CS 4850 – Senior Project Sections 02 & 03, Spring 2025

24-T1 OWL JUDGE

Team Members

Name

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Bill Roan Simo
Minh Quang Vu

Advisor / Instructor: Sharon Perry
Role: Facilitate project progress; advise on project planning and management.

April 28th, 2025

Website: https://owl-judge-21-t1.github.io/project/
GitHub: https://github.com/OwlJudge-Mobile-App/OwlJudge-App

STATS AND STATUS

Lines of Code	2500
Components/Tools	11
Estimated Hours	450
Actual Hours	500

Table of Contents

I. Introduction

This document provides an overview of the development, design, and implementation of the **OwlJudge Mobile Application**, a system created for digital judging of projects or events. The system automates the traditionally manual process, improving efficiency, accuracy, and transparency. The app aims to monitor the judging process, improve accuracy, and offer real-time updates for judges, participants, and administrators. This app is developed using React Native for the mobile app, PostgreSQL for database and Node.js for the backend. The app ensures a responsive and secure experience across mobile platforms.

Goals and Objectives:

- Automate the event judging process to increase efficiency.
- Provide a user-friendly interface for judges and administrators.
- Ensure secure authentication and authorization through industry-standard protocols.
- Integrate PostgreSQL for reliable data storage and Redis for performance optimization.
- Enable real-time monitoring and analytics to track event progress.

Key Features:

- Secure login with role-based access control for Admins, and Judges.
- Event and judge management with customizable scoring criteria.
- Real-time score submission and aggregation.
- Real-time ranking and performance analytics for event administrators.

II. Requirements

1. Functional Requirements:

1. **User Management & Authentication:**
   - Secure login for judges, admins, and participants.
   - Role-based access control (Admin, Judge).
   - Password recovery and secure password management.
2. **Event Management:**
   - Admins can create, edit, and delete events.
   - Bulk import of judge and project data.
   - Event progress tracking for administrators.
3. **Project & Judge Assignment:**
   - Automated/manual assignment of judges to projects.
   - Notifications to judges upon assignment.

4. **Digital Scoring System:**
   - Real-time score input and submission by judges.
   - Auto-save scores periodically.
   - Lock scores upon submission to prevent unauthorized changes.
5. **Real-Time Score Aggregation & Ranking:**
   - Scores are aggregated in real-time as judges submit evaluations.
   - Tie-breaker mechanisms for scoring conflicts.
   - Real-time leaderboard and ranking for projects.
6. **Reporting & Analytics:**
   - Real-time event analytics for administrators.
   - Export of results in CSV/PDF format.
7. **Security & Data Protection:**
   - Data encryption at rest and in transit.
   - Audit logs for administrative actions and judge activity.
   - Authentication using OAuth and JWT.

2. Non-Functional Requirements:

1. **Performance:**
   - System must handle at least 100 concurrent users without degradation.
   - Response times for score submission should be less than 2 seconds.
2. **Scalability:**
   - multiple concurrent events without performance issues.
3. **Usability:**
   - Mobile-first responsive design, ensuring the application works smoothly on every mobile device.
4. **Reliability:**
   - System availability should be 99.9% during competition hours.
   - Automated backups to prevent data loss.
5. **Security:**
   - Compliant with FERPA and university IT security policies.

III. Analysis / Design

1. Analysis

The **OwlJudge Mobile App** is designed using a **microservices architecture**. It is divided into several modular components:

Security Design:

- **Authentication & Authorization:** Implemented using **OAuth 2.0** and **JWT** to ensure secure user login and role-based access control.
- **Encryption:** Data is encrypted at rest and in transit using **TLS 1.3**.

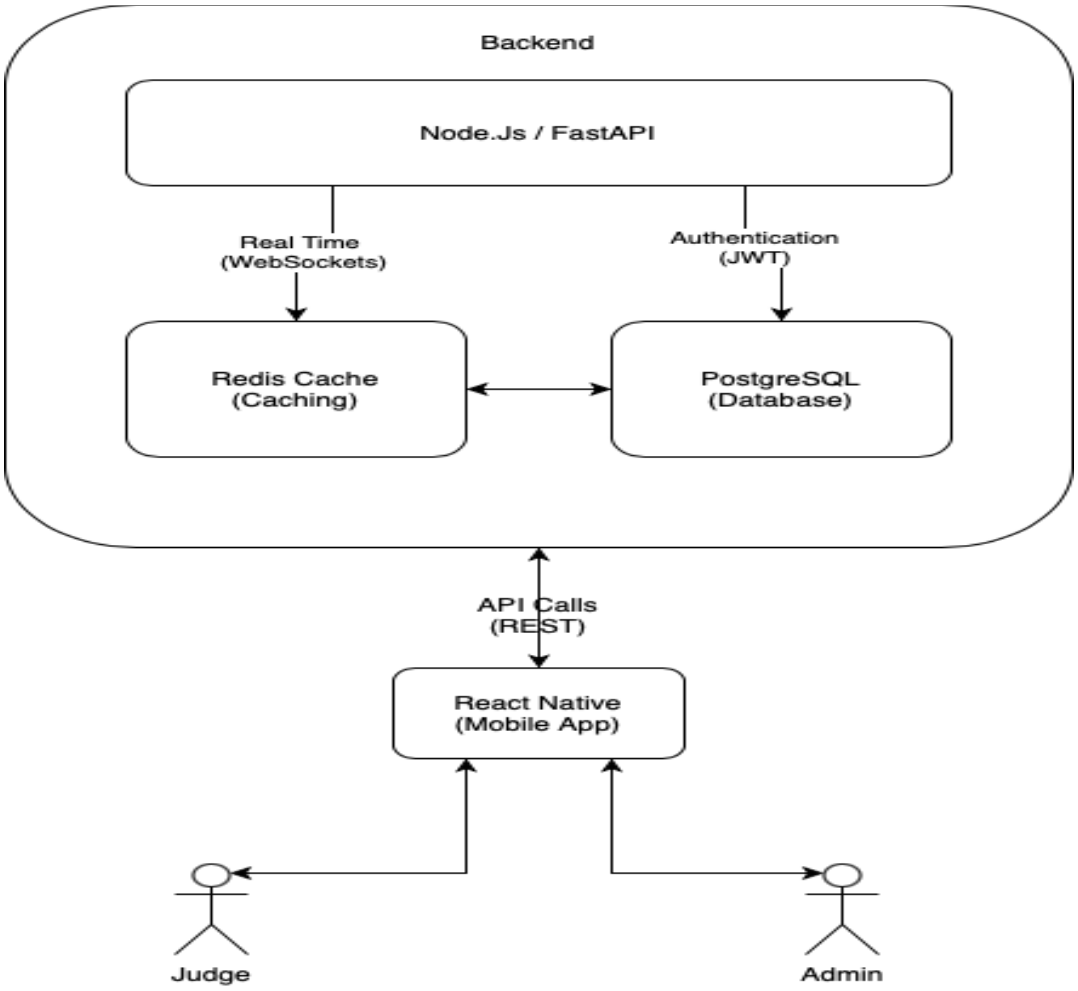
System Architecture:

- **Frontend:** Developed using **React Native**, ensuring a responsive, mobile-friendly interface for judges and administrators.
- **Backend:** Built using **Node.js** (Express) or **Python (FastAPI)** to provide high-speed asynchronous processing.
- **Database: PostgreSQL** for structured data storage (users, events, scores), **Redis** for caching frequently accessed data.

System Components:

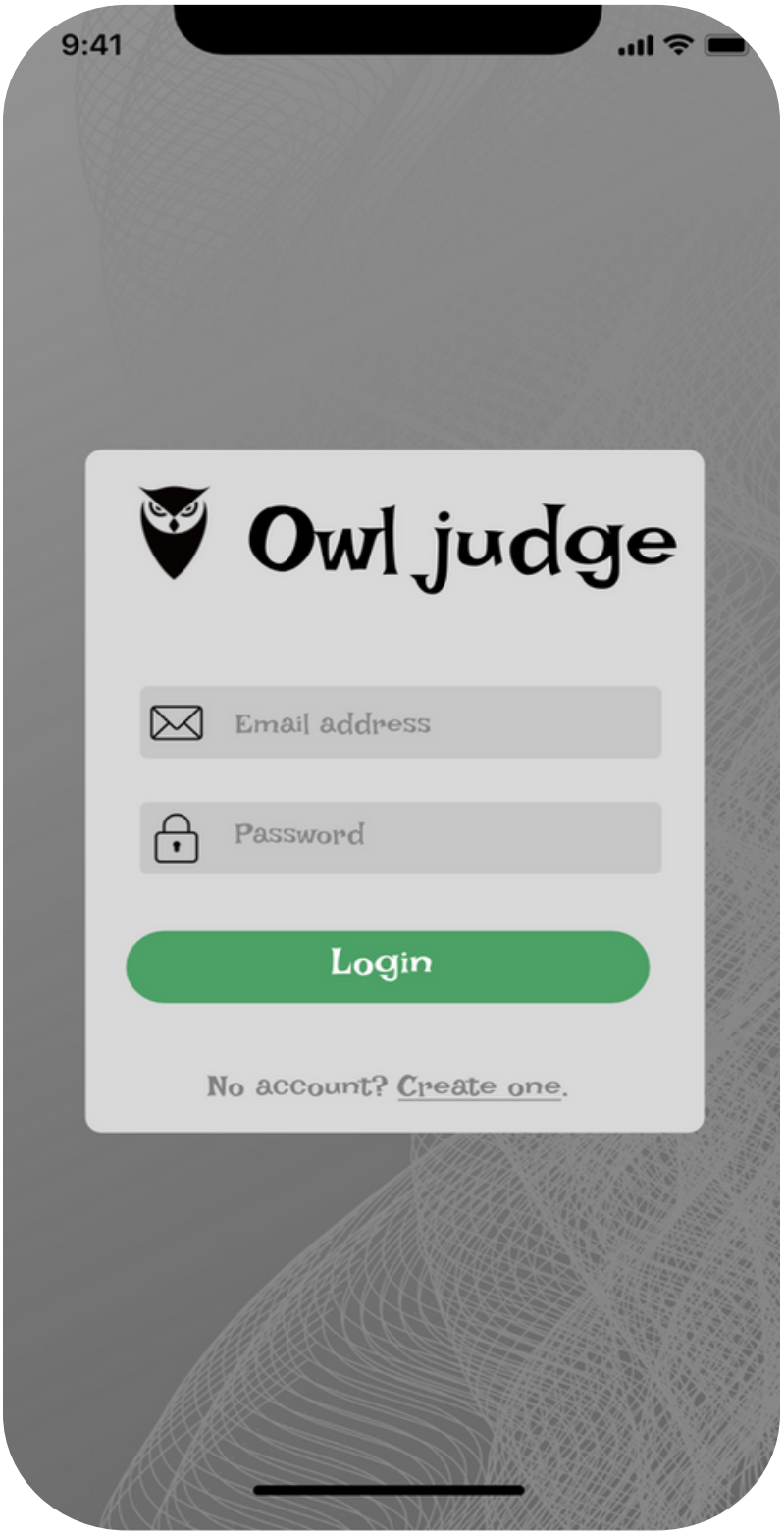
1. **User Management Service:** Handles login, registration, and user roles.
2. **Event Management Service:** Manages event creation, judge assignments, and event tracking.
3. **Project & Judge Assignment Service:** Ensures judges are assigned to projects in a fair and balanced manner.
4. **Scoring System:** Provides judges with an interface to input and submit scores.
5. **Reporting & Analytics Module:** Aggregates data and generates real-time reports for administrators.

System Architecture Diagram:

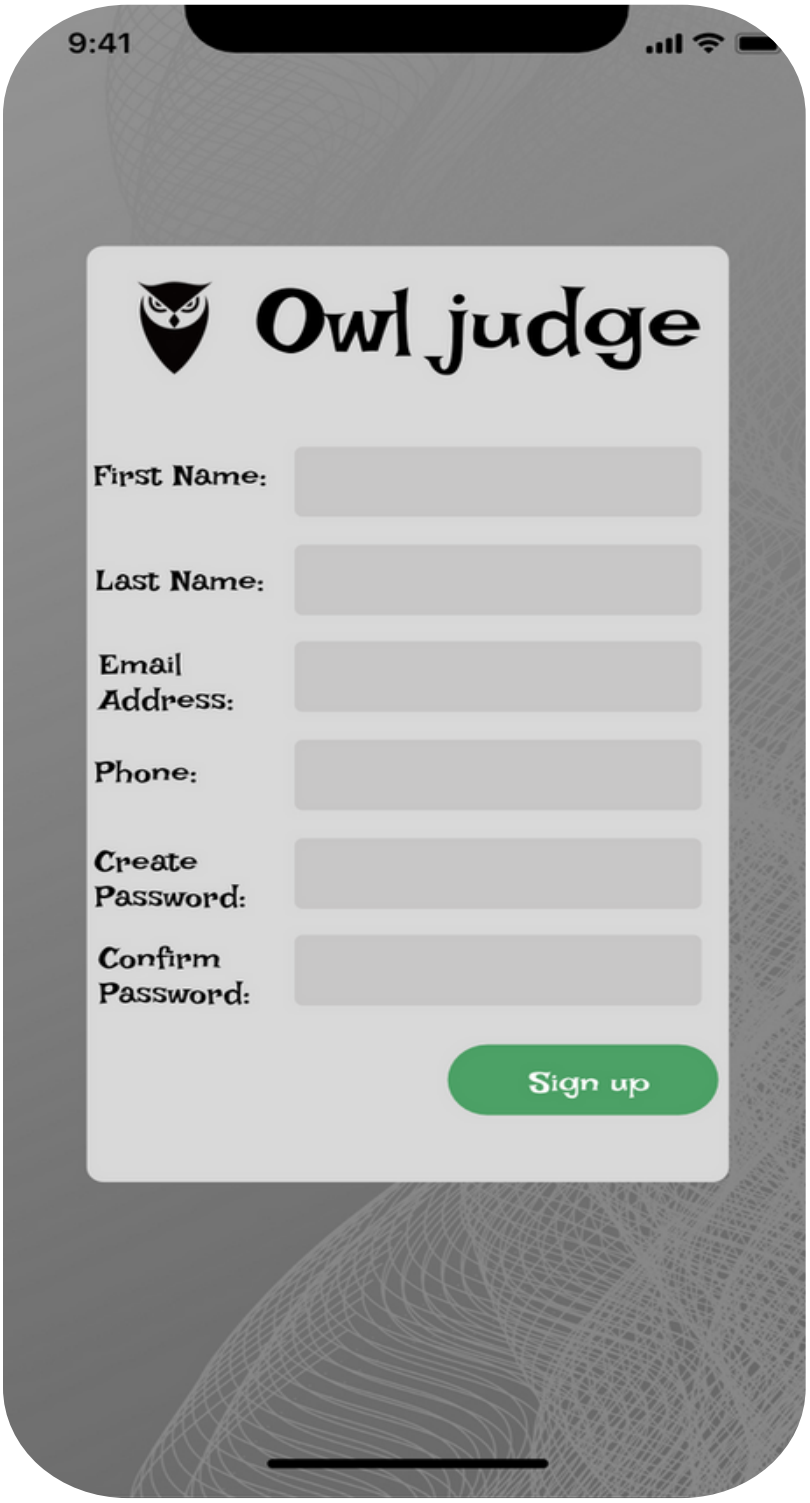

Backend
Node.Js / FastAPI
Real Time
(WebSockets)
Authentication
(JWT)
Redis Cache
(Caching)
PostgreSQL
(Database)
API Calls
(REST)
React Native
(Mobile App)
Judge
Admin

2. Design

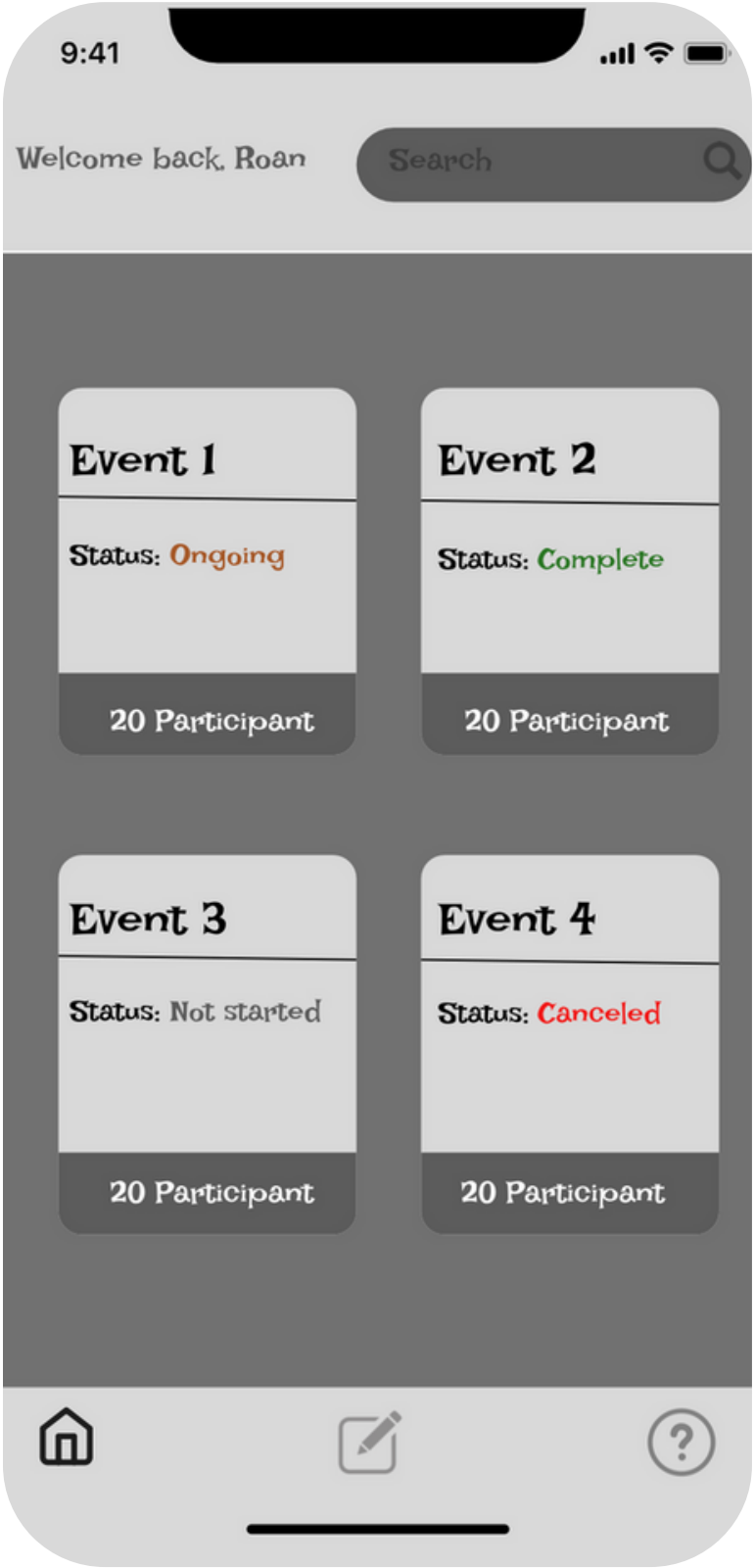
- **Login:**



- **Create an account:**



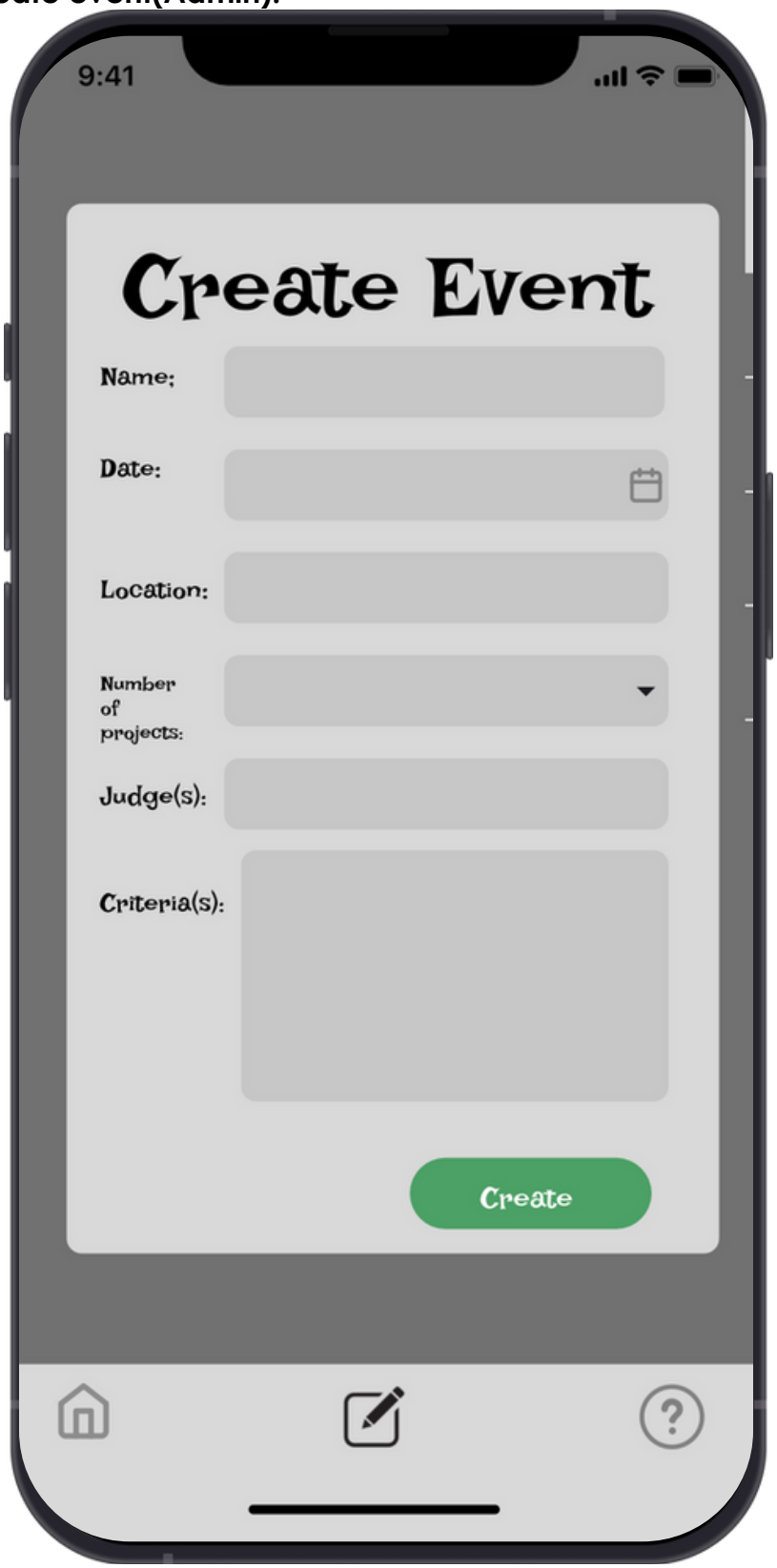
- **Home (judge and admin):**



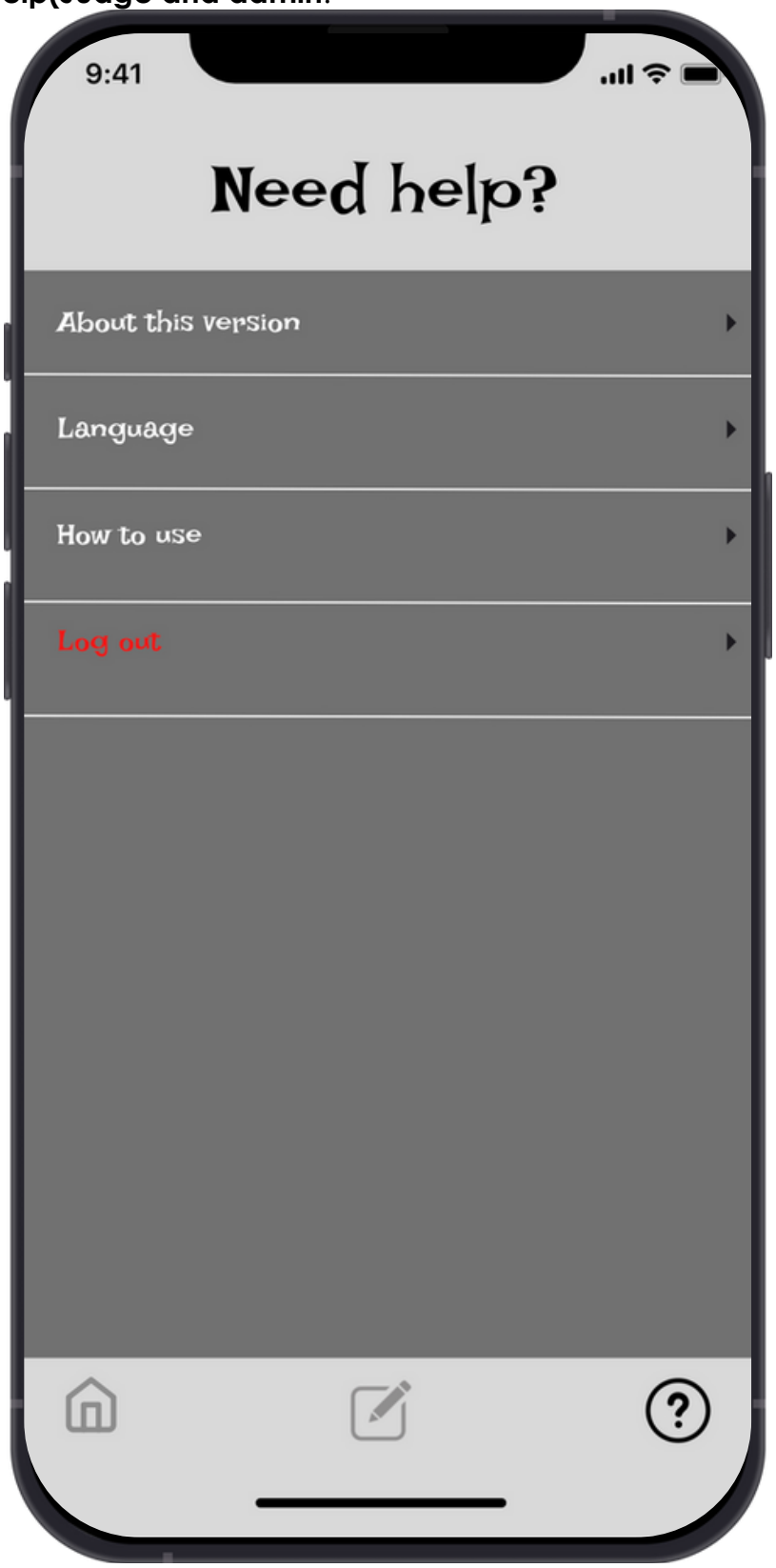
- **Event Informations (admin):**

- **Project information(Admin)**:

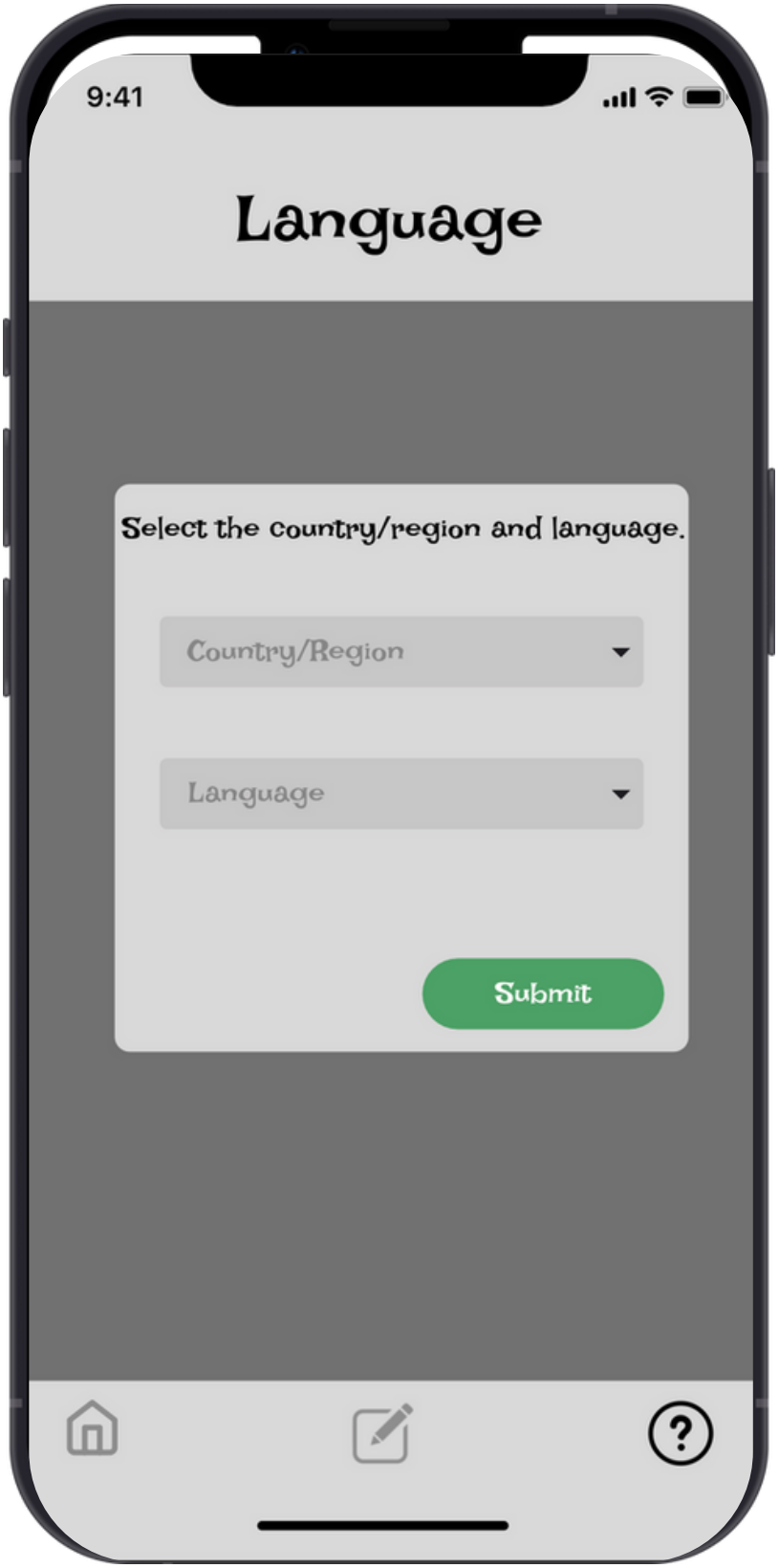
- **Create event(Admin):**



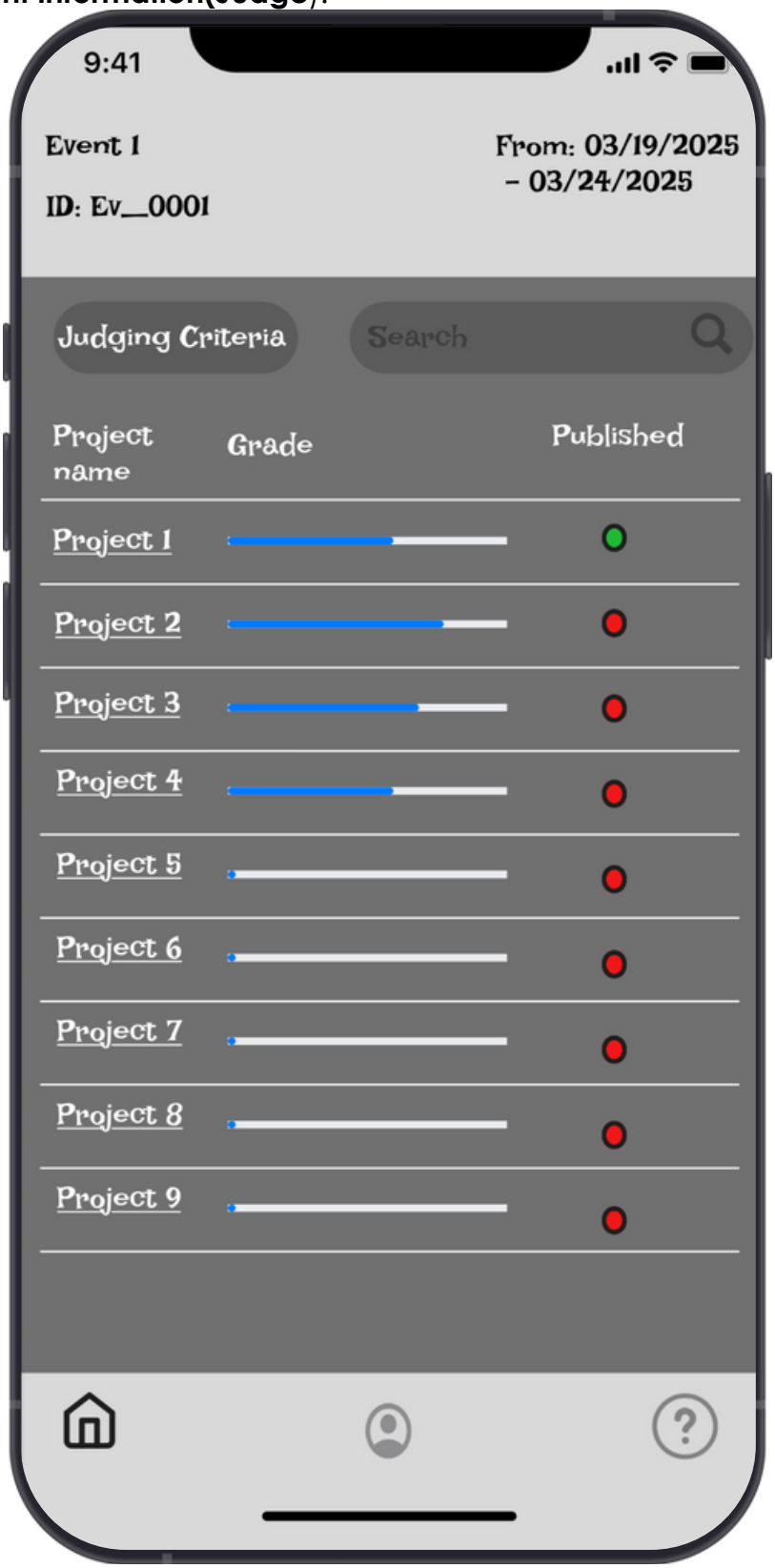
- **Help(Judge and admin**:



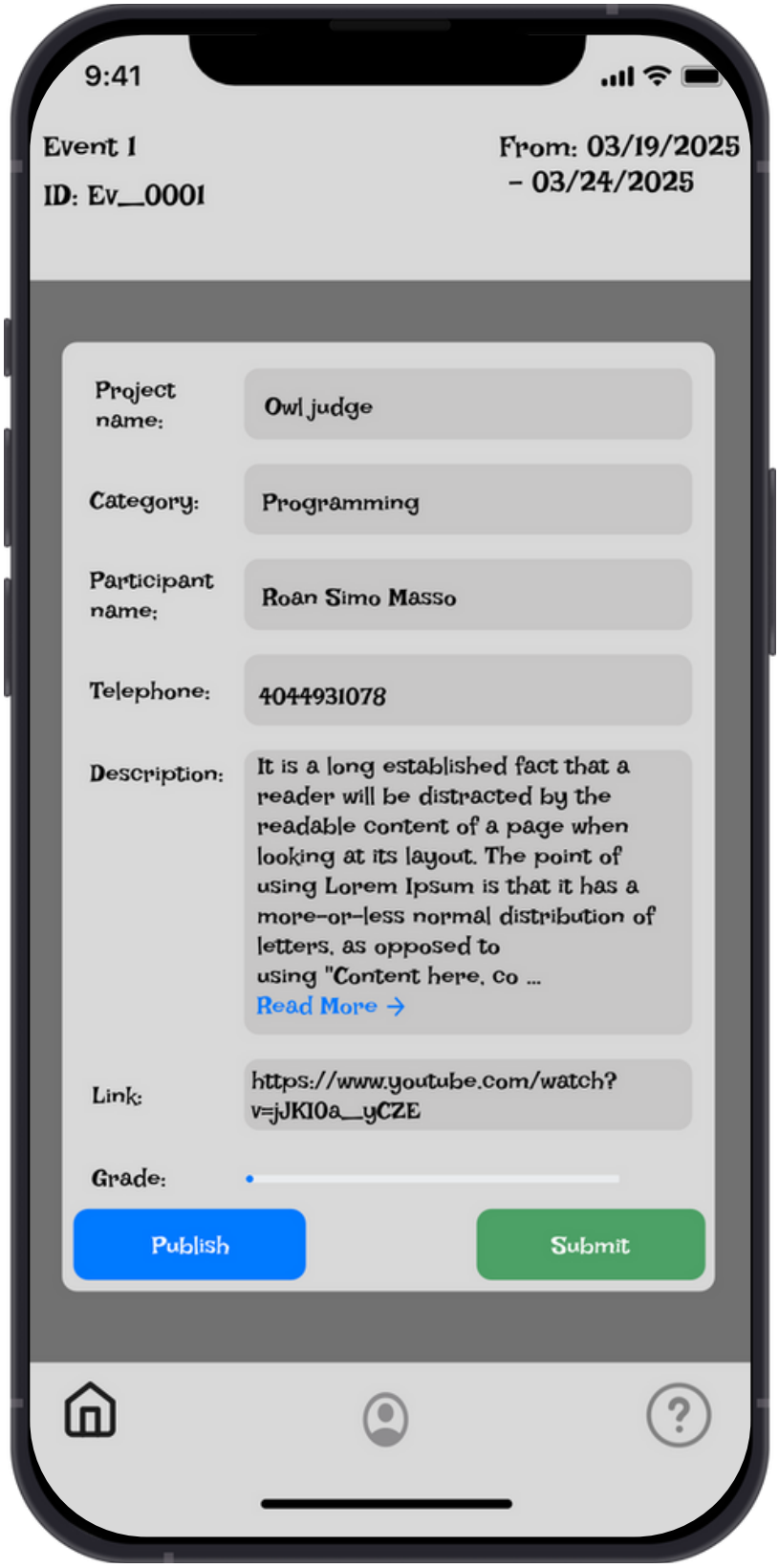
- **Language / region(Judge and admin):**



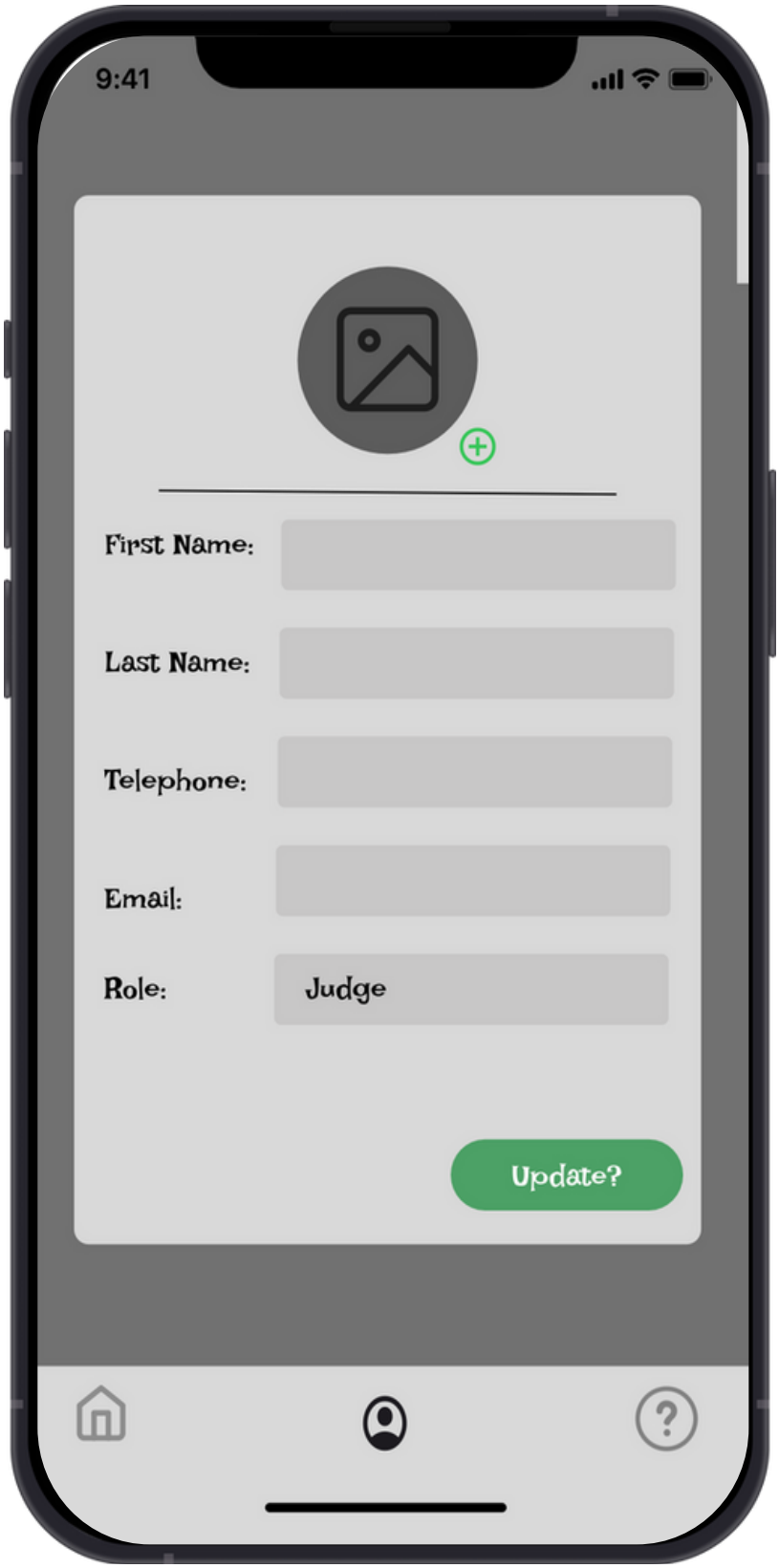
- **Event information(Judge)**:



- **Project information(judge)**:



- **View personal information(Judge):**



IV. Development

1. Backend Development:

The backend API is built using **Node.js** for handling HTTP requests. The backend APIs were built using **FastAPI** for asynchronous support and high performance. **JWT** is used for user authentication, ensuring that only authorized users can access sensitive data and submit scores.

2. Database Connection:

In the **OwlJudge Web Application**, the database connection is one of the core components for handling and storing data, such as user information (admins, judges, participants), events, projects, and scores. The system uses **PostgreSQL** as the relational database management system (RDBMS) and **Redis** as an in-memory cache to enhance performance for frequently accessed data.

PostgreSQL Database Connection

To connect to the **PostgreSQL** database, we use **SQLAlchemy** with **FastAPI**. This allows us to manage database sessions, perform queries, and interact with the data stored in the database.

1. Database Overview:

- **PostgreSQL** stores structured data like:
  - **Users:** Admins, Judges, and Participants
  - **Events:** Event details, dates, status
  - **Projects:** Project information, categories, participants
  - **Scores:** Scores and feedback from judges
- **Redis** is used for caching frequently queried data to reduce the load on the database and speed up access.

Setting Up PostgreSQL Connection with FastAPI

Here's an example of how the database connection works in the **OwlJudge** application.

Below are the code snippets for database connection:

Step 1: Install dependencies

```
pip install fastapi
pip install sqlalchemy
pip install psycopg2  # PostgreSQL driver
pip install redis
pip install uvicorn  # For running the app
```

Step 2: Set up database connection

In your backend, create a file called database.py to manage the connection to the **PostgreSQL** database and the **Redis**cache.

```
from sqlalchemy import create_engine
from sqlalchemy.ext.declarative import declarative_base
from sqlalchemy.orm import sessionmaker

DATABASE_URL = "postgresql://username:password@localhost/dbname"

# SQLAlchemy setup
engine = create_engine(DATABASE_URL)
SessionLocal = sessionmaker(autocommit=False, autoflush=False, bind=engine)
Base = declarative_base()

# Redis setup for caching
import redis
redis_client = redis.StrictRedis(host='localhost', port=6379, db=0)
```

- **DATABASE_URL**: This string connects to the **PostgreSQL** database. Replace "username", "password", "localhost", and "dbname" with the actual credentials and database name.
- **Redis** is initialized to cache frequently accessed data. Here, Redis is connected on the default port (6379), and we're using **database 0**.

Step 3: Create a database session

For each request that requires interacting with the database, you will need to create a session. This session will interact with the database and handle transactions.

```
def get_db():
    db = SessionLocal()
    try:
        yield db
    finally:
        db.close()
```

This function is used by FastAPI to provide a session to handle database queries in the routes.

3. Frontend Development:

   The frontend was developed using **React Native** for mobile-first, responsive design. Judges can access their dashboard to evaluate projects, while admins can track event progress and scores in real time.

4. Security:

   - **JWT Tokens** is used for authentication to ensure secure login.
   - **TLS 1.3** encryption is implemented for all data transmission between the app and the backend.
   - **Role-Based Access Control:** Admins, judges, and participants have specific permissions, ensuring that sensitive information is protected.

5. Setting Up the Project

   Step 1: Clone the Repository

   First, clone the **OwlJudge** repository from GitHub:

   ```
   git clone https://github.com/ccseowljudge.git
   cd ccseowljudge
   ```

   Step 2: Install Dependencies

   Use pip to install the required dependencies as mentioned earlier:

   ```
   pip install -r requirements.txt
   ```

   This will install FastAPI, SQLAlchemy, Redis, and other required libraries.

   Step 3: Set Up the Database

   a) Create PostgreSQL Database:
      - If you're using PostgreSQL locally, create a database:

        ```
        psql -U postgres
        CREATE DATABASE owljudge;
        ```

   b) Configure Environment Variables:
      - Create a .env file in the root directory of your project to securely store database credentials:
        DB_HOST=localhost

```
DB_USER=username
DB_PASSWORD=password
DB_NAME=owljudge
```

c) Run the Database Migrations:
   - Use Alembic or SQLAlchemy's Base.metadata.create_all() method to create the tables:

```
python run.py
```

Step 4: Configure Frontend

1. **React Native Setup**:
   - Make sure you have **Node.js** and **npm** installed.
   - To install React Native dependencies:

```
npm install
```

2. **Mobile App Build**:
   - To build the mobile app for both iOS and Android, use the following commands (ensure you have **Expo CLI** installed):

```
eas build:configure
eas build --platform all
```

Step 5: Start the Application

1. **Run the Backend**:
   - To start the backend server using Uvicorn (for FastAPI), run:

bash
Copy
```
uvicorn main:app --reload
```

2. **Run the Frontend (React Native)**:
   - To start the mobile app in development mode:

```
npm start
```

V. Test Plan and Test Report

Test Methodology:

- **Manual Testing:** Performed to simulate real-world usage scenarios, including user login, event creation, and score submission.
- **Automated Testing:** Focused on security (e.g., login attempts, data encryption), performance (e.g., load testing), and system stability.
- **User Acceptance Testing (UAT):** Real users (admins and judges) tested key features such as login, score submission, and event creation.

Test Results:

- **User Login:** Pass – Users can log in successfully with valid credentials.
- **Score Submission**: Pass – Judges can submit scores without issues.
- **Event Creation:** Pass – Admins can create events with correct data.
- **Real-Time Score Aggregation:** Pass – Scores update in real-time as judges submit evaluations.
- **System Performance under Load:** Pass – The system can handle 100 concurrent users without performance degradation.

Requirement	Expected Outcome	Pass/Fail	Severity
User Login	Users can log in successfully with valid credentials	Pass	Minor
Score Submission by Judge	Judges can submit scores without issues	Pass	Major
Event Creation by Admin	Admin can create events with correct data	Pass	Critical
Event Deletion and Modification	Admin can delete or modify events correctly	Pass	Critical
Email Notifications to Judges	Judges receive email notifications after assignment	Pass	Minor
Project and Judge Assignment	Judges are assigned to projects correctly	Pass	Critical
Judge Notifications for Project Assignment	Judges receive notifications about project assignments	Pass	Minor
Score Auto-Saving	Scores are auto-saved periodically to prevent data loss	Pass	Major
Score Locking After Submission	Scores are locked to prevent unauthorized changes after submission	Pass	Critical
Real-Time Score Aggregation	Scores update in real-time as judges submit evaluations	Pass	Critical
Tie-Breaking Mechanism	Tie-breaker mechanism works when scores are tied	Pass	Major
Export Results to CSV/PDF	Results can be exported in CSV or PDF format	Pass	Major
System Performance under Load (100 users)	System can handle 100 concurrent users without performance degradation	Pass	Critical

Real-Time Event Analytics for Admin	Admin can access real-time event analytics during the event	Pass	Minor
Password Recovery	Password recovery process works as expected	Pass	Minor

VI. Version Control

Version Control System:

- The project uses **GitHub** for version control. All team members commit their changes regularly, and the repository is maintained under an organization account for better collaboration.
- **Branching Strategy:** Each feature or fix is developed in its own branch, which is merged into the main branch after thorough testing.

Access Control:

- The repository is private during development, with access restricted to the project team members. Once the project is complete, the repository will be made public for final release.

VII. Conclusion

The **OwlJudge Mobile app** successfully digitizes the judging process for event such as the **C-Day** event at **Kennesaw State University**, improving the accuracy, efficiency, and transparency of event management. The system meets all functional and non-functional requirements, including real-time score aggregation, secure authentication, and scalability for large events. The project is now complete and fully operational, with all tests passing as expected.
Moving forward, future enhancements include the integration of AI-driven analytics to assist with scoring adjustments and expanded scalability to support multi-institutional events.

VIII. Appendix

1. Project Plan:

a) Project Overview / Abstract

The CCSE OwlJudge Web Application is a scalable, secure, and user-friendly platform designed to enhance the digital judging process for Kennesaw State University's C-Day event. The application will enable judges to evaluate capstone projects efficiently, ensuring fairness and transparency. It will feature real-time scoring, project tracking, and seamless integration with university systems.

b) Project Website

URL: Temporary Placeholder: www.ccseowljudge.com (This will no longer be used because we are developing a mobile app)

c) Deliverables

The project will produce the following key deliverables to demonstrate its success and functionality:

1. **Final Report**: A comprehensive summary of the project, including design choices, results, and challenges encountered.
2. **Source Code**: Fully documented and structured code available on a GitHub organization account.
3. **Website with GitHub Integration**: A central platform that connects all project components.
4. **Final Presentation Video**: A video walkthrough showcasing the application's features.
5. **Weekly Activity Reports**: Regular updates to track progress and maintain accountability.
6. **Technical Documentation**: Detailed guides for setup, usage, and further development.
7. **Prototype Presentations**: Iterative demos to gather feedback during development.
8. **Fully Deployed Application**: The final version of the application, hosted on AWS.

d) Group Meeting Schedule

Meetings will be held regularly to enure coordination among team members:

- **FaceTime**: Fridays at 6 PM for informal discussions and check-ins.
- **Teams**: Mondays and Wednesdays at 11 AM for in-depth technical planning.
- **In-person**: As needed, for critical technical discussions and debugging sessions.

e) Collaboration and Communication Plan

- Teams for virtual meetings

- Google Drive for shared documents
- GitHub for version control and code sharing
- Trello for task management

f) Project Schedule and Task Planning

The project will follow the Software Development Life Cycle (SDLC) stages:

Initiation Phase:
- Kickoff meeting: Jan 22, 2025
- Requirements gathering: Jan 29, 2025

Planning Phase:
- Database schema design: Feb 17, 2025
- System architecture planning: Mar 03, 2025

Execution Phase:
- Backend development: Mar 10, 2025
- Frontend development: Mar 17, 2025

Closure Phase:
- Testing and QA: Apr 07, 2025
- Deployment: Apr 13, 2025
- Final Adjustments: Apr 17, 2025
- Final presentation C-Day: Apr 22, 2025

Gantt Chart:

Project Name: OWL JUDGE
Report Date: 1/23/25

					Milestone #1				*Milestone #2*				*Milestone #3*				C-Day	
Phase	**Tasks**	**Complete%**	**Current Status Memo**	**Assigned To**	**01/11**	**01/13**	**01/20**	**02/03**	**02/10**	**02/17**	**02/24**	**03/03**	**03/10**	**03/17**	**03/24**	**03/31**	**04/07**	**04/22**
Requirements	Meet with stakeholder(s) SH	50%	Delayed	Lumiere, James	10	4												
	Define requirements																	
	Review requirements with SH	10%		Lumiere		10	15											
	Get sign off on requirements	0%		James			5	10										
Project design	Define tech required *	0%		Bill				10	4									
	Database design	0%		James, Bill				5	10	10								
	Front End design	0%		Lumiere, Minh						10	10							
	Develop working prototype	0%		Bill						10	10							
	Test prototype	0%		Lumiere							5	10	5					
Development	Review prototype design	0%		Bill								8	5	10				
	Rework requirements	0%		James								8	10	20	20			
	Document updated design	0%		Lumiere											10	10		
	Test product	0%		Minh										8	5	20		
Final report	Presentation preparation	0%		Lumiere, Minh, Bill, James												15	10	10
	Poster preparation	0%		Lumiere, James														10
	Final report submission to D2L and project owner	0%																5
			Total work hours	**337**	**10**	**14**	**20**	**25**	**14**	**30**	**25**	**26**	**20**	**38**	**35**	**45**	**10**	**25**

* formally define how you will develop this project including source code management

Legend
Planned
Delayed
Number Work: man hours

g) Other Plans

Risk Assessment:

- Identify risks related to AWS resource constraints, performance bottlenecks, and data security.
- Mitigation Plan: Optimize resource usage, conduct regular performance testing, and encrypt sensitive data.

h) Version Control Plan

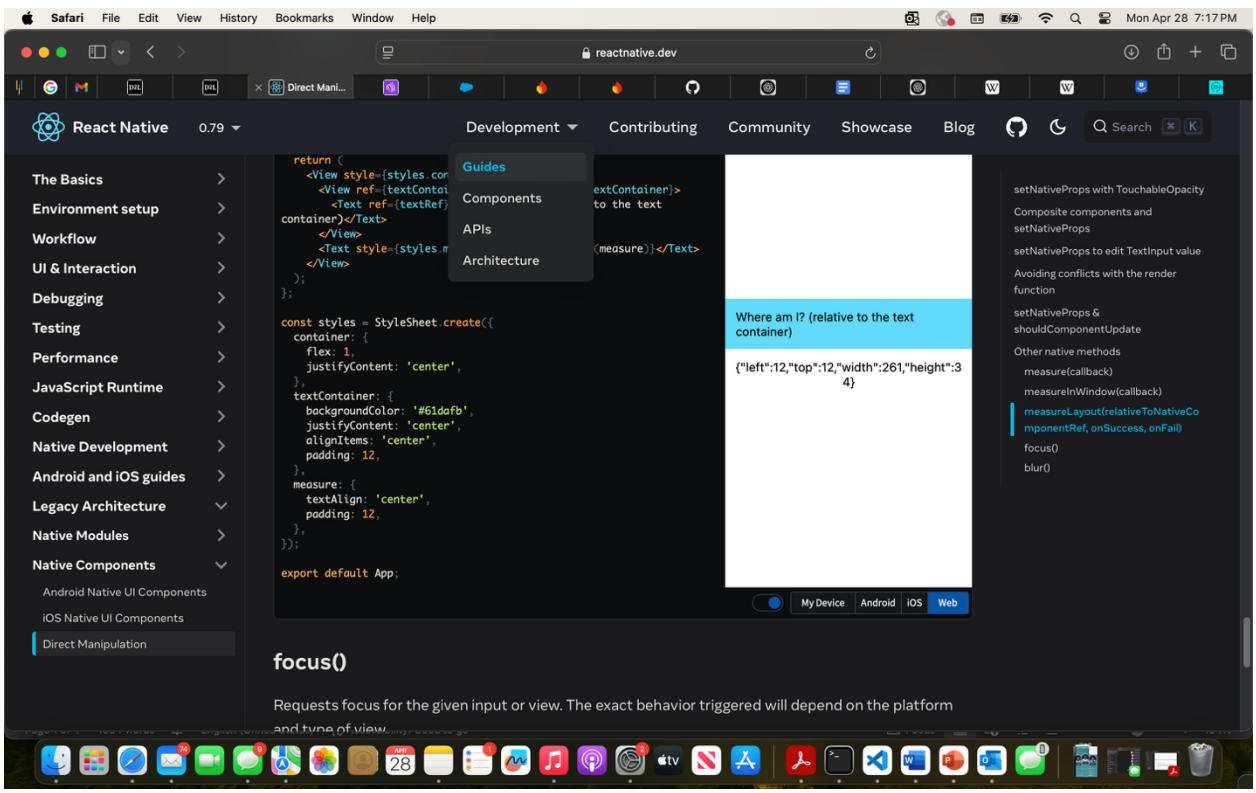
Version Control: GitHub organization account

- **Purpose**: To manage version history and collaboration efficiently.
- **Access Control**: Team members only; public repository for final release.

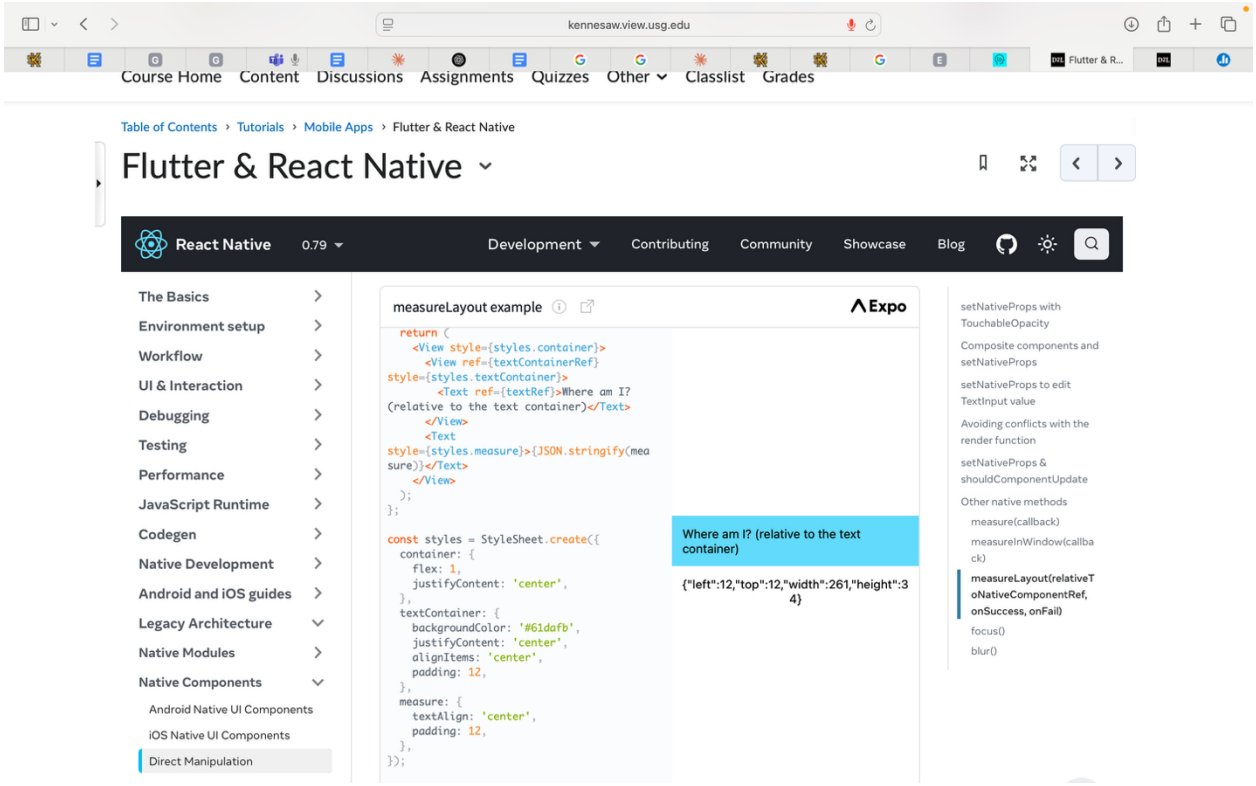
2. Training Verification (if applicable):

We all completed the react native tutorial and below are screen shots of the final module completed by each membe.

- Roan Simo Masso



- Nathanael Fokou



- Lumiere Nathan Kue