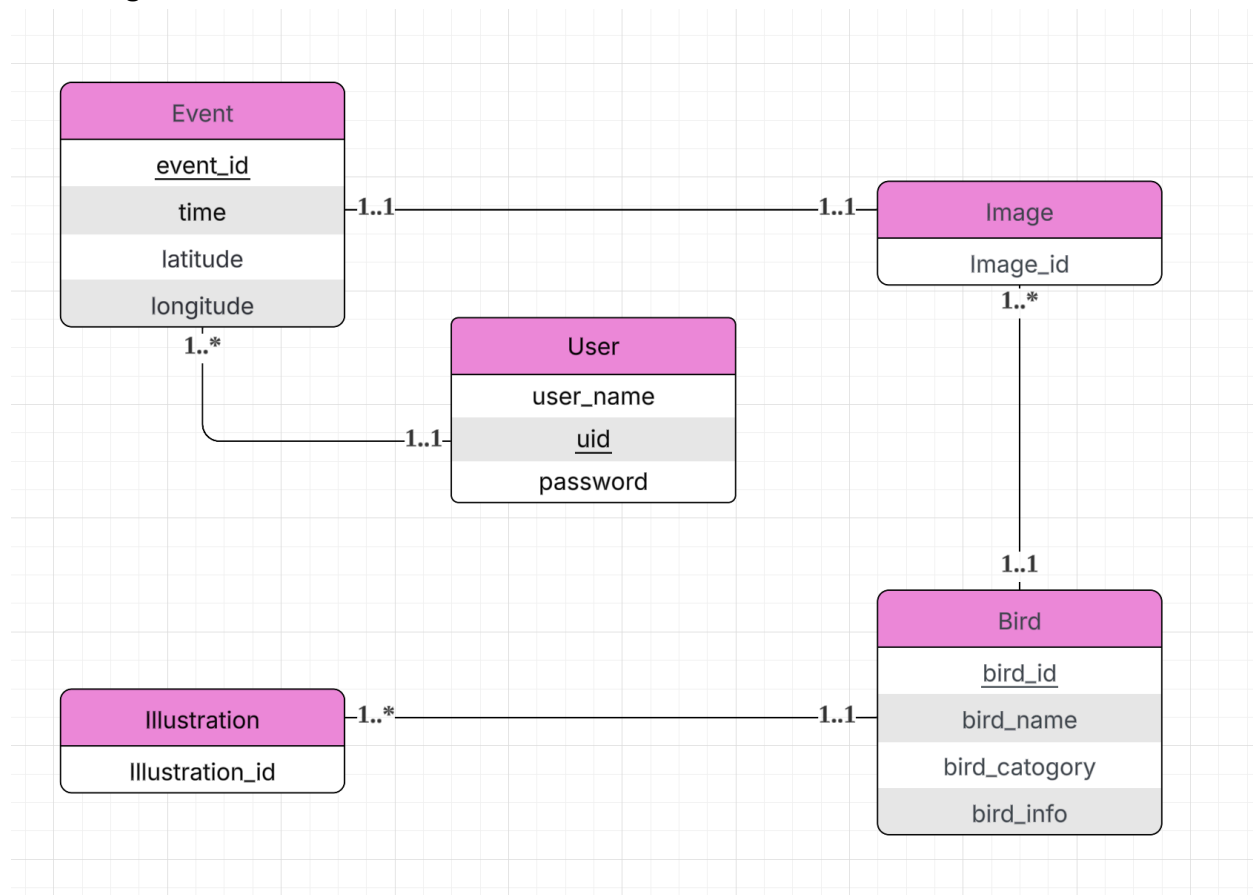


## UML Diagram



**A. Explain your assumptions for each entity and relationship in your model. Discuss why you've modeled something as an entity rather than an attribute of another entity. Describe the cardinality of relationships, like why a student is linked to only one advisor. These assumptions might come from customer requirements or application constraints. Please clarify them.**

### User Entity

#### Assumptions

- Each user has a unique uid, user\_name, and password.
- A user can participate in multiple events.
- A user is the creator of events (hence, the 1-to-many relationship between User and Event).

#### Why is this an Entity?

- Users are independent entities that authenticate and interact with the system. Their details such as usernames and password are fundamental and should not be attributes of another entity.

#### Cardinality

- User (1) → (M) Event
  - A user can create multiple events, but each event is created by only one user.

## Event Entity

### Assumptions

- An event is a logged observation of birds at a specific time and location.
- Events have attributes like event\_image, event\_time, event\_longitude, and event\_latitude.

### Why is this an Entity?

- Events are standalone records representing sightings and need to be stored independently.
- The event's location and time make it distinct and identifiable, so it shouldn't be just an attribute of User.

### Cardinality

- Event (1) → (1) Image
  - Each event can only have one image associated with it.
- User (1) → (M) Event
  - A user can create multiple events.

## Image Entity

### Assumptions

- Each image is uniquely identified by image\_id.
- An image is associated with exactly one event (where it was taken).
- Each image depicts exactly one bird species.

### Why is this an Entity?

- Images are essential records that need to be stored with metadata (event location, timestamp).
- Making it an entity allows flexibility in storing additional attributes in the future such as image resolution or format.

### Cardinality

- Image (1) → (1) Bird
  - Each image represents one bird species.
- Image (1) → (1) Event
  - An image can only belong to one event.

## Bird Entity

### Assumptions

- Each bird is uniquely identified by bird\_id.
- Birds have attributes such as bird\_name, bird\_category, and bird\_info.

### Why is this an Entity?

- Birds are independent objects with significant attributes.
- Storing birds as an entity enables efficient categorization, querying, and data management.

### Cardinality

- Bird (1)  $\rightarrow$  (M) Image
  - A bird species may be captured in multiple images.
- Bird (1)  $\rightarrow$  (M) Illustration
  - A bird can have multiple illustrations.

### Illustration Entity

#### Assumptions

- Illustrations represent artistic drawings or detailed pictures of birds.
- Each illustration is linked to one specific bird.

#### Why is this an Entity?

- Illustrations exist as separate visual representations of birds, often unrelated to the event images.
- Making it an entity allows for storing details about illustrations separately.

#### Cardinality

- Illustration (1)  $\rightarrow$  (1) Bird
  - Each illustration corresponds to one bird species.

## B. Process of normalization

A relation R with function dependency F is 3NF if and only if for all  $X \rightarrow A$  in  $F^+$ , A in X or X is a super key or A is a part of some minimal keys for R.

Here we list all dependencies in each table:

1. User Table ( $uid \rightarrow user\_name, password$ )
  - The Primary Key is uid.
  - uid determines user\_name and password completely.
  - No transitive dependencies.
2. Event Table ( $event\_id \rightarrow time, latitude, longitude$ )
  - The Primary Key is event\_id.
  - event\_id determines the attributes completely.
3. Image Table ( $image\_id \rightarrow event\_id, bird\_id$ )
  - The Primary Key is image\_id.
  - Each image belongs to one event and is linked to one bird.
4. Bird Table ( $bird\_id \rightarrow bird\_name, bird\_category, bird\_info$ )
  - The Primary Key is bird\_id.
  - The attributes depend directly on bird\_id.
5. Illustration Table ( $illustration\_id \rightarrow bird\_id$ )
  - The Primary Key is illustration\_id.
  - The only dependency is  $illustration\_id \rightarrow bird\_id$ , meaning no partial or transitive dependencies.

Since all attributes in each table depend only on the primary key, and there are no transitive dependencies, the schema is in 3NF.

**C. Convert your conceptual database design (ER/UML) to the logical design (relational schema).**

User (

uid INT[PK],  
user\_name VARCHAR(100),  
password VARCHAR(100)

);

Event (

event\_id INT [PK],  
user\_id INT [FK to User.uid],  
time DATETIME,  
latitude DECIMAL(10, 6),  
longitude DECIMAL(10, 6)

);

Image (

image\_id INT [PK],  
event\_id INT [FK to Event.event\_id],  
image\_url VARCHAR(255)

);

Bird (

bird\_id INT [PK],  
bird\_name VARCHAR(100),  
bird\_category VARCHAR(100),  
bird\_info VARCHAR(500)

);

Illustration (

illustration\_id INT [PK],  
bird\_id INT[FK to Bird.bird\_id],  
illustration\_url VARCHAR(255)

);