CS 411 STAGE 2: Conceptual and Logical Database Design

AI-Powered Job Recommendation and Notification System (Job-Genie)

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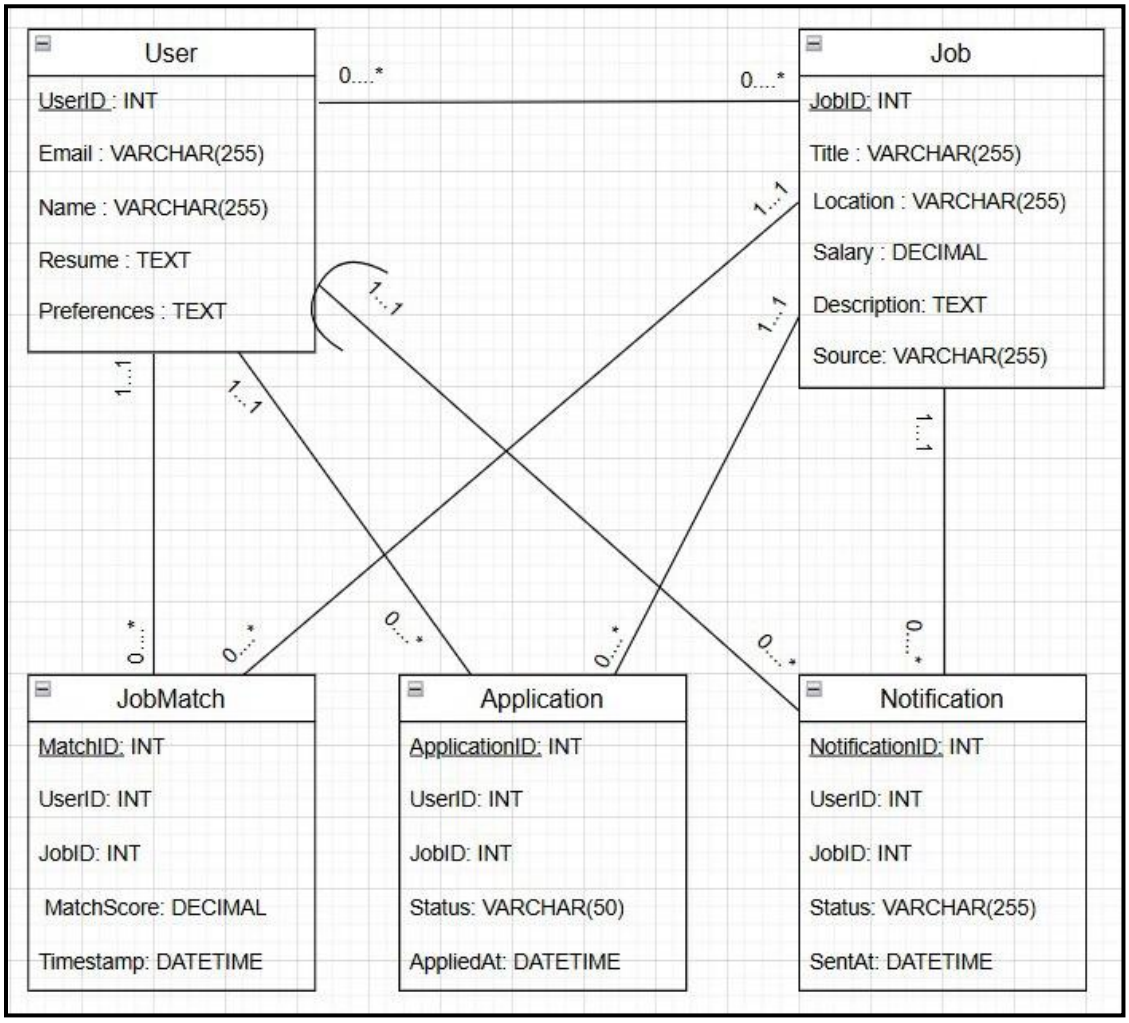
Introduction

This document presents the conceptual and logical database design for our project, Job-Genie, an AI-powered job recommendation and notification system. The design follows the required ER/UML model, ensuring that our schema adheres to normalization principles (3NF) for efficiency and correctness.

Conceptual Design (ER/UML Diagram)



Assumptions and Relationship Justifications

Each entity is designed based on our system's requirements:

1. User

- Stores essential user details, resumes, and preferences.
- A user can receive multiple job matches, notifications, and applications, but each job match, application, or notification belongs to only one user.
- 1 User → Many JobMatches, Many Applications, Many Notifications

2. Job

- Represents unique job postings from multiple sources.
- A job can be matched to multiple users and receive multiple applications, but each job match or application is associated with a single job.
- 1 Job → Many JobMatches, Many Applications

3. JobMatch

- Tracks AI-generated job recommendations.
- Stores the match score (how well a job fits a user’s profile).
- A user can be matched with multiple jobs, and a job can be matched to multiple users.
- Many Users ↔ Many Jobs

4. Application

- Tracks applications submitted by users.
- Applications are separate from job matches (not all matches turn into applications).
- A user can apply to multiple jobs, and each job can have multiple applicants.
- Many Users ↔ Many Jobs

5. Notification

- Stores alerts sent to users for job recommendations.
- Tracks which jobs were notified to the user and the timestamp.
- A user can receive multiple notifications, and each notification is linked to one job.
- 1 User → Many Notifications and 1 Job → Many Notifications

Logical Database Design (Relational Schema)

Below is the relational schema derived from our ER diagram:

User(UserID: INT [PK], Email: VARCHAR(255), Name: VARCHAR(255), Resume: TEXT, Preferences: TEXT)

Job(JobID: INT [PK], Title: VARCHAR(255), Company: VARCHAR(255), Location: VARCHAR(255), Salary: DECIMAL, Description: TEXT, Source: VARCHAR(255))

JobMatch(MatchID: INT [PK], UserID: INT [FK to User.UserID], JobID: INT [FK to Job.JobID], MatchScore: DECIMAL, Timestamp: DATETIME)

Notification(NotificationID: INT [PK], UserID: INT [FK to User.UserID], JobID: INT [FK to Job.JobID], Status: VARCHAR(50), SentAt: DATETIME)

Application(ApplicationID: INT [PK], UserID: INT [FK to User.UserID], JobID: INT [FK to Job.JobID], Status: VARCHAR(50), AppliedAt: DATETIME)

SQL BASED DATABASE SCHEMA

Below is the database schema:

```
CREATE TABLE User (
    UserID INT PRIMARY KEY AUTO_INCREMENT,
    Email VARCHAR(255) UNIQUE NOT NULL,
    Name VARCHAR(255) NOT NULL,
    Resume TEXT,
    Preferences TEXT
);
CREATE TABLE Job (
    JobID INT PRIMARY KEY AUTO_INCREMENT,
    Title VARCHAR(255) NOT NULL,
    Location VARCHAR(255),
    Salary DECIMAL(10,2),
    Description TEXT,
    Source VARCHAR(255)
);
```

```
CREATE TABLE JobMatch (
    MatchID INT PRIMARY KEY AUTO_INCREMENT,
    UserID INT NOT NULL,
    JobID INT NOT NULL,
    MatchScore DECIMAL(5,2) NOT NULL,
    Timestamp DATETIME DEFAULT CURRENT_TIMESTAMP,
    FOREIGN KEY (UserID) REFERENCES User(UserID) ON DELETE CASCADE,
    FOREIGN KEY (JobID) REFERENCES Job(JobID) ON DELETE CASCADE
);
CREATE TABLE Application (
    ApplicationID INT PRIMARY KEY AUTO_INCREMENT,
    UserID INT NOT NULL,
    JobID INT NOT NULL,
    Status VARCHAR(50) NOT NULL CHECK (Status IN ('Pending', 'Accepted', 'Rejected')),
    AppliedAt DATETIME DEFAULT CURRENT_TIMESTAMP,
    FOREIGN KEY (UserID) REFERENCES User(UserID) ON DELETE CASCADE,
    FOREIGN KEY (JobID) REFERENCES Job(JobID) ON DELETE CASCADE
);
CREATE TABLE Notification (
    NotificationID INT PRIMARY KEY AUTO_INCREMENT,
    UserID INT NOT NULL,
    JobID INT NOT NULL,
    Status VARCHAR(255) NOT NULL,
    SentAt DATETIME DEFAULT CURRENT_TIMESTAMP,
    FOREIGN KEY (UserID) REFERENCES User(UserID) ON DELETE CASCADE,
    FOREIGN KEY (JobID) REFERENCES Job(JobID) ON DELETE CASCADE
);
```

Normalization (3NF)

Our schema follows Third Normal Form (3NF):

1. **No Partial Dependencies**
    - All attributes depend on the entire primary key.
    - Example: MatchScore in JobMatch depends on both UserID and JobID, ensuring no partial dependency.
2. **No Transitive Dependencies**
    - Each attribute is fully dependent on the primary key and not on any other non-key attribute.
    - Example: Title, Location, and Salary in Job are all dependent only on JobID, not on each other.
3. **Separation of Concerns**
    - JobMatch is separate from Application because matching is an AI-generated recommendation, while applications are initiated by the user.
    - Notification is stored separately to track sent alerts without redundancy.

Thus, our schema is fully normalized to 3NF, preventing data anomalies while maintaining efficiency and reducing redundancy.