TECHNICAL SPECIFICATION DOCUMENT

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INTRODUCTION

NIBO is a comprehensive location technology platform designed to enhance user experiences through mobile and web applications. It offers cutting-edge digital addressing and navigation services, catering to the evolving needs of users across Africa.

PURPOSE

This document serves as a comprehensive guide to the software technical specifications for the NIBO mobile application on the Android platform. It delves into the intricacies of the architecture, key components, interfaces, and the underlying data model.

INTENDED AUDIENCE

The target audience for this document includes:

- **NIBO Software Engineers and Architects:** To provide in-depth technical insights and guidance during the development process.
- **Leadership and Technology Decision-Makers:** Offering a high-level understanding of the technology stack and its strategic implications.
- **External Partners Integrating with NIBO's Systems:** Providing necessary technical details for seamless integration.

PROJECT SCOPE

The NIBO mobile application encompasses a range of features:

1. **Native Android Application:** Tailored for optimal performance on Android devices.
2. **Integration Layers with Core Back-End Services:** Ensuring smooth communication between the mobile app and the core infrastructure.
3. **Modules:**
    - **Geospatial Tagging:** Captures precise coordinates and detailed address information.
    - **QR Code Scanning:** Enables users to generate and scan location-specific QR codes.

- **User Management:** Handles authentication, user profiles, and preferences.

SYSTEM ARCHITECTURE

The NIBO mobile application is structured with distinct layers:

- **Presentation Layer:** Engaging Android user interface and views for an intuitive user experience.
- **Business Logic Layer:** Robust application logic and services governing the core functionalities.
- **Data Access Layer:** Interfaces seamlessly with NIBO back–end services to retrieve and update information.
- **External Services Layer:** Integrates with external services such as Google Maps, Firebase, AWS, and Twilio for extended functionality.
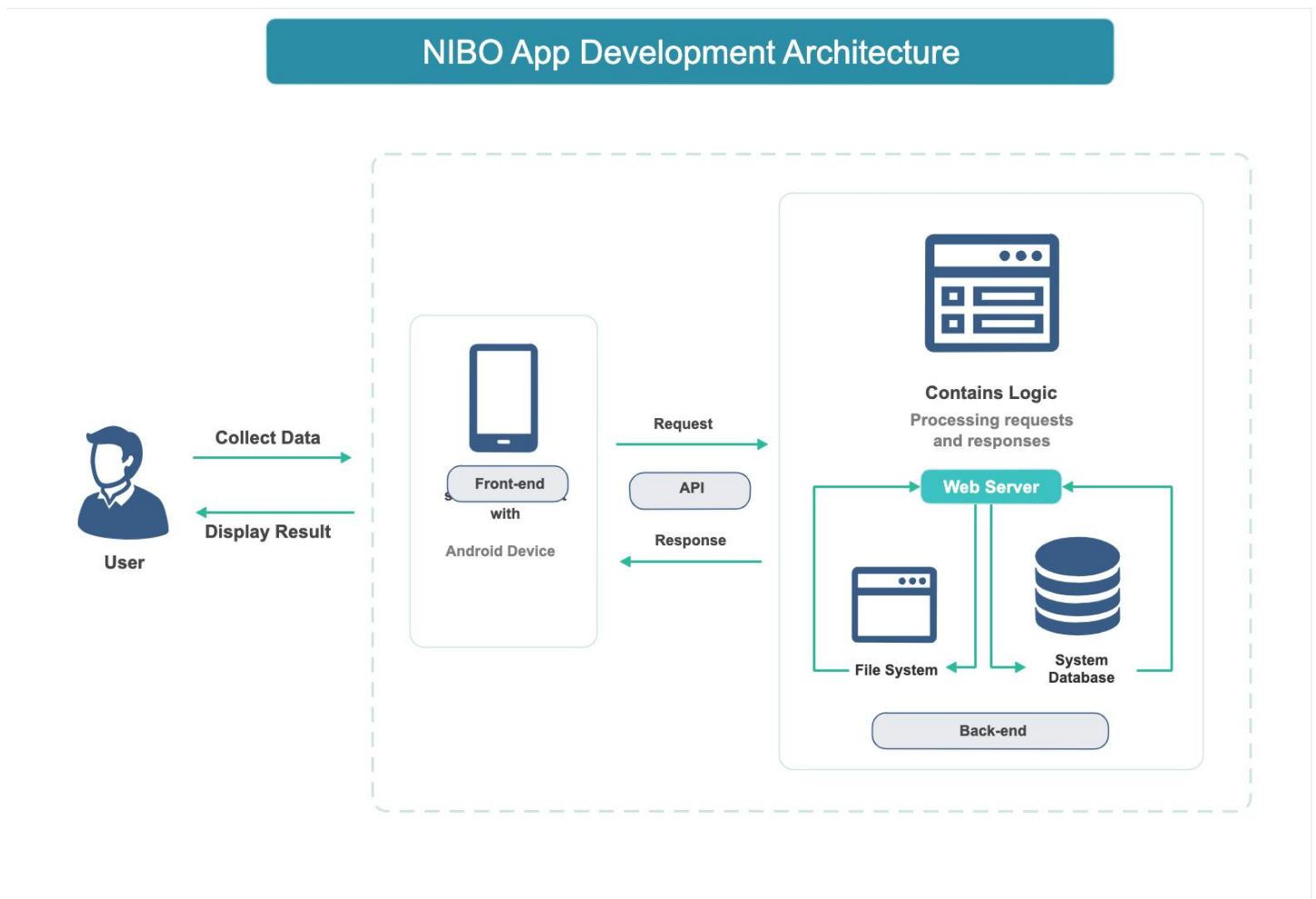

Figure 1: NIBO Development Architecture

PLATFORMS AND TOOLS

Android Studio: The primary tool for Android application development, ensuring efficiency and adherence to industry standards.

Java: The core programming language, chosen for its versatility and compatibility with the Android platform.

Firebase: Powering the mobile app's real-time data layer for seamless user interactions.

Google Maps: Providing essential mapping visualizations and location-based APIs for enhanced navigation.

KEY COMPONENTS

1. **User Management:**
   - Authentication: Ensures secure access to the application.
   - Profiles: Manages user information and preferences.
   - Preferences: Allows users to customize their experience within the app.

2. **Location Tagging:**
   - Coordinate Capture: Captures precise geographical coordinates.
   - Address Details: Provides detailed information about a specific location.

3. **QR Codes:**
   - Generation: Allows users to generate QR codes associated with their location.
   - Scanning: Enables users to scan QR codes for location-specific information.

4. **Navigation:**
   - **Search Functionality:** Empowers users to search for specific locations within the NIBO ecosystem.
   - **Directions:** Provides accurate and efficient navigation to NIBO locations.
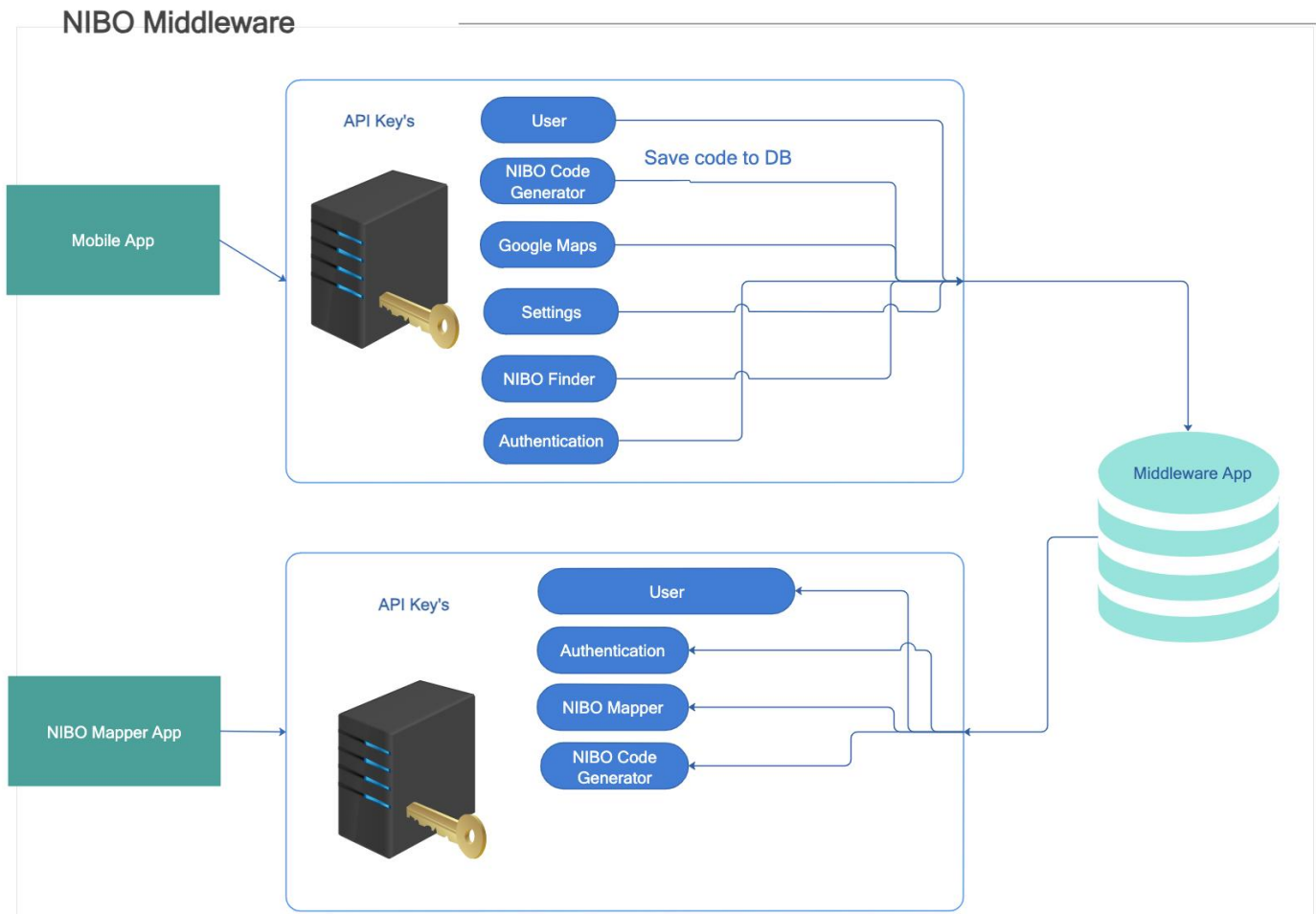
Figure 2: NIBO Middleware Architecture

DATA MODEL

The mobile application utilizes a robust data model:

Firebase Real-Time Database: Stores and synchronizes user data, preferences, and cached locations in real-time.

Postgres Database: Houses all structured data in the backend, ensuring reliability and scalability.

EXTERNAL INTEGRATIONS

The NIBO mobile application seamlessly integrates with external services:

Google Maps: Utilized for interactive maps and geo-coding functionalities.

Firebase: Facilitates the synchronization of user data for a cohesive user experience.

AWS S3: Ensures secure storage of images and files associated with the application.

Twilio: Integrated for communication services, enhancing user engagement within the NIBO platform.

PRODUCT DESCRIPTION

Product Perspective

The NIBO mobile application originates from the need to revolutionize location technology. It is designed to seamlessly integrate with existing platforms and services, providing enhanced functionality and a user-centric experience.

Features

Main Features:

1. **Digital Addressing:** Offers precise digital addresses for locations across Africa.
2. **Navigation Services:** Provides real-time directions and navigation to NIBO locations.
3. **Geo-spatial Tagging:** Captures and manages precise geographical coordinates.
4. **QR Code Functionality:** Enables users to generate and scan QR codes for location-specific information.
5. **User Management:** Implements robust authentication, user profile, and preference management.

User Overview

User Groups:

1. **General Users:** Individuals utilizing NIBO for navigation and location-based services.
2. **Software Engineers and Architects:** Involved in the development and maintenance of the NIBO platform.
3. **Decision-Makers:** Leadership and technology decision-makers influencing the strategic direction of NIBO.
4. **External Partners:** Entities integrating their systems with NIBO.

OPERATING ENVIRONMENT

The NIBO mobile application operates in the following environment:

Hardware Platform: Android devices with varying specifications.

Operating Systems: Android OS versions compatible with the app.

Other Software Components: Integration with Google Maps, Firebase, AWS, and Twilio.

Constraints: Implementation / Design

The development of the NIBO mobile application is subject to the following constraints:

Limited Device Capabilities: Varied capabilities of Android devices may impact certain features.

Data Security Regulations: Compliance with data protection and privacy regulations.

Documentation

Documentation for the NIBO mobile application includes:

Content: Comprehensive technical and user documentation.

Mode of Delivery: Digital documentation accessible online.

Standards: Adherence to industry-standard documentation practices.

Assumptions / Dependencies

Key assumptions and dependencies include:

Internet Connectivity: Assumes users have consistent access to the internet for real-time features.

External Service Availability: Relies on the availability of external services (Google Maps, Firebase, AWS, Twilio).

SYSTEM FEATURES

System Feature 1

Description and Priority: Real-time Navigation

Stimulus / Response Sequences:

- **Stimulus:** User enters a destination.
- **Response:** The app generates real-time navigation directions.

Functional Requirements:

- The app should integrate with Google Maps for accurate navigation.
- User location and destination should be continuously updated.

System Feature 2

Description and Priority: QR Code Scanning

Stimulus / Response Sequences:

- **Stimulus:** User scans a QR code.
- **Response:** The app decodes the QR code and provides relevant location information.

Functional Requirements:

- The app should have a QR code scanning module.
- Decoded QR codes should link to specific locations in the app.

System Feature 3

Description and Priority: User Preferences

Stimulus / Response Sequences:

- **Stimulus:** User updates preferences.
- **Response:** The app customizes the user experience based on preferences.

Functional Requirements:

- The app should provide a user–friendly interface for preference settings.
- User preferences should be stored and applied across sessions.

REQUIREMENTS OF EXTERNAL INTERFACE

1. User Interfaces

The product/user interface characteristics include:

Standards: Adherence to Material Design guidelines.

Style Guides: Consistent use of colors, fonts, and layouts.

Functionality: Intuitive and user–friendly navigation.

2. Hardware Interfaces

The product/hardware interface characteristics include:

Nature of Interactions: Seamless integration with device hardware features (GPS, camera).

Communication Protocols: Standard communication protocols for device connectivity.

3. Software Interfaces

The product/other software interface characteristics include:

Component Names and Versions: Clear identification of components and their versions.

Databases: Interaction with the Postgres database and Firebase real–time database.

Operating Systems: Compatibility with Android OS versions.

4. Communication Interfaces

Requirements for communication functions include:

Email: No direct email communication within the app.

Browsers: Compatibility with major mobile browsers.

Servers: Secure communication with external servers.

Data Transfer Rates: Efficient data transfer for real–time features.

Security Measures: Encryption for sensitive data.

ADDITIONAL NONFUNCTIONAL REQUIREMENTS

Performance

- **Response Time:** Navigation directions should be generated within seconds.
- **Scalability:** The app should handle increasing user loads without performance degradation.

Safety

- **User Safety:** The app should not encourage unsafe behavior during navigation.
- **Data Safety:** Measures to prevent data loss or corruption.

Security

- **Data Encryption:** Sensitive user data should be encrypted during transmission.
- **Authentication:** Robust user authentication mechanisms.

Software Quality

- **Reliability:** The app should function reliably without frequent crashes.
- **Usability:** Intuitive design and user–friendly interactions.
- **Maintainability:** Codebase should be maintainable for future updates.