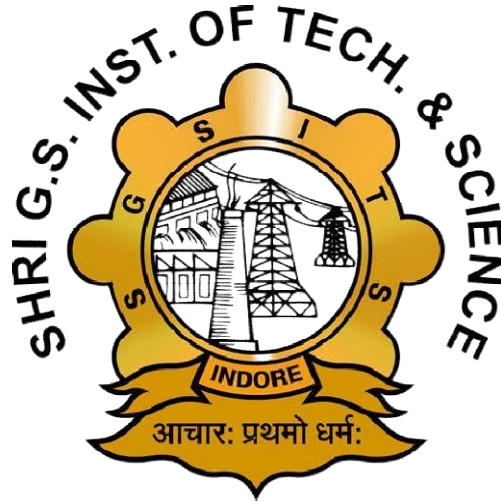


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DEPARTMENT OF INFORMATION TECHNOLOGY

DATABASE MANAGEMENT SYSTEM

IT38513

SESSION 2024 - 25

DATABASE ANALYSIS REPORT

Submitted To-

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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:

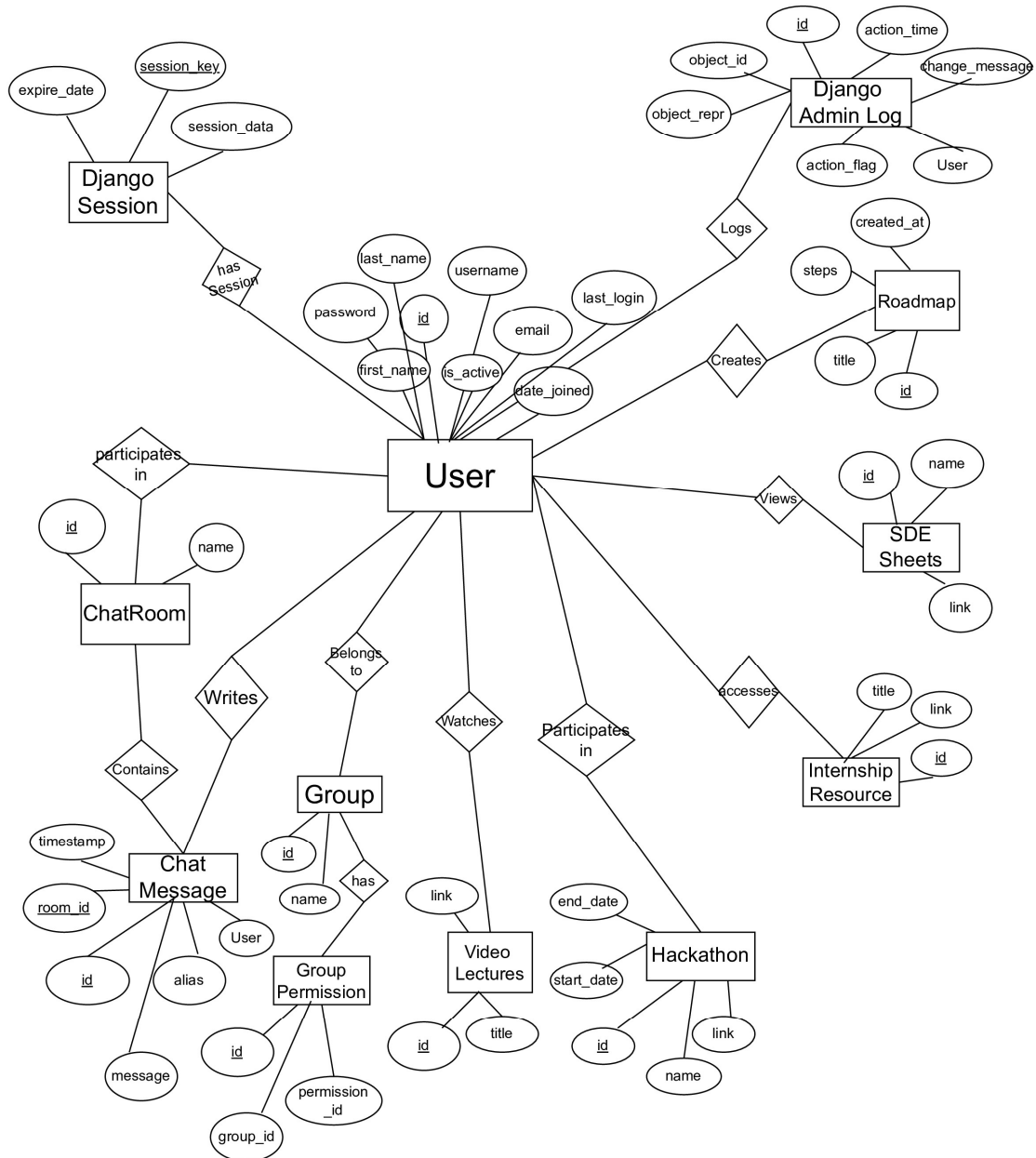
The YourPlacementBuddy is designed to help students navigate their college journey towards successful placements. With an overwhelming amount of online content, students often struggle to find a clear and structured path for their career preparation. This project provides:

- 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



User (auth_user)

- PK: id
- username (Unique)
- email
- password

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- - 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

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```
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

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```
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:

$\sigma_{is_active=TRUE}(User)$

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:

$\pi_{username,email}(User)$

SQL Query:

SELECT username, email FROM User;

- **Cartesian Product (\times) – Combining Two Tables Without a Condition**

Relational Algebra:

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

$User \times Roadmap$

SQL Query:

SELECT * FROM User CROSS JOIN Roadmap;

- **Join (\bowtie) – Combining Tables with Conditions**

Inner Join (θ -Join)

Relational Algebra:

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

$User \bowtie_{User.id=Roadmap.user_id} Roadmap$

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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**:

$$\text{User} \bowtie \text{User.id} = \text{ChatMessage.user_id} \text{ChatMessage}$$

SQL Query:

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

- **Set Operations – Union, Intersection, Difference**

Union (\cup) – Combining Two Queries

Relational Algebra:

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

$$\pi_{\text{link}}(\text{InternshipResource}) \cup \pi_{\text{link}}(\text{SDESheet})$$

SQL Query:

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

Intersection (\cap) – Common Data Between Two Queries

Relational Algebra:

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

$$\pi_{\text{user_id}}(\text{ChatRoom}) \cap \pi_{\text{user_id}}(\text{Hackathon})$$

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:**

$\pi_{\text{user_id}}(\text{Roadmap}) - \pi_{\text{user_id}}(\text{Hackathon})$

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.