants", 2, 2, "Self-explanatory", '2020-01-02', '2020-01-15', 1);
**INSERT** INTO **WORKSON** VALUES(1, 10, '2020-01-01', '2020-01-15', "Writes Code");
**INSERT** INTO **WORKSON** VALUES(2, 11, '2020-01-05', '2020-01-15', "Water Gatherer");

**SET** FOREIGN_KEY_CHECKS=1;

# Phase 3:

## Implementation

We implemented a 3-tier application program (Desktop GUI) that impersonates a KFUPM club database administration system using the tools mentioned below.

## Tools Utilized

**Java Programming Language:** **Java** is a class-based, object-oriented-program that is designed to have as few implementation dependencies as possible. It is a general-purpose programming language intended to let application developers *write once, run anywhere* (WORA).

**Gluon Scene Builder:** It is a drag and drop user-interface software that allows rapid integration and iteration with Java.

**Javafx, JFoenix, FontAwesome Frameworks:** These frameworks are used in building the GUI of the application.

**MySQL Workbench:** A software for tracking database tables, schemas, and usage of SQL language for database queries.

**Amazon Web Services (AWS) RDS:** AWS RDS is a web service from Amazon that provides a way to host MySQL databases on cloud.

We used the conceptual and logical design provided as a solution of phase1 of the project. However, we made significant changes to ensure design consistency and these changes can be seen in the AWS RDS schema.

## Challenges Faced

1. Using MySQL workbench and integrating it with Java app.
2. For System Admin – Considering minute details such as displaying statuses associated with clubs and role of clubadmins etc.
3. Complications associated with JavaFX not pinpointing the exact location of the errors.
4. Keeping track of real-world scenarios applicable to our database and application design.
5. Maintaining consistencies in structure when coding in Java.
6. Coming up with a foundational file structure that will act as a base for our entire code.

# Project Learning Outcomes

1. Learnt the backend component of a database.
2. Learnt the frontend component of the application (CSS).
3. Learnt to efficiently integrate backend and frontend components into a fully functional full stack application involving a database,
4. Learnt to deploy database on cloud using AWS RDS.
5. Utilized external libraries for generating user-friendly UI, faster execution time, and intuitive and compact functionalities.

# Function Completion Table

| Functionality | % Completion |
|---|---|
| Adding new Club | 100% |
| Adding new Member to a Club | 100% |
| Change member to president/secretary of club | 100% |
| Compute number of members in each club | 100% |
| Compute the number of projects in each club | 100% |
| Add new project | 100% |
| Change the status of a project | 100% |
| Add members to a project | 100% |
| Select the leader of a project | 100% |
| Compute the number of projects in his club | 100% |
| Approve a member to join his club | 100% |
| Browse projects information | 100% |
| Volunteer for a project in his club | 100% |
| Terminate his club membership | 100% |
| Browse club info | 100% |
| Register to join any club. | 100% |
| Login and Logout | 100% |

# Extra Functionalities/Features

1. Deployment of MySQL database on a cloud (AWS RDS), making it a 3-tier architecture.
2. Encrypted passwords are populated in the database, thus ensuring user data privacy.
3. Added additional functionality of editing and saving the input fields and updating the database as required.
4. Enhance the app into a rich looking UI by utilizing various third party libraries/frameworks and CSS, thus making it more appealing to the users.
5. Introduction of new tables and attributes into the schema such as Leader and Creds in order to reflect real world scenarios and conform to the functions that were needed to be implemented.

# Contribution

**Note**: All members contributed equally to the report (33%-33%-33%). The work contribution shown in the table below pertains to the tasks relating the application itself (in %). However, we would like to iterate that each member contributed equally to the project development as all members met regularly and aided each other in their tasks.

| | System Admin | Club Admin | Club Member/ Guest | Login | Frontend | AWS RDS Cloud | Extra functionalities | Extra Database functionalities |
|---|---|---|---|---|---|---|---|---|
| **Amaan Izhar** | 70 | 15 | 15 | 33.3 | 33.3 | 33.3 | 33.3 | 33.3 |
| **Farhan AbdulQadir** | 15 | 70 | 15 | 33.3 | 33.3 | 33.3 | 33.3 | 33.3 |
| **AbdulJawad Mohammed** | 15 | 15 | 70 | 33.3 | 33.3 | 33.3 | 33.3 | 33.3 |

# Suggestions and Final Thoughts

The project was a fruitful experience for us, reaping valuable lessons of teamwork, project planning, and organization. It also gave us a taste of the world of database applications on an enterprise level. Developing a database that reflected the KFUPM student club made us more appreciative of the complexity behind seemingly simple systems. However, we also feel that there is room for improvement.

For future projects, we would like to suggest the following:

The phase 3 implementation could have been announced earlier in order to provide sufficient room and time for students to complete and refine their projects.

*Thank You for a great experience.*