MILESTONE ONE: Discovery & Architecture Documentation

University E-Voting System

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Status: Final Draft

Abstract

This document serves as the comprehensive architectural and discovery report for the University E-Voting System. It details the stakeholder analysis, user journeys, system architecture, and risk management strategies for a secure, mobile-first electronic voting platform. The system is designed to ensure transparency, security, and accessibility in university elections through role-based access control, cryptographic verification, and real-time analytics.

Keywords: E-Voting, System Architecture, User Journey, ERD, Risk Management, CI/CD, React Native, Node.js.

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1. Introduction

1.1 Background

University elections are critical for student representation but often suffer from low turnout, logistical challenges, and transparency concerns when conducted manually. The University E-Voting System addresses these issues by providing a secure, accessible digital platform.

1.2 Objectives

- **Security:** Ensure vote integrity and voter anonymity.
- **Accessibility:** Enable voting from any location via mobile devices.
- **Transparency:** Provide real-time results and immutable audit logs.
- **Efficiency:** Streamline nomination and election management processes.

1.3 Scope

The project encompasses a mobile application for voters and candidates, and a web-based administration dashboard. Key features include OTP-based authentication, role-based dashboards, and real-time result visualization.

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2. Stakeholder Mapping

The system identifies three primary stakeholder groups, each with distinct roles and privileges.

Stakeholder	Role Description	Key Responsibilities
Administrators	System Overseers	• Manage election configuration (Positions, Dates) • Oversee user management (Officers, Voters) • Monitor system health and audit logs
Returning Officers	Election Managers	• Verify and approve candidate nominations • Monitor election conduct

		• Address voter issues
Candidates	Election Participants	• Submit nominations and manifestos • Campaign to voters • Monitor election results
Voters	End Users	• Verify identity via OTP • Cast secure, anonymous votes • View election results

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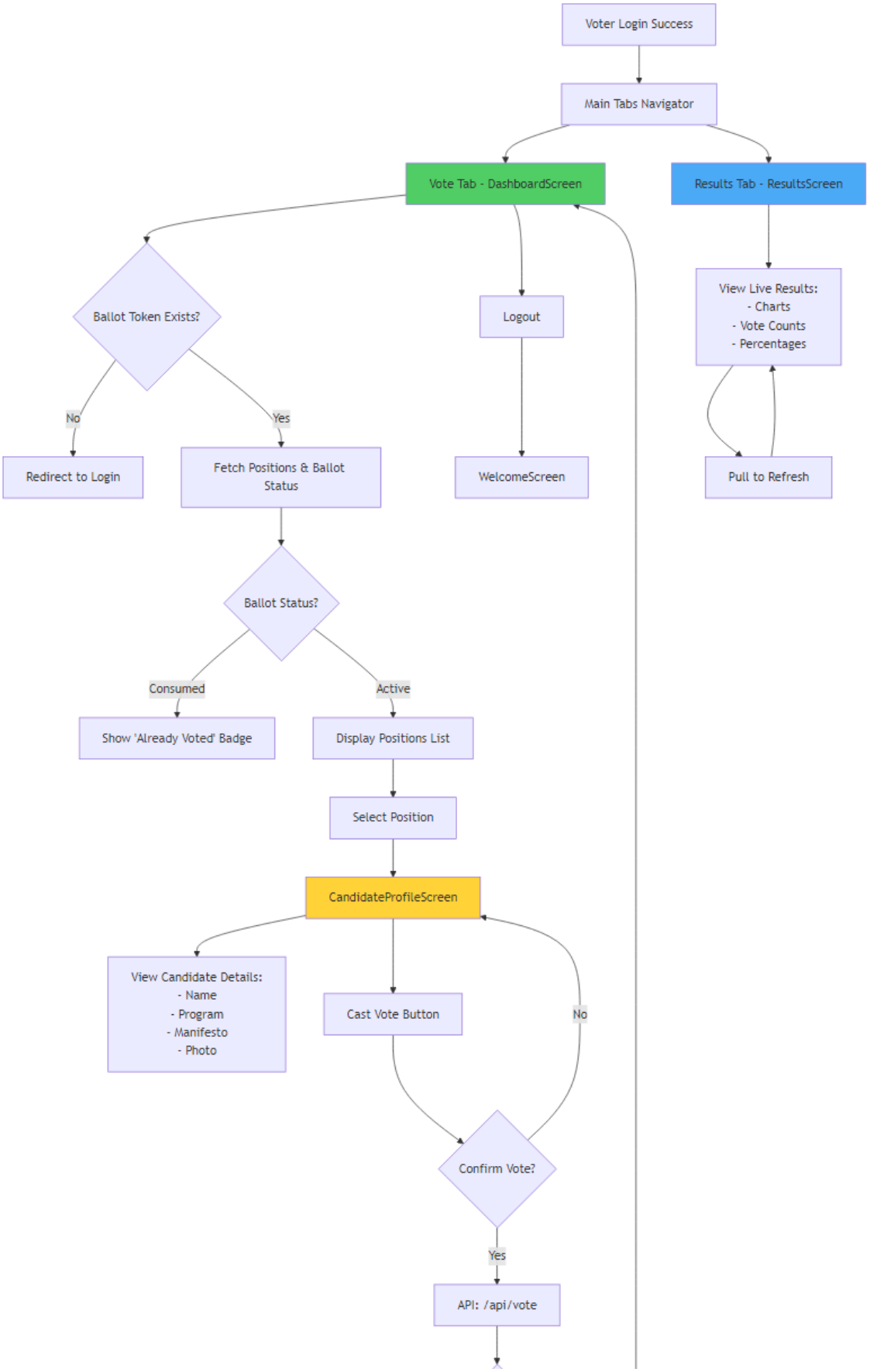
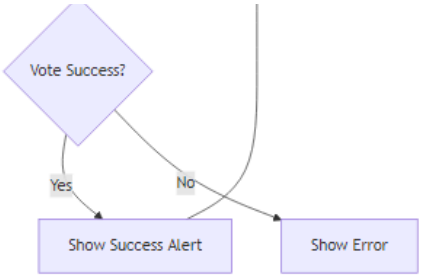
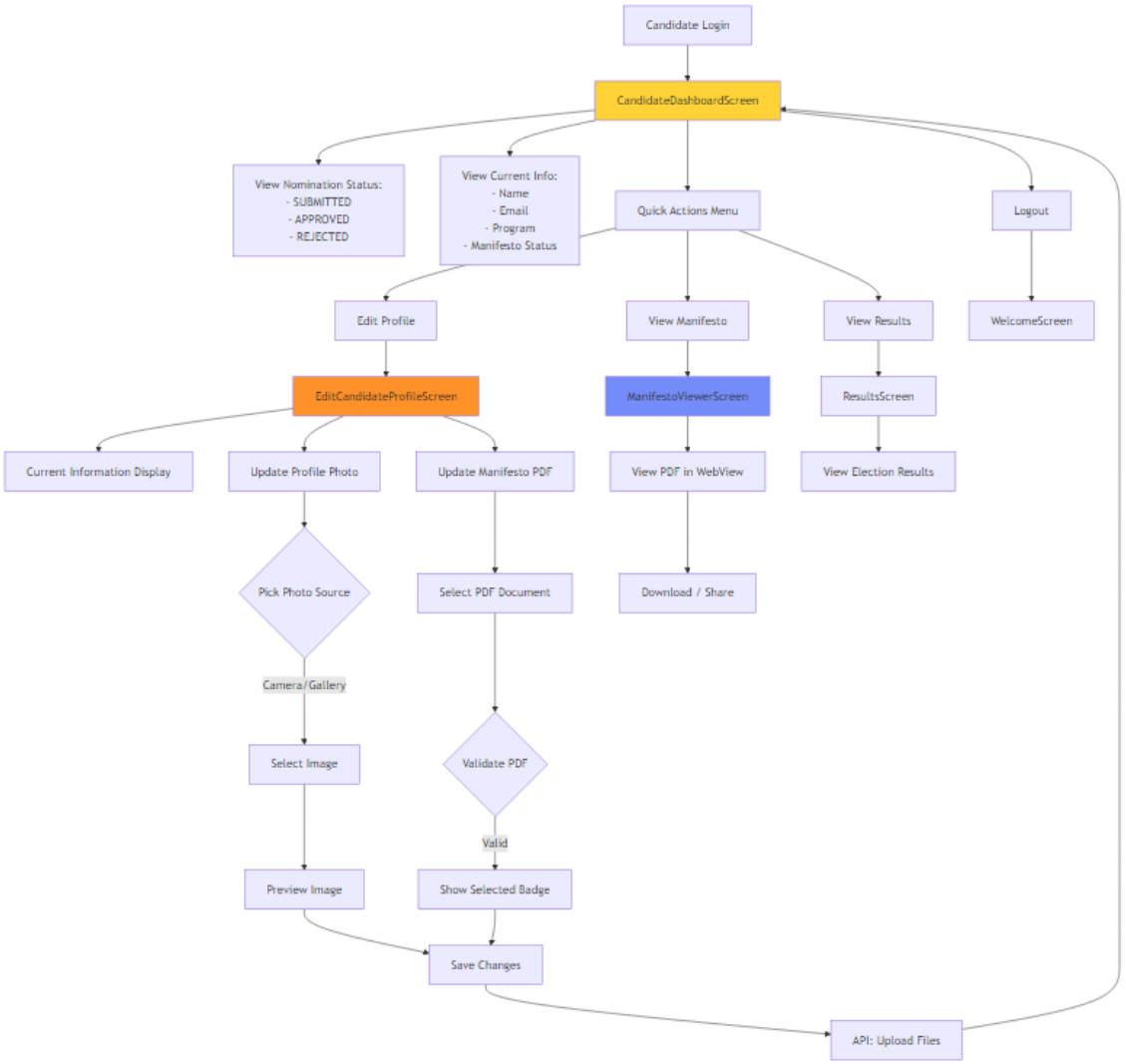
3. User Journeys

3.1 Voter Journey


Voter Login Success
Main Tabs Navigator
Vote Tab - DashboardScreen
Results Tab - ResultsScreen
Ballot Token Exists?
Logout
View Live Results:
- Charts
- Vote Counts
- Percentages
No
Yes
Redirect to Login
Fetch Positions & Ballot Status
WelcomeScreen
Pull to Refresh
Ballot Status?
Consumed
Active
Show 'Already Voted' Badge
Display Positions List
Select Position
CandidateProfileScreen
View Candidate Details:
- Name
- Program
- Manifesto
- Photo
Cast Vote Button
No
Confirm Vote?
Yes
API: /api/vote



3.2 Candidate Journey



3.3 Admin & Officer Journey

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4. Wireframes (Key Flows)

4.1 Voter Authentication Flow

- **Screen 1: Login Input**
  - **UI Elements:** Logo, "Voter Login" title, Registration Number Input field, "Request OTP" button.
  - **Action:** User enters Reg No and taps Request.
- **Screen 2: OTP Verification**
  - **UI Elements:** "Enter Verification Code" title, 6-digit Input field, "Verify & Login" button, "Resend OTP" link.
  - **Action:** User enters code. App validates and transitions to Dashboard.

4.2 Voting Interface Flow

- **Screen 1: Dashboard (Ballot)**
  - **UI Elements:** List of Positions (e.g., President, Secretary). Progress bar (e.g., "0/5 Selected").
  - **Action:** User taps a Position card.
- **Screen 2: Candidate Selection**
  - **UI Elements:** List of Candidates for selected position. Each card shows Photo, Name, Program. "View Profile" button.
  - **Action:** User selects a candidate. Selection is highlighted.

4.3 Candidate Nomination Flow

- **Screen 1: Dashboard**
  - **UI Elements:** "My Nomination" status card. "Edit Profile" button.
  - **Action:** User taps "Edit Profile".
- **Screen 2: Edit Profile**
  - **UI Elements:** Photo upload area, Name input, Manifesto upload (PDF picker), "Save Changes" button.
  - **Action:** User uploads files and saves. Status updates to "Submitted".

4.4 Admin Dashboard Flow

- **Screen 1: Overview**

- **UI Elements:** Stat cards (Total Voters, Votes Cast, Candidates). Quick Actions grid (Add Position, Add Officer).
- **Action:** Admin views high-level metrics.

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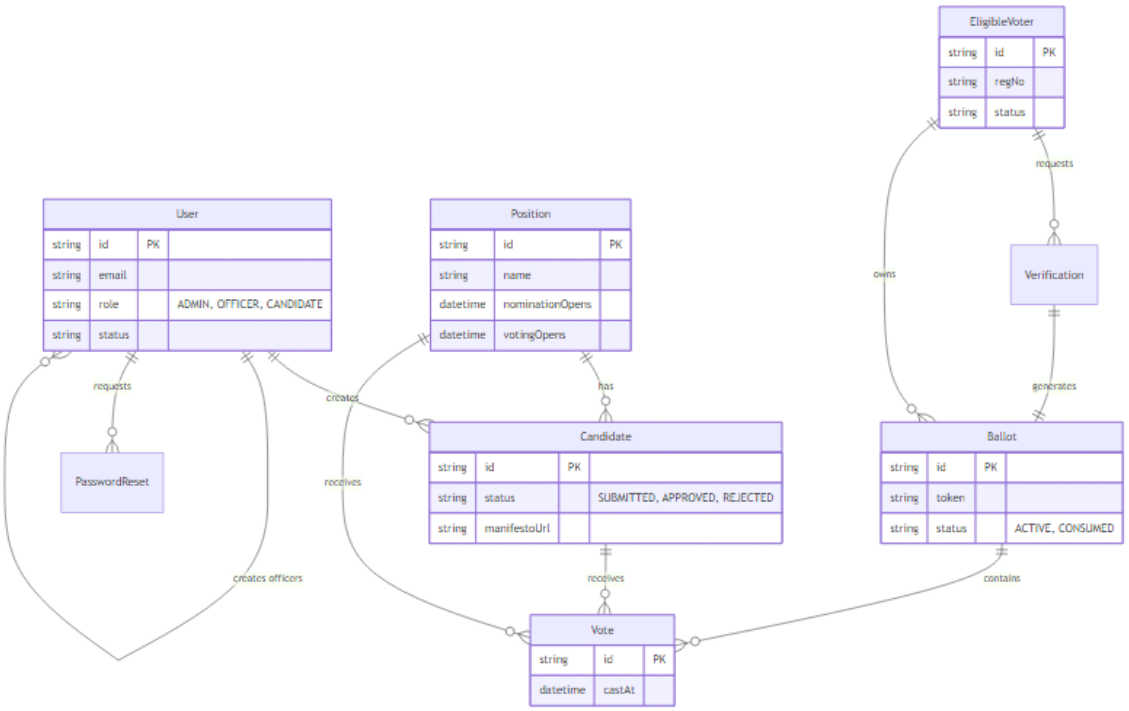
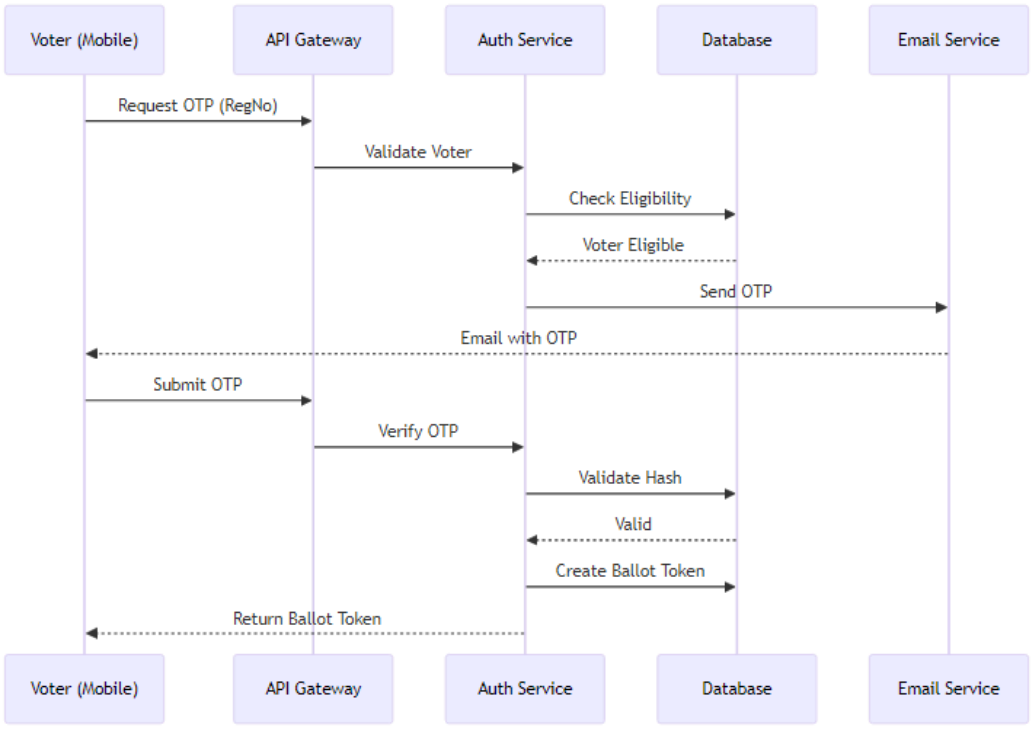
5. System Architecture

5.1 Entity Relationship Diagram (ERD)

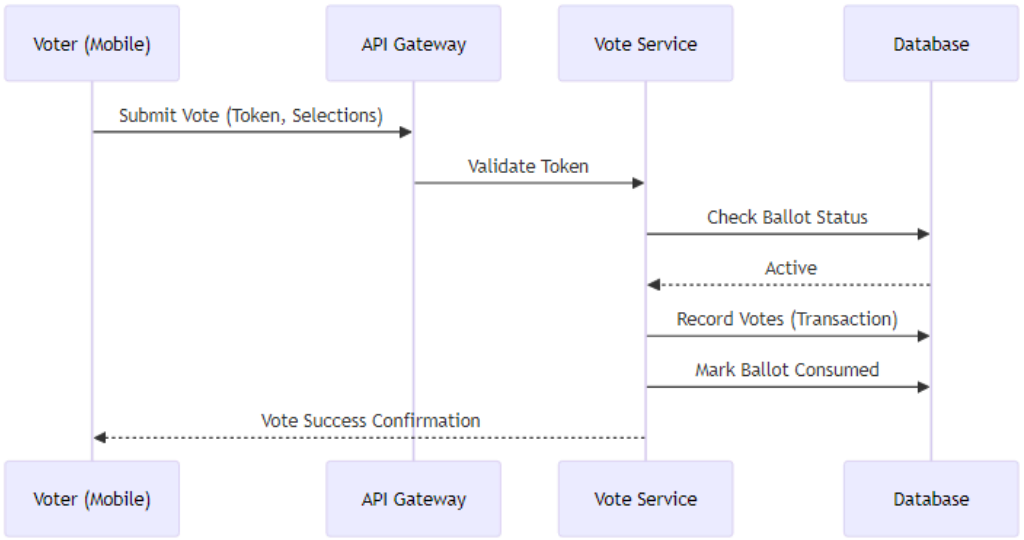


5.2 Sequence Diagrams

5.2.1 Voter Authentication & Ballot Issuance



5.2.2 Vote Casting



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6. Risk Model

Risk Category	Risk Description	Impact	Mitigation Strategy
Security	Unauthorized Access	High	Role-Based Access Control (RBAC), JWT Authentication.

Security	Voter Impersonation	High	Two-Factor Authentication (Reg No + OTP via Email).
Security	Double Voting	High	Single-use Ballot Tokens, Database constraints.
Availability	System Downtime	Medium	Load balancing, Scalable cloud infrastructure.
Data Integrity	Vote Tampering	Critical	Immutable Audit Logs, Transactional database writes.
Usability	Poor Mobile Network	Medium	Offline-first architecture considerations, Optimized API payloads.

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7. CI/Git Setup & Development

7.1 Version Control (Git)

- **Repository Structure:** Two separate repositories:
  - **Backend API:** Evoting-Backend-API
  - **Mobile App:** Evoting_mobile_group3
- **Branching Strategy:** Feature-branch workflow (e.g., `feature/auth-flow`, `fix/vote-bug`) merging into `main`.
- **Commit Convention:** Conventional Commits (e.g., `feat: add voter login`, `fix: resolve otp error`).

7.2 Continuous Integration (CI)

- **Linting:** ESLint and Prettier configured for code quality.
- **Testing:** Jest for unit testing backend logic.
- **Build:** Expo EAS (Exchange Application Services) for mobile build generation.

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8. Technologies Used

8.1 Mobile Client

- **Framework:** React Native (Expo)
- **Language:** JavaScript/TypeScript
- **State Management:** React Hooks, Context API
- **Storage:** AsyncStorage (Local persistence)
- **Networking:** Axios

8.2 Backend Server

- **Runtime:** Node.js
- **Framework:** Express.js
- **Database:** MySQL
- **ORM:** Prisma
- **Authentication:** JSON Web Tokens (JWT), Bcrypt

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9. Future Plans

- **Biometric Authentication:** Integration of FaceID/TouchID for faster voter login.

- **Blockchain Integration:** Storing vote hashes on a public ledger for ultimate transparency.
- **Push Notifications:** Real-time updates for candidates and voters (e.g., "Voting is now open").
- **Multi-Language Support:** Localization for diverse student bodies.

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10. References

1. React Native Documentation: https://reactnative.dev/
2. Prisma ORM Documentation: https://www.prisma.io/docs/
3. Expo Documentation: https://docs.expo.dev/
4. IEEE Standard for Software System Architecture Description (IEEE 1471).