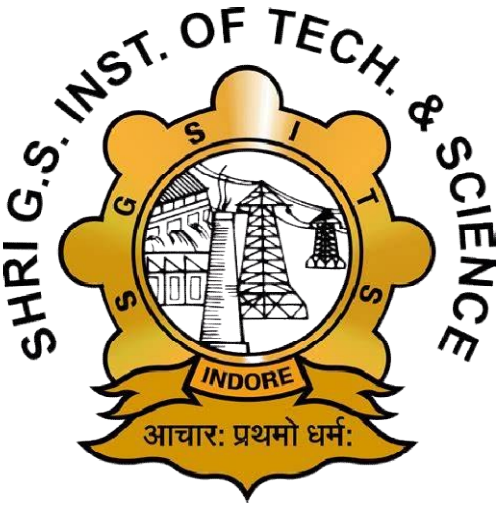
Shri G.S. Institute of Technology and Science (SGSITS), Indore



DEPARTMENT OF INFORMATION TECHNOLOGY

DATABASE MANAGEMENT SYSTEM

IT38513

SESSSION 2024 - 25

DATABASE ANALYSIS REPORT

Submitted To-

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INDEX

INTRODUCTION

OBJECTIVE:

The primary objective of **YourPlacementBuddy** is to serve as a **one-stop resource hub** for **first-year college students** embarking on their **placement preparation journey**. It provides a **comprehensive collection of guides and resources**, uniquely tailored to their needs. To enhance this experience, we have integrated an **AI-powered roadmap generator** that curates personalized career paths, along with relevant resources sourced from across the web. There is also a community page which allows students to seek guidance, share resources and stay updated on placement trends, coding challenges and interview experience. Additionally, our **database-driven storage** ensures seamless access to saved content, while the **interactive visual roadmap maker** allows users to **customize and create structured mind maps**, helping them navigate their career journey with clarity and confidence.

Key Features:

1. **Roadmap-Based Learning**
    - **Editable Visual Roadmaps**: Graphical roadmaps to track progress.
    - **Branching Options**: Users can customize their roadmap based on their interests
    - **AI-Generated Roadmaps**: Users get personalized roadmaps using **Google Gemini API**
2. **Guidance & Resources**
    - **Links to Hackathons**: Information on ongoing and upcoming competitions
    - **Recommended Courses**: List of useful courses.
    - **Career Advice**: Guides on interview preparation, company selection, and job roles
3. **User Interaction & Customization**
    - **Roadmap Editor**: Allows users to modify roadmaps based on their preferences
    - **Login & Authentication**: Users can log in to save progress
4. **Backend Functionalities (Django + MySQL)**
    - **User Authentication & Progress Storage**
    - **Archive Section for Saved Roadmaps**
    - **Admin Panel for Managing Roadmaps**

Purpose of The Project:

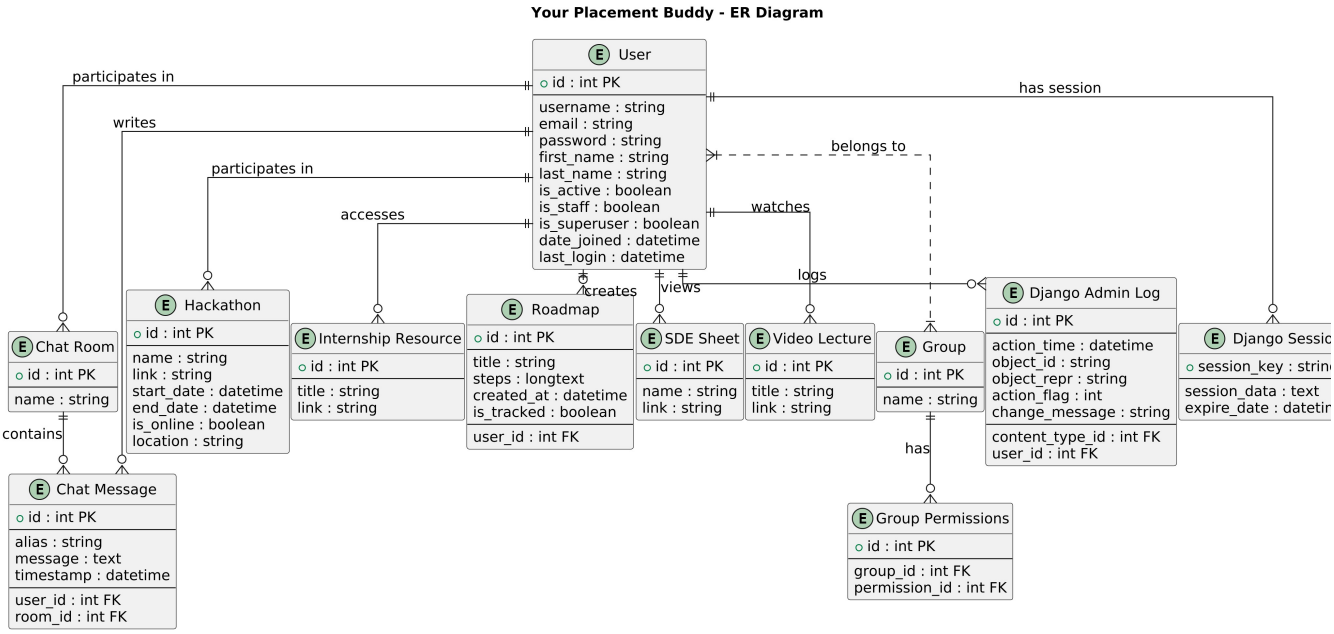
The YourPlacementBuddy is designed to help students navigate their college journey towards successful placements. With an overwhelming amount of online content, students often struggle to find a clear and structured path for their career preparation. This project provides:

- AI-generated roadmaps
- Curated resources for learning and placement preparation
- Hackathon listings and competitive programming events
- Roadmap Editor to create a personalized roadmap tailored to your schedule.
- A user-friendly and ad-free environment for career guidance

Scope of The Project:

1.Roadmap Generation & Editing: Users can create, edit, and track progress on their roadmaps.
2. Resource Aggregation: The platform provides recommended courses, guides, and learning materials.
3. Hackathon & Competitive Programming Events: Aggregating links to ongoing challenges.
4. Backend Functionalities: Data storage, user management, and admin control via Django and MySQL.

ER DIAGRAM



(Note: PK and FK refer to Primary Key and Foreign Key respectively)

User (auth_user)

- - PK: id
- - username (Unique)
- - email
- - password
- - first_name
- - last_name
- - is_active
- - is_staff
- - is_superuser
- - date_joined
- - last_login

Chat Room (accounts_chatroom)

- - PK: id
- - name (Unique)

Chat Message (accounts_chatmessage)

- - PK: id
- - alias

- - message
- - timestamp
- - FK: user_id → User
- - FK: room_id → Chat Room

Hackathon (accounts_hackathon)

- - PK: id
- - name
- - link
- - start_date
- - end_date
- - is_online
- - location (Nullable)

Internship Resource (accounts_internshipresource)

- - PK: id
- - title
- - link

Roadmap (accounts_roadmap)

- - PK: id
- - title
- - steps (Longtext)
- - created_at
- - is_tracked (Boolean)
- - FK: user_id → User

SDE Sheet (accounts_sdesheet)

- - PK: id
- - name
- - link

Video Lecture (accounts_videolecture)

- - PK: id
- - title
- - link

Group (auth_group)

- - PK: id
- - name (Unique)

Group Permissions (auth_group_permissions)

- - PK: id

- - FK: group_id → Group
- - FK: permission_id

Django Admin Log (django_admin_log)

- - PK: id
- - action_time
- - object_id (Nullable)
- - object_repr
- - action_flag
- - change_message
- - FK: content_type_id
- - FK: user_id → User

Django Session (django_session)

- - PK: session_key
- - session_data
- - expire_date

Relationships

- - User (auth_user) has a One-to-Many relationship with Chat Message (accounts_chatmessage)
- - User (auth_user) has a One-to-Many relationship with Roadmap (accounts_roadmap)
- - Chat Room (accounts_chatroom) has a One-to-Many relationship with Chat Message (accounts_chatmessage)
- - Group (auth_group) has a Many-to-Many relationship with User (auth_user)
- - Group (auth_group) has a One-to-Many relationship with Group Permissions (auth_group_permissions)

RDBMS

```
mysql> describe accounts_chatmessage;
+-----------+-------------+------+-----+---------+----------------+
| Field     | Type        | Null | Key | Default | Extra          |
+-----------+-------------+------+-----+---------+----------------+
| id        | bigint      | NO   | PRI | NULL    | auto_increment |
| alias     | varchar(50) | YES  |     | NULL    |                |
| message   | longtext    | NO   |     | NULL    |                |
| timestamp | datetime(6) | NO   |     | NULL    |                |
| user_id   | int         | NO   | MUL | NULL    |                |
| room_id   | bigint      | NO   | MUL | NULL    |                |
+-----------+-------------+------+-----+---------+----------------+
6 rows in set (0.00 sec)
```

schema for chatmessage

```
mysql> describe accounts_chatroom;
+-------+--------------+------+-----+---------+----------------+
| Field | Type         | Null | Key | Default | Extra          |
+-------+--------------+------+-----+---------+----------------+
| id    | bigint       | NO   | PRI | NULL    | auto_increment |
| name  | varchar(255) | NO   | UNI | NULL    |                |
+-------+--------------+------+-----+---------+----------------+
2 rows in set (0.00 sec)
```

schema for chatroom

```
mysql> describe accounts_hackathon;
+------------+--------------+------+-----+---------+----------------+
| Field      | Type         | Null | Key | Default | Extra          |
+------------+--------------+------+-----+---------+----------------+
| id         | bigint       | NO   | PRI | NULL    | auto_increment |
| name       | varchar(255) | NO   |     | NULL    |                |
| link       | varchar(200) | NO   |     | NULL    |                |
| end_date   | date         | NO   |     | NULL    |                |
| is_online  | tinyint(1)   | NO   |     | NULL    |                |
| location   | varchar(255) | YES  |     | NULL    |                |
| start_date | date         | NO   |     | NULL    |                |
+------------+--------------+------+-----+---------+----------------+
7 rows in set (0.00 sec)
```

schema for hackathons

```
mysql> describe accounts_internshipresource;
+-------+--------------+------+-----+---------+----------------+
| Field | Type         | Null | Key | Default | Extra          |
+-------+--------------+------+-----+---------+----------------+
| id    | bigint       | NO   | PRI | NULL    | auto_increment |
| title | varchar(255) | NO   |     | NULL    |                |
| link  | varchar(200) | NO   |     | NULL    |                |
+-------+--------------+------+-----+---------+----------------+
3 rows in set (0.00 sec)
```

schema for internship resource

```
mysql> describe accounts_roadmap;
+------------+--------------+------+-----+---------+----------------+
| Field      | Type         | Null | Key | Default | Extra          |
+------------+--------------+------+-----+---------+----------------+
| id         | bigint       | NO   | PRI | NULL    | auto_increment |
| title      | varchar(255) | NO   |     | NULL    |                |
| steps      | longtext     | NO   |     | NULL    |                |
| created_at | datetime(6)  | NO   |     | NULL    |                |
| user_id    | int          | NO   | MUL | NULL    |                |
| is_tracked | tinyint(1)   | NO   |     | NULL    |                |
+------------+--------------+------+-----+---------+----------------+
6 rows in set (0.00 sec)
```

schema for roadmap

```
mysql> describe accounts_sdesheet;
+-------+--------------+------+-----+---------+----------------+
| Field | Type         | Null | Key | Default | Extra          |
+-------+--------------+------+-----+---------+----------------+
| id    | bigint       | NO   | PRI | NULL    | auto_increment |
| name  | varchar(255) | NO   |     | NULL    |                |
| link  | varchar(200) | NO   |     | NULL    |                |
+-------+--------------+------+-----+---------+----------------+
3 rows in set (0.00 sec)
```

schema for sdesheet

```
mysql> describe accounts_videolecture;
+-------+--------------+------+-----+---------+----------------+
| Field | Type         | Null | Key | Default | Extra          |
+-------+--------------+------+-----+---------+----------------+
| id    | bigint       | NO   | PRI | NULL    | auto_increment |
| title | varchar(255) | NO   |     | NULL    |                |
| link  | varchar(200) | NO   |     | NULL    |                |
+-------+--------------+------+-----+---------+----------------+
3 rows in set (0.00 sec)
```

schema for videolecture

```
mysql> describe auth_group;
+-------+--------------+------+-----+---------+----------------+
| Field | Type         | Null | Key | Default | Extra          |
+-------+--------------+------+-----+---------+----------------+
| id    | int          | NO   | PRI | NULL    | auto_increment |
| name  | varchar(150) | NO   | UNI | NULL    |                |
+-------+--------------+------+-----+---------+----------------+
2 rows in set (0.00 sec)

mysql> describe auth_group_permissions;
+---------------+--------+------+-----+---------+----------------+
| Field         | Type   | Null | Key | Default | Extra          |
+---------------+--------+------+-----+---------+----------------+
| id            | bigint | NO   | PRI | NULL    | auto_increment |
| group_id      | int    | NO   | MUL | NULL    |                |
| permission_id | int    | NO   | MUL | NULL    |                |
+---------------+--------+------+-----+---------+----------------+
3 rows in set (0.00 sec)
```

schema for auth_group and auth_permissions

```
mysql> describe auth_user;
+--------------+--------------+------+-----+---------+----------------+
| Field        | Type         | Null | Key | Default | Extra          |
+--------------+--------------+------+-----+---------+----------------+
| id           | int          | NO   | PRI | NULL    | auto_increment |
| password     | varchar(128) | NO   |     | NULL    |                |
| last_login   | datetime(6)  | YES  |     | NULL    |                |
| is_superuser | tinyint(1)   | NO   |     | NULL    |                |
| username     | varchar(150) | NO   | UNI | NULL    |                |
| first_name   | varchar(150) | NO   |     | NULL    |                |
| last_name    | varchar(150) | NO   |     | NULL    |                |
| email        | varchar(254) | NO   |     | NULL    |                |
| is_staff     | tinyint(1)   | NO   |     | NULL    |                |
| is_active    | tinyint(1)   | NO   |     | NULL    |                |
| date_joined  | datetime(6)  | NO   |     | NULL    |                |
+--------------+--------------+------+-----+---------+----------------+
11 rows in set (0.00 sec)
```

schema for auth_user

NORMALIZATION

To ensure **data integrity** and **minimize redundancy**, normalization was applied to the YourPlacementBuddy database through the following stages:

First Normal Form (1NF):

- All tables were structured so that **each column contains atomic values**, and each record is **unique**.
- **Multi-valued attributes** were eliminated.
- Each table has a **primary key**, ensuring that every row is uniquely identifiable.

Second Normal Form (2NF):

- **Partial dependencies** were removed by ensuring that **all non-key attributes** are fully functionally dependent on the **primary key**.
- Tables with **composite keys** were further divided to ensure that **non-prime attributes** (attributes not part of the primary key) do not depend on **only part of a composite key**.
- **Example:** The `Roadmap` table references the `User` table via `user_id` as a **foreign key**, ensuring that each roadmap belongs to a specific user.

Third Normal Form (3NF):

- **Transitive dependencies** were removed, ensuring that **non-key attributes** are not dependent on other non-key attributes.
- This reduced the likelihood of **data anomalies** during **insertions, updates, and deletions**.
- **Example:** In the `Hackathon` table, attributes such as `location` were separated into distinct tables where necessary, reducing redundancy.

Boyce-Codd Normal Form (BCNF):

- **BCNF was applied** to address situations where a table was not fully in 3NF, ensuring that **every determinant is a candidate key**.
- Any **remaining anomalies** due to functional dependencies were resolved by restructuring tables where necessary.
- **Example:** If `GroupPermissions` had an issue where `permission_id` depended on `group_id` but was not a candidate key, the table was reorganized to eliminate such dependencies.

By applying **normalization** to the **YourPlacementBuddy database**, we ensured that data is **efficiently structured, redundancy is minimized, and inconsistencies are prevented**. This improves **query performance, data integrity, and maintainability** of the system.

RELATIONAL ALGEBRA OPERATIONS

- ## Selection (σ) – Filtering Data

  To find all **active users** in the `User` table:

  σis_active=TRUE(User)

  sql query:

  SELECT * FROM User WHERE is_active = TRUE;

- ## Projection (π) – Selecting Specific Columns

  Relational Algebra:
  To retrieve only **usernames and emails** from the `User` table:

  πusername,email(User)
  SQL Query:

  SELECT username, email FROM User;

- ## Cartesian Product (×) – Combining Two Tables Without a Condition

  Relational Algebra:
  To combine `User` and `Roadmap` tables without specifying any condition:

  User×Roadmap
  SQL Query:

  SELECT * FROM User CROSS JOIN Roadmap;

- ## Join (⋈) – Combining Tables with Conditions

  ### Inner Join (θ-Join)

  Relational Algebra:
  To find **roadmaps created by each user**:

  User⋈User.id=Roadmap.user_idRoadmap

SQL Query:

```
SELECT User.username, Roadmap.title
FROM User
JOIN Roadmap ON User.id = Roadmap.user_id;
```

Equi-Join (Natural Join)

Relational Algebra:
To retrieve **chat messages along with user details**:

User⋈User.id=ChatMessage.user_idChatMessage

SQL Query:

```
SELECT User.username, ChatMessage.message, ChatMessage.timestamp
FROM User
NATURAL JOIN ChatMessage;
```

- ## Set Operations – Union, Intersection, Difference

Union (∪) – Combining Two Queries

Relational Algebra:
To retrieve all **internship and SDE sheet links**:

πlink(InternshipResource)∪πlink(SDESheet)

SQL Query:

```
SELECT link FROM InternshipResource
UNION
SELECT link FROM SDESheet;
```

Intersection (∩) – Common Data Between Two Queries

Relational Algebra:
To find **users who participated in both chat rooms and hackathons**:

πuser_id(ChatRoom)∩πuser_id(Hackathon)

SQL Query:

SELECT user_id FROM ChatRoom

INTERSECT

SELECT user_id FROM Hackathon;

Difference (-) – Subtracting One Query from Another

Relational Algebra:
To find **users who created roadmaps but never participated in a hackathon**:

πuser_id(Roadmap)−πuser_id(Hackathon)

SQL Query:

SELECT user_id FROM Roadmap

EXCEPT

SELECT user_id FROM Hackathon;

- **Aggregation (SUM, COUNT, AVG, MAX, MIN)**
- **Relational Algebra:**
  To count the total **number of users**:

  COUNT(User)

  SQL Query:

  SELECT COUNT(*) FROM User;

  To get the **average number of chat messages per user**:

  AVG(COUNT(ChatMessage.id)) grouped by user_id

  SQL Query:

  SELECT user_id, COUNT(*) / (SELECT COUNT(*) FROM User) AS avg_messages

  FROM ChatMessage

  GROUP BY user_id;

CONCLUSION

The **YourPlacementBuddy** database is structured to be **scalable, secure, and efficient**, aligning with the project's objective of guiding students in placement preparation. By applying **relational algebra principles**, **normalization techniques**, and **SQL best practices**, the system ensures **optimal performance** while maintaining a **user-friendly experience**.

Future Enhancements:

1. Implement AI-based recommendations for roadmaps.

2. Add real-time chat features for community discussions.

3. Improve roadmap visualization using graph-based UI.

4. Integrate with more APIs for fetching external learning resources.