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MINISTER OF HIGHER EDUCATION

UNIVERSITY OF BUEA

DEPARTMENT OF COMPUTER ENGINEERING

Course Code: CEF440

Course name - Internet Programming And Mobile Programming

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UI Design and Implementation

Task 5

Project 1

Task Report

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GROUP 6

Prepared on:
Sunday 1st June 2025

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1. Introduction

This document outlines the user interface (UI) design and frontend implementation of a Mobile Network Quality of Experience (QoE) Data Collection System (**WaveWatch**), developed to support improved mobile network monitoring and feedback analysis in developing countries, with a particular focus on Cameroon. It details the process of designing and building two interconnected applications: a subscriber-facing mobile app and an administrative dashboard for network operators such as MTN, Orange, and Camtel.

The purpose of this document is to present the full design rationale, visual identity development, and frontend engineering work behind the system. It includes descriptions of the Figma-based design process, user experience considerations, UI components, accessibility features, and cross-platform implementation using Flutter. The document also highlights how the interfaces were tailored to different user roles to ensure clarity, usability, and effective interaction with network quality data.

In addition to technical implementation, this report serves as a comprehensive reference for the completed frontend system—demonstrating its readiness for integration with backend services and further deployment. It aims to provide stakeholders with clear insights into the design decisions, functional scope, and expected impact of the user interface on data collection and network performance monitoring workflows.

2. System Architecture and Design Philosophy

2.1 Overall System Design

The WaveWatch's architecture follows a distributed, microservices-based approach that ensures scalability, reliability, and maintainability. The frontend applications are built using Flutter, Google's UI toolkit that enables cross-platform development with native performance on both iOS and Android platforms. This choice significantly reduces development time and maintenance overhead while ensuring consistent user experience across different devices and operating systems.

The system operates on a three-tier architecture model consisting of the presentation layer (mobile applications), the business logic layer (backend services and APIs), and the data persistence layer (database systems). This separation of concerns enables independent scaling of different system components and facilitates future enhancements without disrupting existing functionality.

2.2 Design Philosophy and User Experience Strategy

The design philosophy behind WaveWatch is rooted in one core objective: making complex network data accessible and meaningful to both everyday users and network administratos. Our approach emphasizes clarity, simplicity, and functionality

To address the distinct needs of both user personas, we adopted a dual-layered design strategy:

For subscribers, the interface is designed to feel intuitive, friendly, and non-intrusive. It focuses on clarity and rewards, using familiar patterns like card-based layouts, large readable text, and color-coded signals to reflect current network conditions. The design avoids overwhelming users with technical jargon, instead guiding them with a visual language that communicates performance in a glance.

For administrators, the UI emphasizes data depth, control, and precision. Dashboards are built with advanced filtering, tabular views, and map visualizations, enabling technical users to drill down into performance issues, feedback trends, and user behaviour metrics. The administrative interface is inspired by professional-grade analytics platforms but styled for accessibility and readability.

Progressive Disclosure and Visual Hierarchy

A key strategy in the UI is **progressive disclosure**—presenting only essential information upfront, while allowing users to dig deeper if needed. For example:

- The subscriber home screen offers a quick overview: current provider, signal strength, and a visual quality indicator.
- From there, users can explore detailed dashboards showing historical performance, location-based comparisons, and feedback logs.

We intentionally **structured information hierarchically**:

- High-level summaries are placed at the top or center of screens.
- Supporting details and actions are revealed through interaction (e.g., tapping cards, expanding sections).

This approach helps reduce cognitive load and empowers users to engage at their own pace.

Visual Language and Colour Psychology

Colours were chosen not just for aesthetic value but to create **emotional clarity**:

- **Green** communicates strong performance and reassurance.
- **Amber (yellow-orange)** alerts users to moderate or fluctuating issues.
- **Red** signals critical problems that need immediate attention.

This visual cue system is consistent across both apps—used in graphs, badges, signal indicators, and feedback responses—to build an intuitive understanding of service quality.

Accessibility and Inclusiveness

We designed with accessibility in mind from the start:

- Font sizes and contrast levels were chosen to support readability across devices and lighting conditions.
- All interactive elements are large enough for touch interaction, and colour choices meet WCAG contrast guidelines.

- Icons are accompanied by labels to ensure clarity for users with cognitive or visual challenges.

Micro-Interactions and Engagement

The use of **micro-interactions**—subtle animations, loading indicators, and gesture-based controls—enhances user engagement without distracting from functionality. These moments of interaction offer feedback and improve the overall user experience. Examples include:

- Animated signal bars that rise and fall in real-time.
- Progress spinners that appear during data uploads or feedback submission.
- Transitions between views that give a smooth, continuous feel.

Consistency Through a Shared Design System

A unified **Figma design system** was created to maintain consistency across screens and platforms. It includes:

- A shared component library (buttons, cards, charts, etc.)
- A cohesive colour palette and typography scale
- Interaction guidelines to align animations and feedback patterns

This design system ensures that both apps feel like part of the same ecosystem while respecting the functional differences in their user flows.

Human-Centred Innovation

Ultimately, the design strategy is about more than visuals—it's about **building trust**. By helping users see and understand their mobile network experience, and by giving administrators tools to respond to real issues, the system bridges the gap between people and infrastructure. The design reflects our belief that **technology should empower, inform, and serve**—not confuse or frustrate.

3. Figma Design Process

3.1 Design Research and Wireframing

The design process commenced with extensive user research and competitor analysis to understand current pain points in network monitoring applications. Through stakeholder interviews with network operators and focus groups with mobile subscribers, we identified key requirements for both user types. This research informed the creation of detailed user personas and journey maps that guided subsequent design decisions.

Initial wireframes were developed using low-fidelity sketches to establish information architecture and navigation flows. These wireframes underwent multiple iterations based on usability testing sessions with representative users from both target segments. The wireframing phase established the foundation for screen layouts, navigation patterns, and content hierarchy that would optimize user task completion rates.

3.2 High-Fidelity Design Development

The transition to high-fidelity designs in Figma involved creating a comprehensive design system that ensures consistency across both applications. The design system includes typography scales, color palettes, component libraries, and interaction patterns that maintain visual coherence while allowing for functional differentiation between subscriber and administrator interfaces.

For the subscriber application, the design emphasizes approachability and clarity through the use of card-based layouts, intuitive iconography, and progress indicators that communicate system status effectively. The color scheme utilizes calming blues and greens to create a trustworthy atmosphere while maintaining sufficient contrast for accessibility compliance.

The administrator application adopts a more sophisticated visual approach with data-dense layouts, comprehensive filtering options, and advanced visualization components. The interface incorporates dashboard design best practices, including strategic use of whitespace, logical grouping of related information, and progressive disclosure of complex data sets.

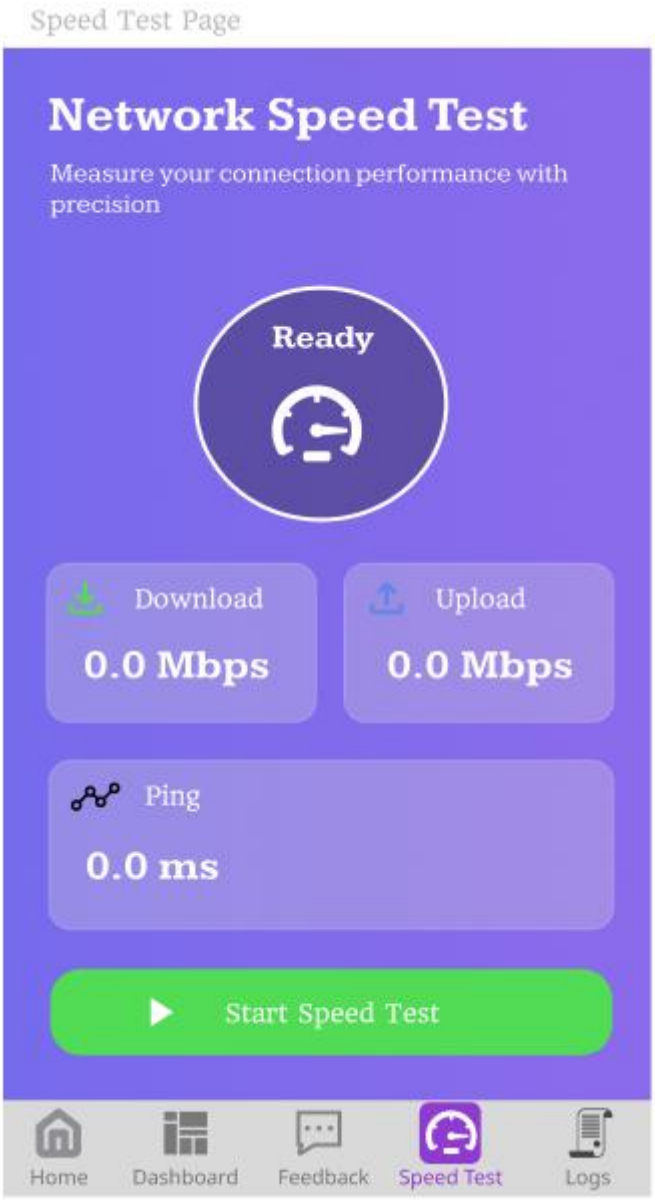
3.3 Component Design and Interaction Patterns

Custom components were designed to address specific use cases within the network monitoring domain. These include real-time metric displays with animated transitions, feedback collection forms with smart validation, and interactive charts that support multiple data views and time ranges. Each component was designed with accessibility considerations, ensuring compatibility with screen readers and support for users with various abilities.

Interaction patterns were carefully crafted to minimize cognitive load while maximizing functionality. Micro-interactions provide immediate feedback for user actions, while loading states and progress indicators maintain user engagement during data processing operations. The design system incorporates gesture-based navigation where appropriate, leveraging platform-specific interaction paradigms to create familiar user experiences.

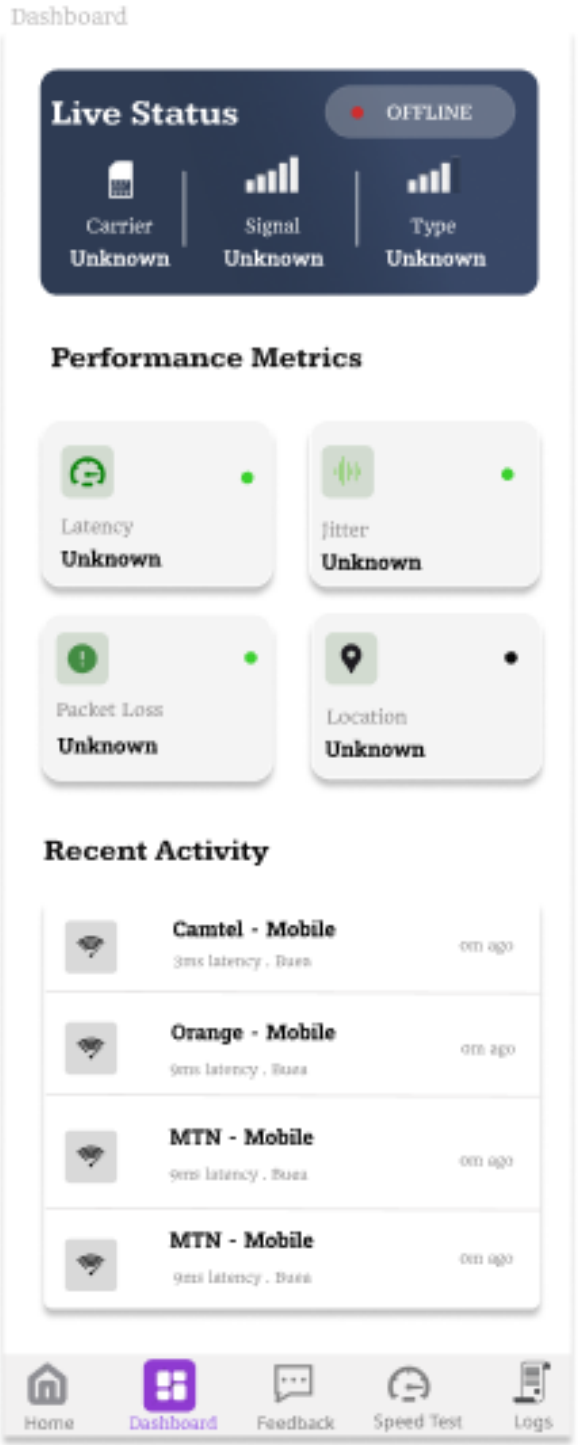
3.4 Speed Test Page

The Speed Test page allows subscribers to instantly measure the quality of their internet connection. With a simple one-tap interface, users can initiate a test that measures download and upload speeds, ping, and jitter. The visual design uses bold colors and large icons for clarity and accessibility, ensuring a quick and engaging experience for users who want to assess their real-time connection performance.



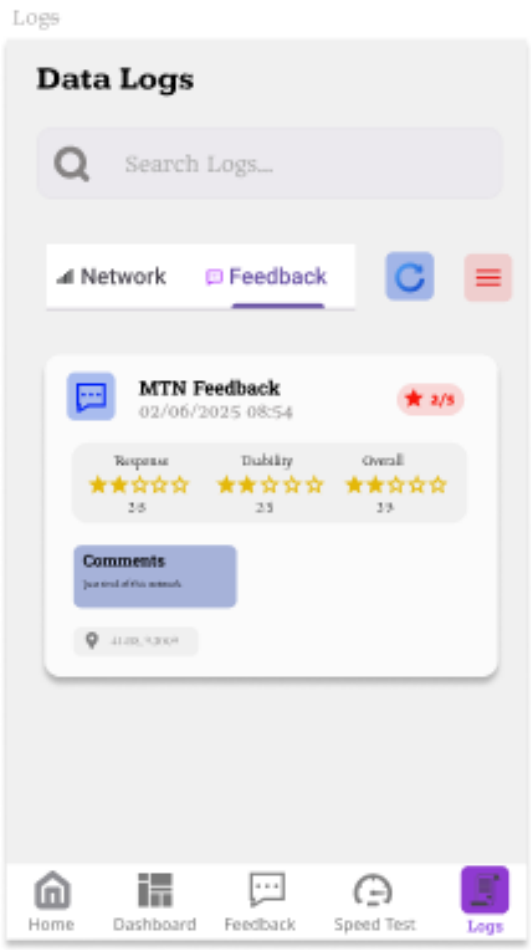
3.5 Subscriber Dashboard

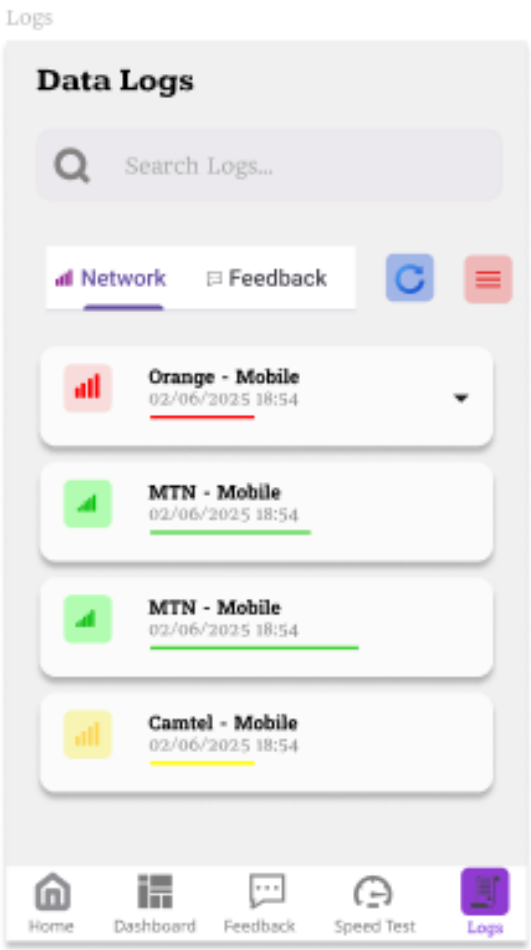
The Dashboard provides subscribers with a real-time snapshot of their network status. It displays live performance metrics such as latency, packet loss, and signal strength. A "Recent Activity" panel logs past network conditions for reference. The design combines functionality with clean, card-based UI elements, making technical data easy to digest even for non-technical users.



3.6 Data Logs (Subscriber View)

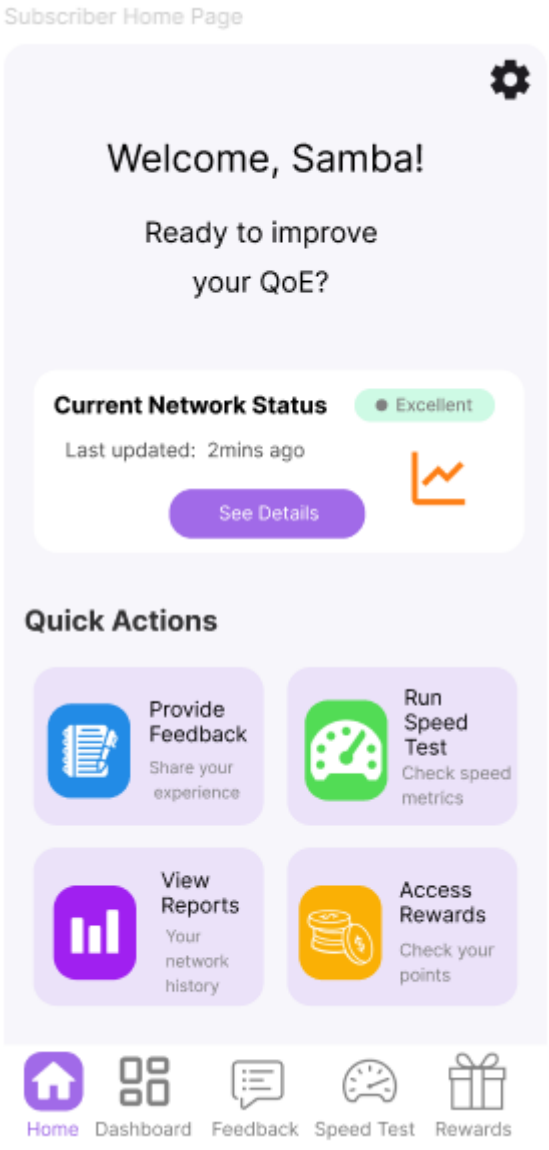
The Data Logs screen organizes user-submitted feedback and automatically collected network data. Users can switch between “Network” and “Feedback” views to explore logs from different providers and experiences. Each log includes timestamps, ratings, and comments. The clean interface supports quick search and data filtering, enabling users to understand historical patterns in their network experience.





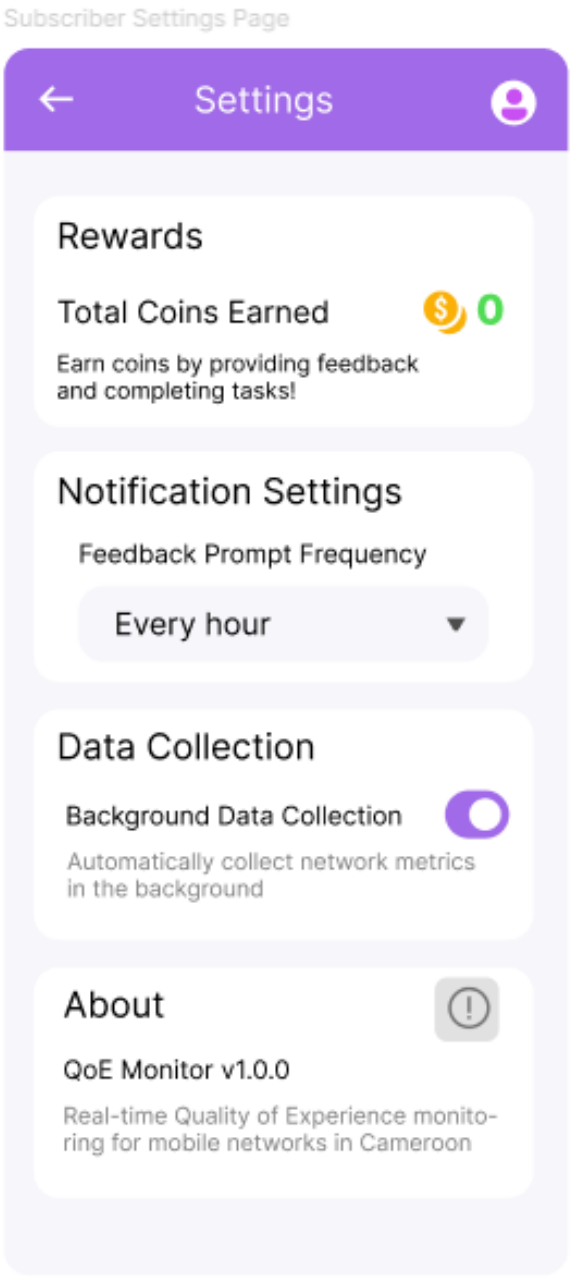
3.7 Subscriber Home Page

This is the primary landing page for users, showing a friendly welcome message, current network status, and quick access to core features like feedback, speed test, reports, and rewards. Visual indicators help users immediately identify their network quality. The layout uses friendly language and icons to promote engagement and encourage users to participate in the QoE monitoring process.



3.8 Subscriber Settings Page

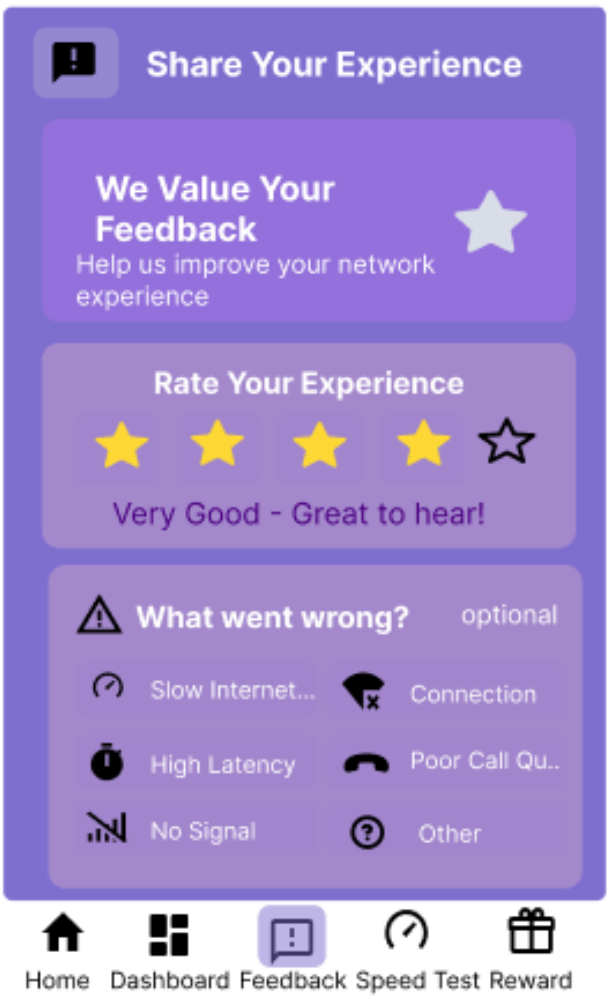
The Settings interface allows users to control background data collection, manage notification preferences, and track their earned rewards. It offers a simple and empowering way for users to customize how the app collects data while ensuring transparency and respecting user privacy. A toggle interface provides effortless control over key functions.

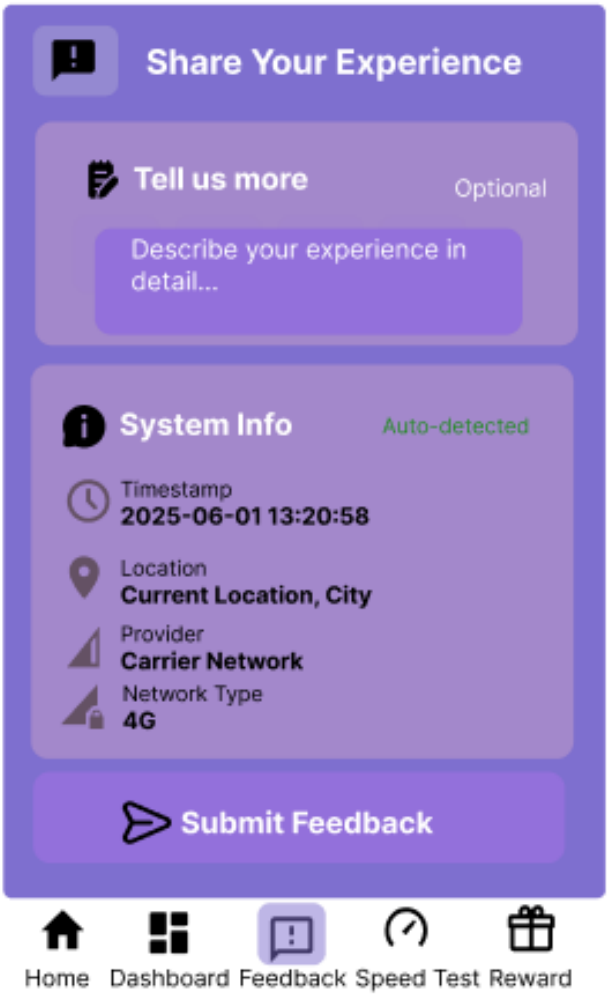


3.9 Feedback

The first part of the Feedback interface lets users quickly rate their experience using a star system and categorize common issues like high latency or poor call quality. It strikes a balance between simplicity and depth, encouraging user participation while capturing essential data.

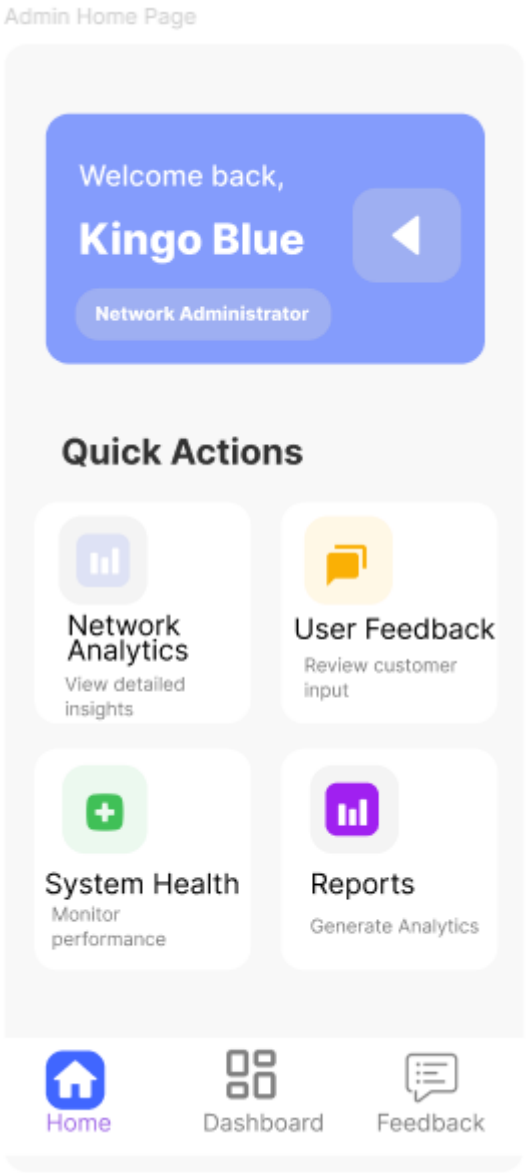
The second feedback screen allows users to describe their experience in detail and displays auto-detected system information like timestamp, location, carrier, and network type. This comprehensive context enriches the feedback, enabling administrators to connect user perception with actual network performance at specific times and places.





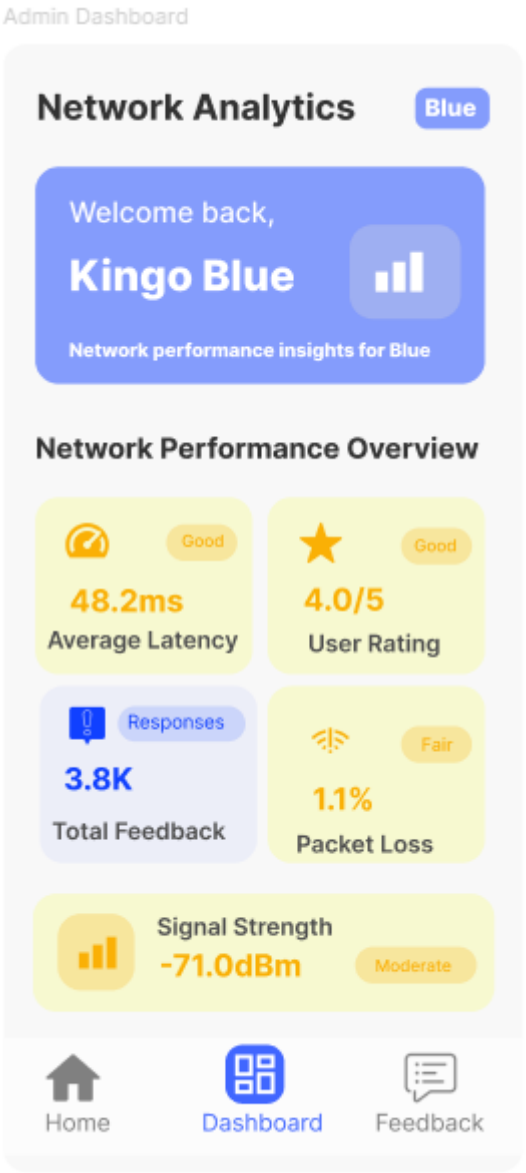
3.10 Admin Home Page

The admin home screen acts as a control center for network operators. It provides quick access to analytics, feedback review, system health monitoring, and report generation. The design focuses on high information density with a clean visual hierarchy, allowing administrators to stay informed and take action quickly.



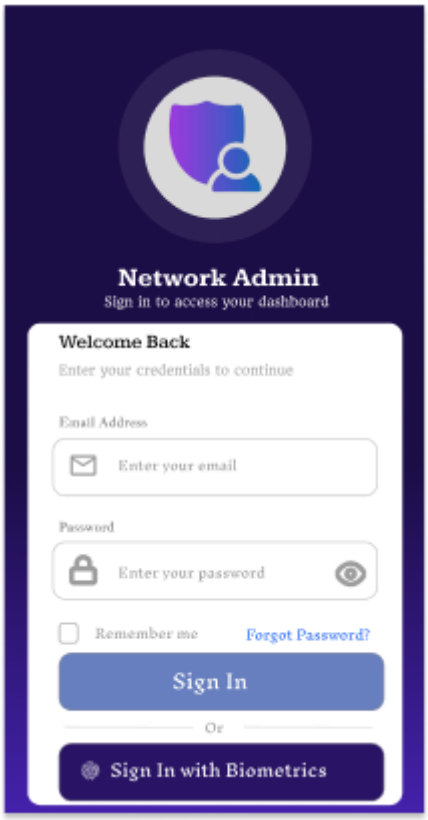
3.11 Admin Dashboard

The dashboard is tailored for administrators to analyze key performance indicators. Metrics like average latency, user ratings, feedback volume, packet loss, and signal strength are presented with intuitive color-coded indicators. This interface enables telecom providers to gain deep insights into their network performance and user satisfaction levels at a glance.



3.12 Admin Login Page

The admin login screen offers a secure entry point for network administrators. It supports both password-based and biometric login methods. The design reinforces trust with a professional aesthetic, featuring a shield logo and minimalistic layout, ensuring that admins can easily and securely access the system.



4. Implementation: Subscriber Application

4.1 Application Architecture and State Management

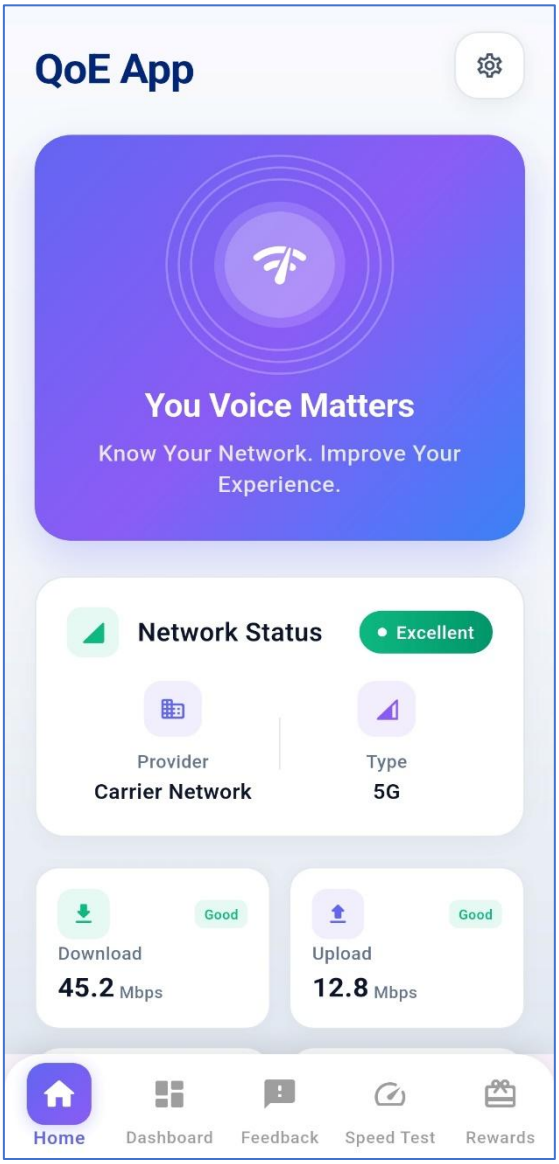
The subscriber application implements a clean architecture pattern that separates business logic from presentation and data layers. This architectural approach ensures testability, maintainability, and flexibility for future enhancements. The application utilizes the Provider pattern for state management, enabling efficient data flow between components while maintaining application performance.

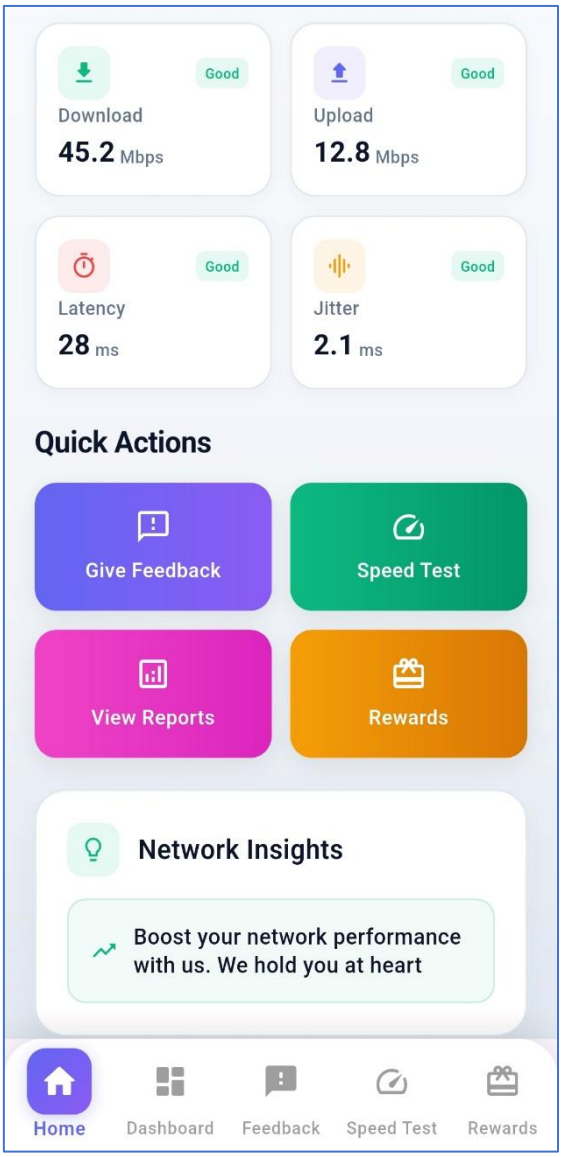
State management handles multiple concurrent data streams including real-time network metrics, user feedback, background data collection, and reward system updates. The implementation ensures that state updates are atomic and consistent, preventing data corruption during concurrent operations. Local state persistence enables the application to maintain functionality during network connectivity issues, with automatic synchronization when connectivity is restored.

4.2 Home Screen Implementation

The home screen serves as the central hub for user interactions and presents critical information immediately. The implementation utilizes a flexible grid layout that adapts to different screen sizes and orientations while maintaining visual hierarchy. Real-time network indicators are updated through efficient polling mechanisms that balance data freshness with battery conservation.

The quick summary card displays current network provider information, signal strength indicators, and overall quality assessments derived from continuous background monitoring. The interface includes smooth animations that provide visual feedback for data updates without causing distraction or performance degradation. Navigation elements are strategically positioned to support both single-handed and two-handed device usage patterns.



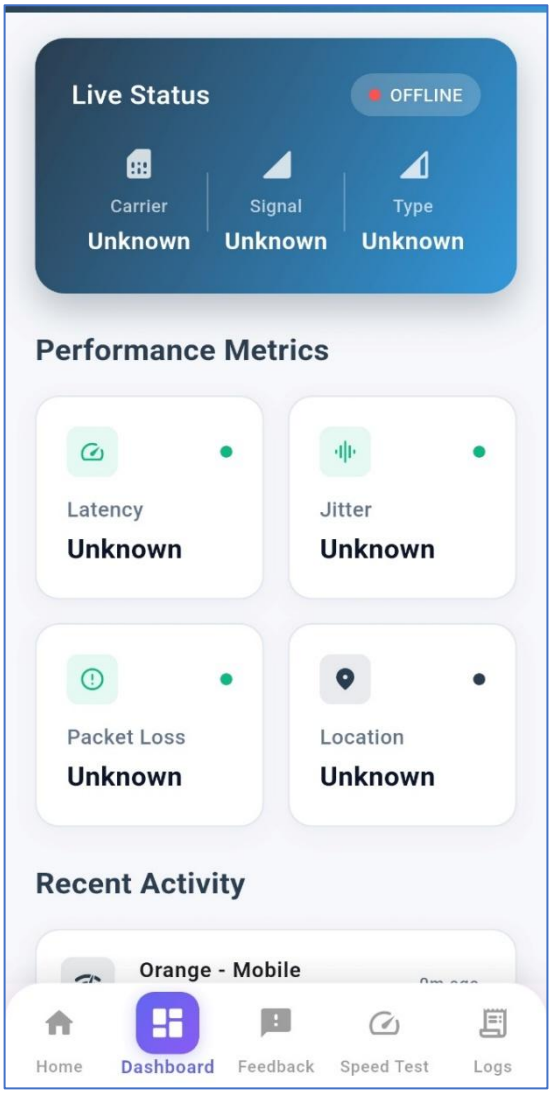


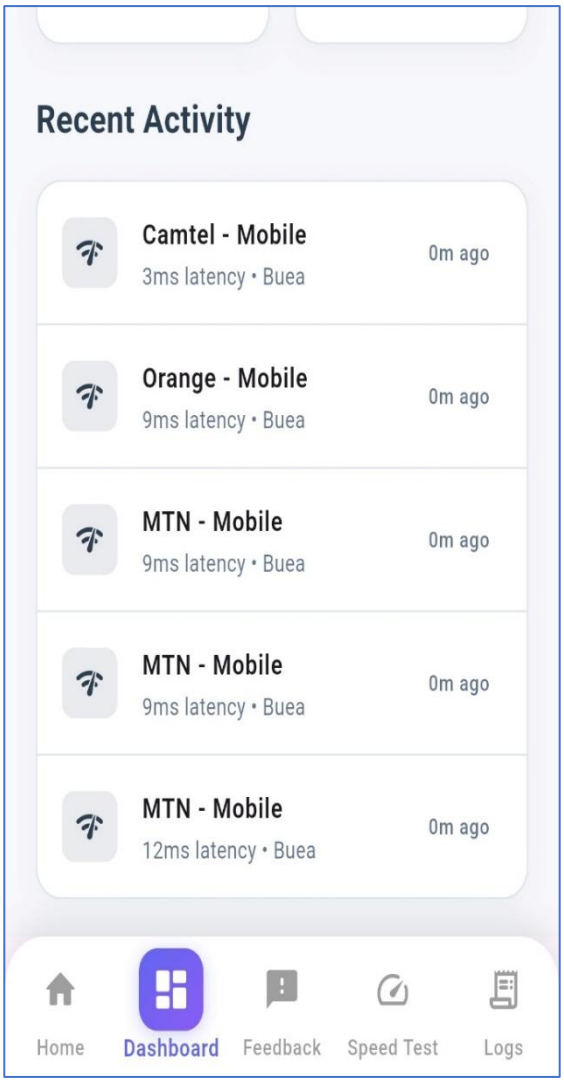
4.3 Dashboard Screen Development

The dashboard screen presents comprehensive network metrics through interactive visualizations that enable users to understand their network experience over time. The implementation includes customizable time range selectors, metric filtering options, and trend analysis capabilities that help users identify patterns in their network performance.

Chart components utilize efficient rendering techniques to display large datasets without compromising application responsiveness. The dashboard supports both real-time and historical data views, with smooth transitions between different visualization modes. Interactive elements allow users to explore specific data points and understand the context behind network performance variations.

Data aggregation algorithms process raw network metrics to generate meaningful insights such as average performance during different times of day, location-based quality variations, and provider comparison metrics. These insights are presented through intuitive visual elements that require minimal technical knowledge to interpret.





4.4 Background Data Collection and Network Monitoring

The background monitoring system operates independently of user interface interactions, collecting network performance data at predetermined intervals without impacting device performance or battery life. The implementation utilizes Android's JobScheduler and iOS's Background App Refresh capabilities to ensure consistent data collection across different operating system versions and device configurations.

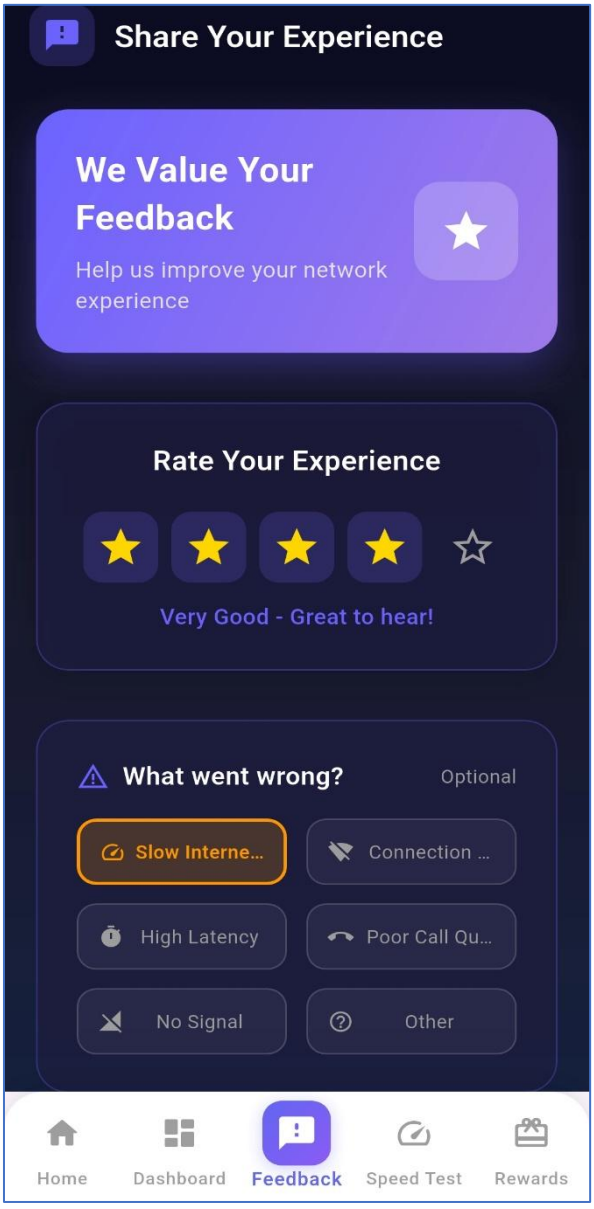
Network metric collection includes comprehensive measurements of signal strength (RSSI, RSRP), network type identification, latency measurements through targeted ping operations, jitter calculations, packet loss detection, and bandwidth estimation through controlled data transfers. GPS location data is collected with user consent and privacy considerations, enabling location-specific performance analysis.

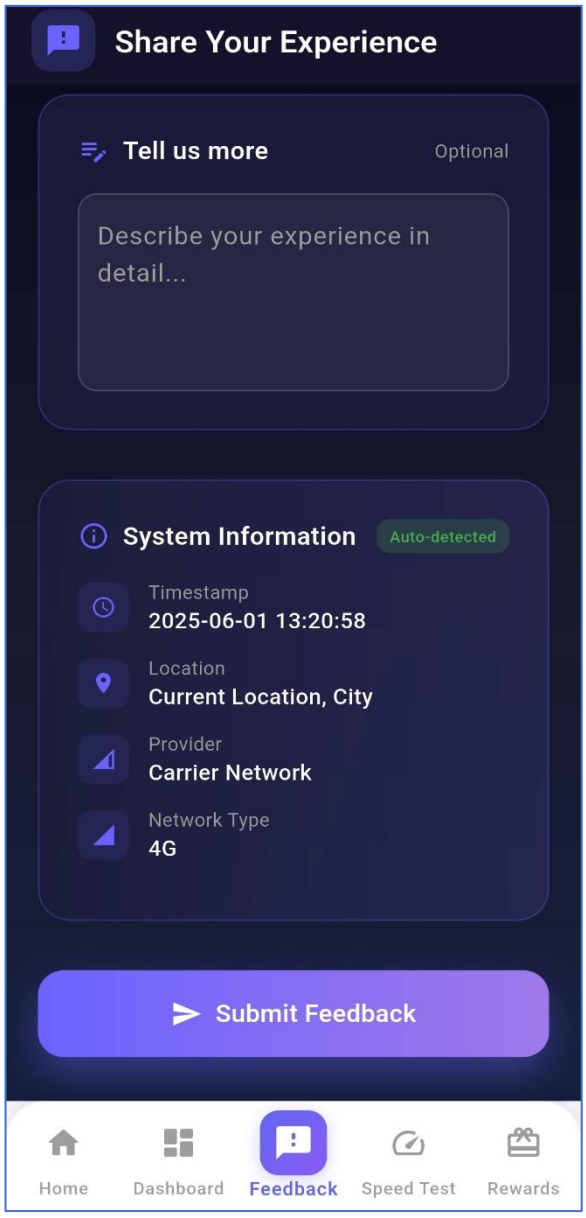
4.5 Feedback Collection and User Interface

The feedback collection system implements both proactive and reactive feedback mechanisms designed to maximize data quality while minimizing user interruption. Smart prompts appear only when network conditions suggest degraded user experience, utilizing contextual information to present relevant feedback options.

The feedback interface supports multiple input methods including structured ratings, categorical issue selection, and free-form text descriptions. Natural language processing capabilities categorize textual feedback automatically, enabling systematic analysis of user concerns and issues

Feedback submission includes comprehensive metadata such as precise timestamps, GPS coordinates, current network metrics, device information, and environmental context. This metadata enables correlation analysis between user perceptions and objective network measurements, providing valuable insights for network optimization efforts.

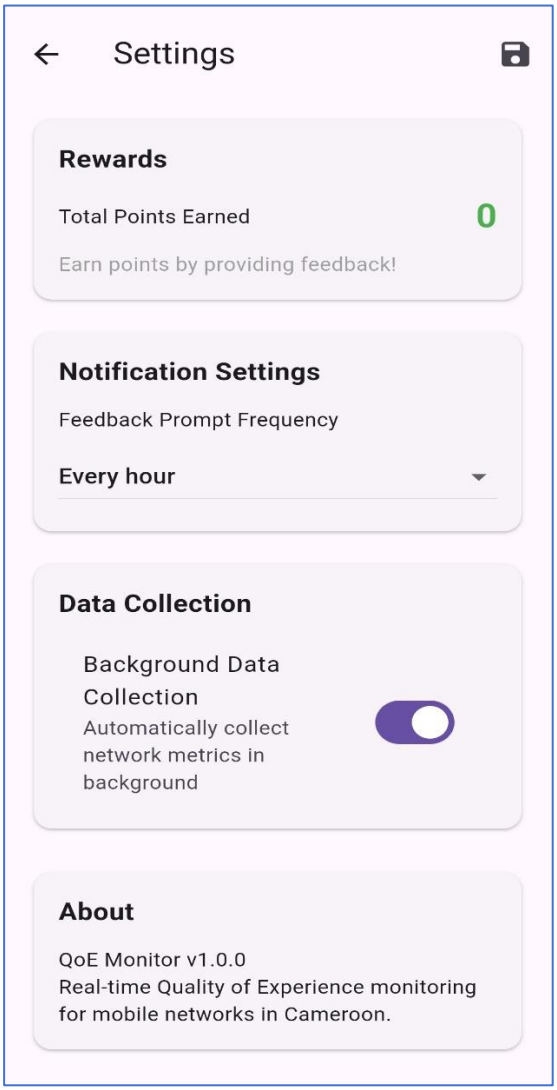




4.6 Settings and Privacy Management

The settings interface provides comprehensive control over data collection preferences, notification settings, and privacy options. Users can customize collection frequency, specify preferred data upload methods, and manage location sharing permissions through intuitive toggle controls and slider interfaces.

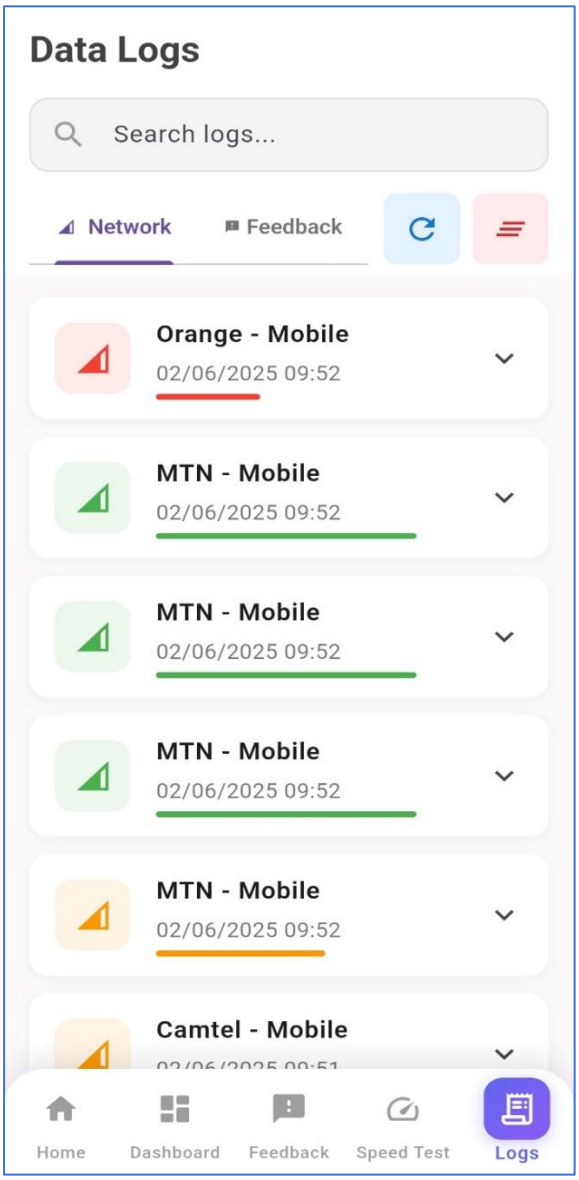
Privacy management features include detailed explanations of data usage, transparent disclosure of information sharing practices, and granular control over data retention periods. The implementation includes secure data handling procedures that comply with international privacy regulations while enabling valuable analytics capabilities.

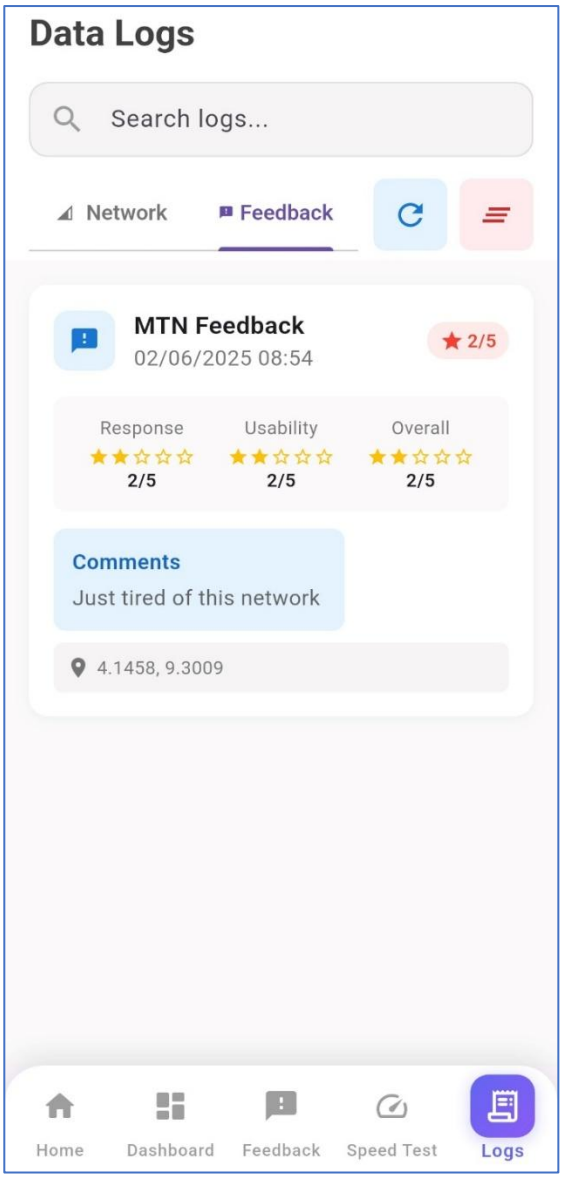


4.7 View Logs and Feedback Screen

This screen displays crowed sourced data to the user on all the detected providers around and their states which serves as a recommendation for the user to know the best available network provider at that time where they find themselves. It as well has another panel to display the Feedback they have provided. And this feedback is timestamped and has the location as well. The user has the ability to clear the logs if not necessary to them.

The feedback carries the Response, Usability and overall performance and a comment (description). The application automatically detects the provider at that time and then logs it together.





5. Implementation: Administrator Application

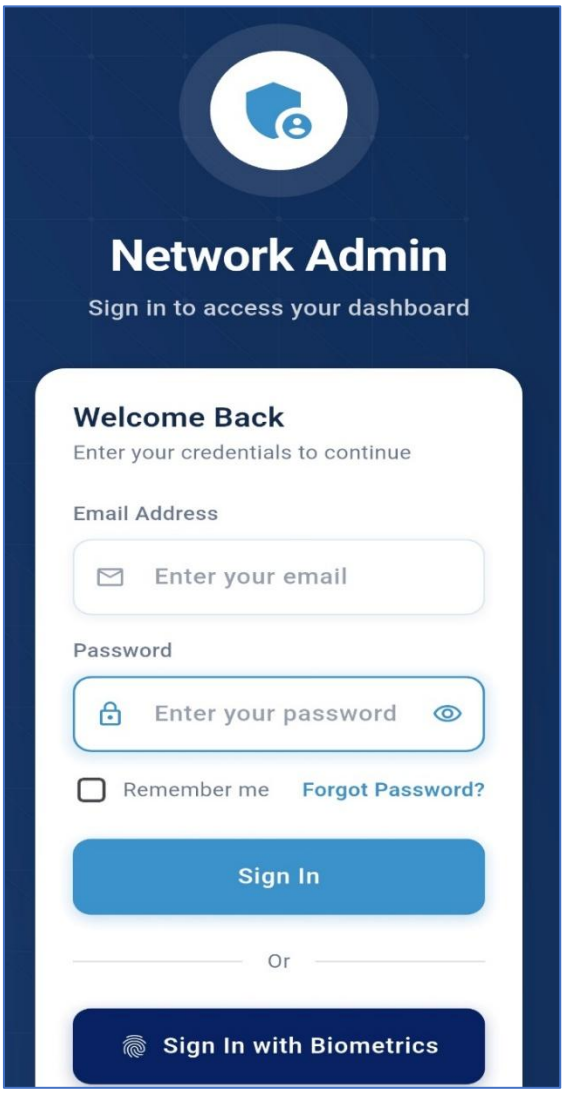
5.1 Authentication and Security Architecture

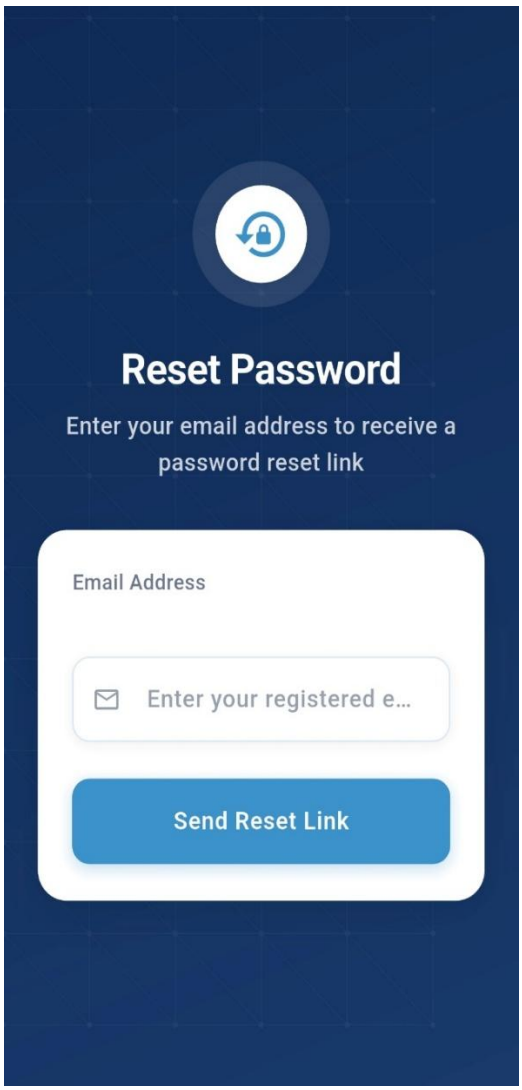
The administrator application implements authentication. Authentication credentials are provided by us the administrators of the application. That is we create them in the database and we assign rules. We can have them as providers (MTN, Orange and blue). We use this provider field to do queries in order to know what to display to each of the providers. Such that MTN provider admin will be only able to view feedback and network trend on data which has MTN as carrier and so is the case for the others.

5.2 Login Screen and Password Management

The login interface implements modern authentication user experience patterns including biometric authentication support, secure credential storage, and intelligent form validation. The implementation includes robust error handling that provides clear feedback for authentication failures without revealing sensitive system information that could be exploited by malicious actors.

Password recovery mechanisms utilize secure email-based verification processes with time-limited recovery links and mandatory password strength requirements. The system includes account lockout protection that prevents brute force attacks while maintaining usability for legitimate users who experience temporary authentication difficulties.

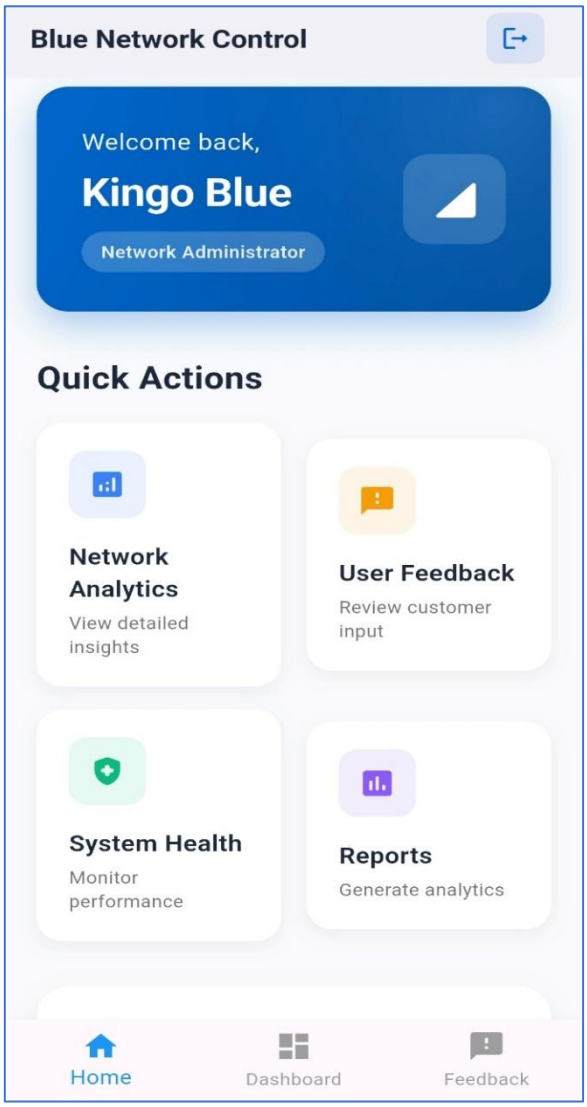


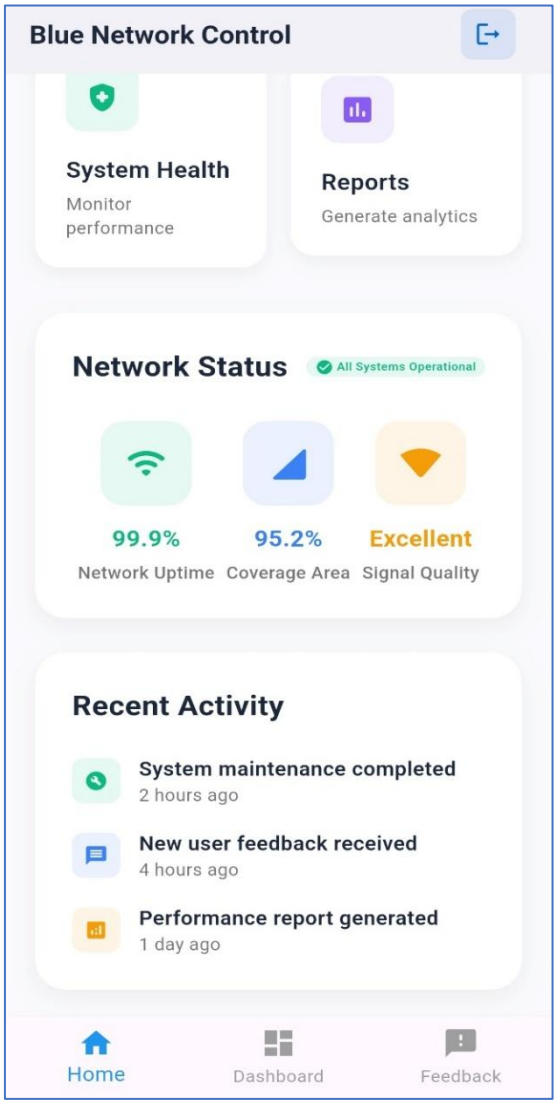


5.3 Administrative Dashboard Development

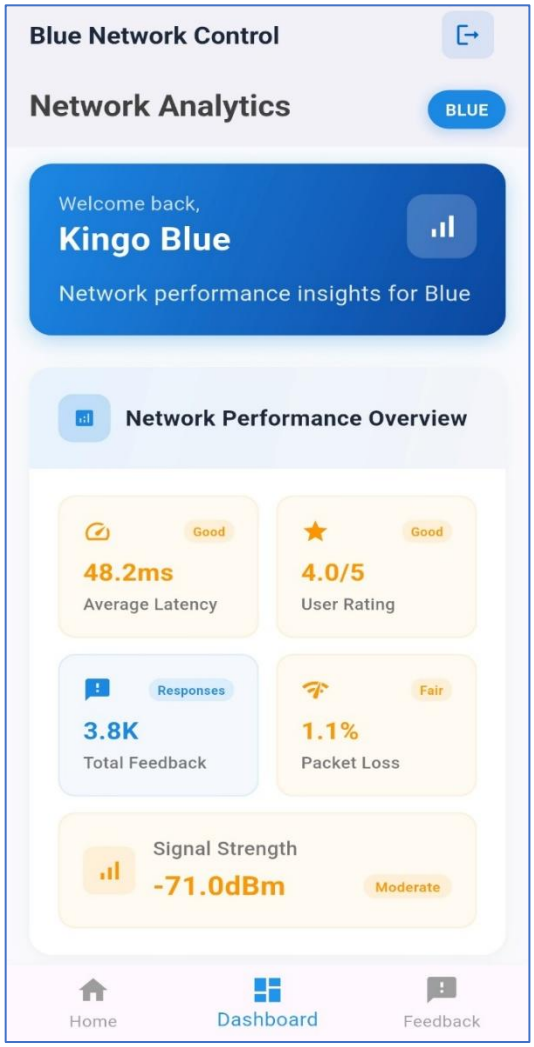
The administrative dashboard presents comprehensive network performance analytics through sophisticated data visualization components that support multiple analysis perspectives. The implementation includes real-time data streaming capabilities that provide immediate visibility into network conditions across different geographical regions and time periods.

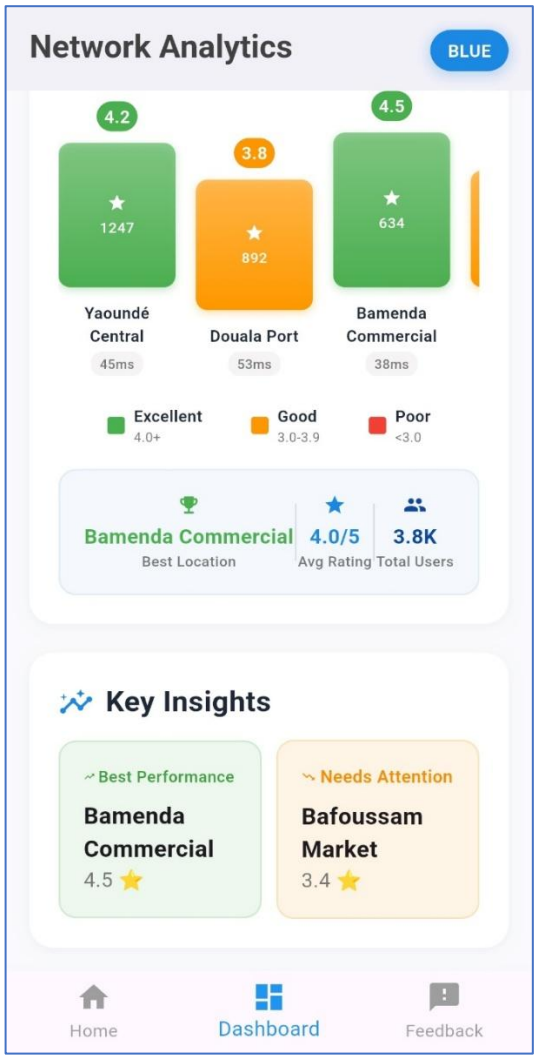
Dashboard components support interactive exploration of performance trends, comparative analysis between different network providers, and drill-down capabilities that enable detailed investigation of specific performance issues. The interface includes customizable widget arrangements that allow administrators to configure displays according to their specific monitoring requirements and preferences.





Geographic visualization capabilities present network performance data through interactive maps that highlight regional variations in service quality. These visualizations support overlay of demographic data, infrastructure information, and competitor performance metrics to provide comprehensive market intelligence for strategic decision-making processes.





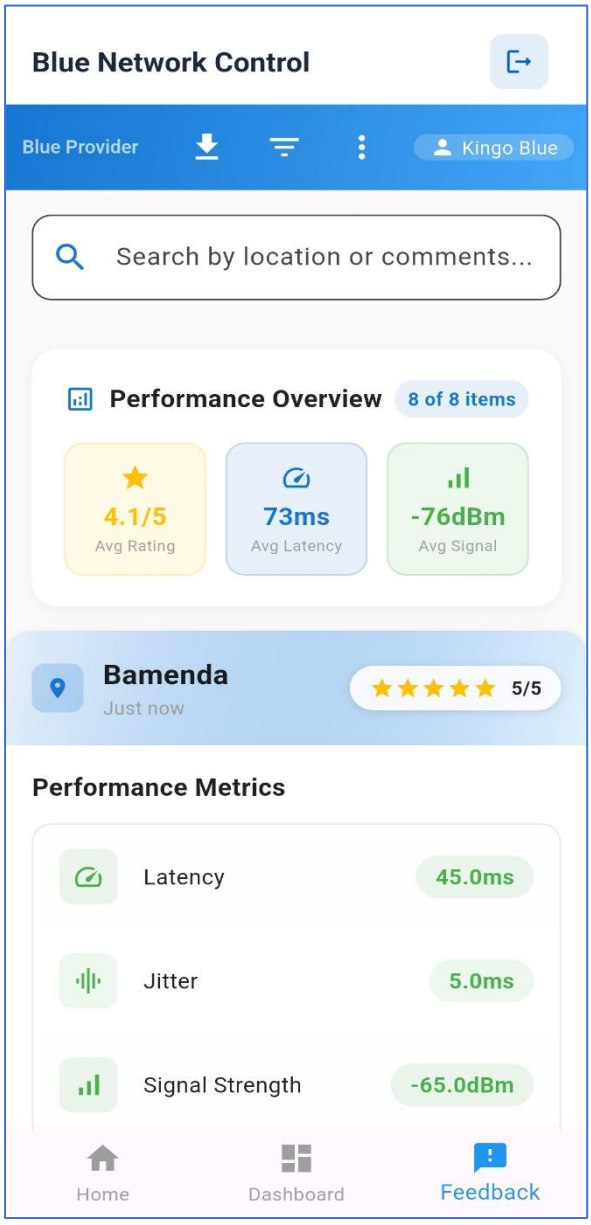
Depending on the admin, the dashoard is customized to carry data or display data based on the provider. Hence, once provider admin is blue, he or she will oly visualize data that that comes from blue users and so is the case with other provider admins such as MTN and Orange. Here, they can see the number of users as provided by our system and also, visualize trends across different towns and cities in Cameroon. However, most of the data here is dummy and will be updated once the backend and database is reasy.

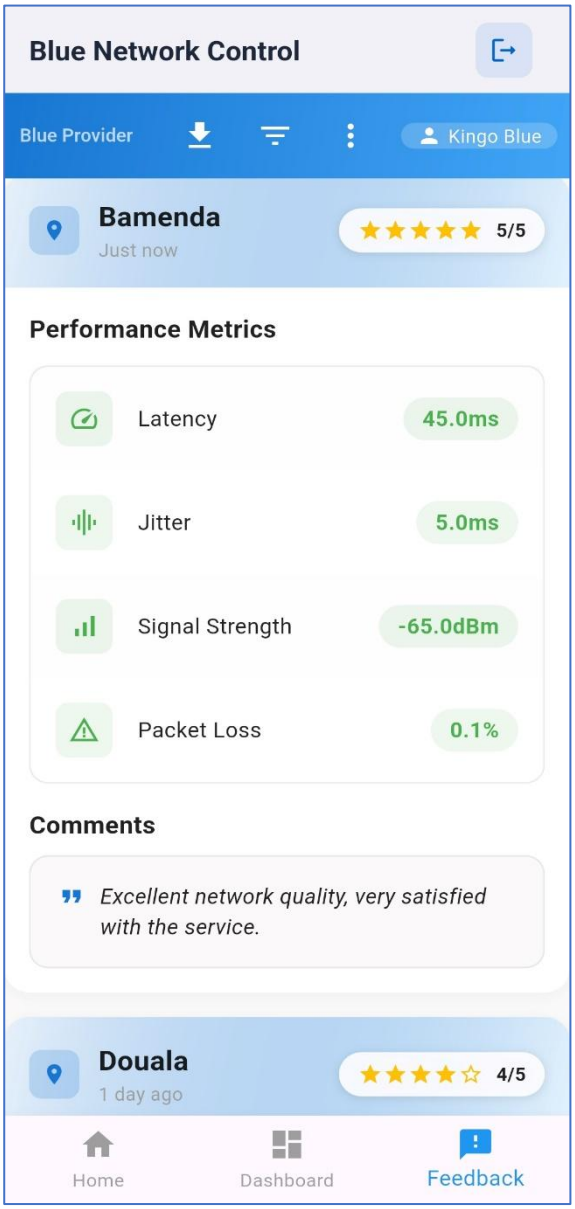
5.4 Feedback Management and Analysis Interface

The feedback management interface provides comprehensive tools for analysing user feedback data including advanced filtering capabilities, sentiment analysis, and trend identification. The implementation supports bulk operations for feedback processing, automated categorization of issues, and integration with customer service workflows.

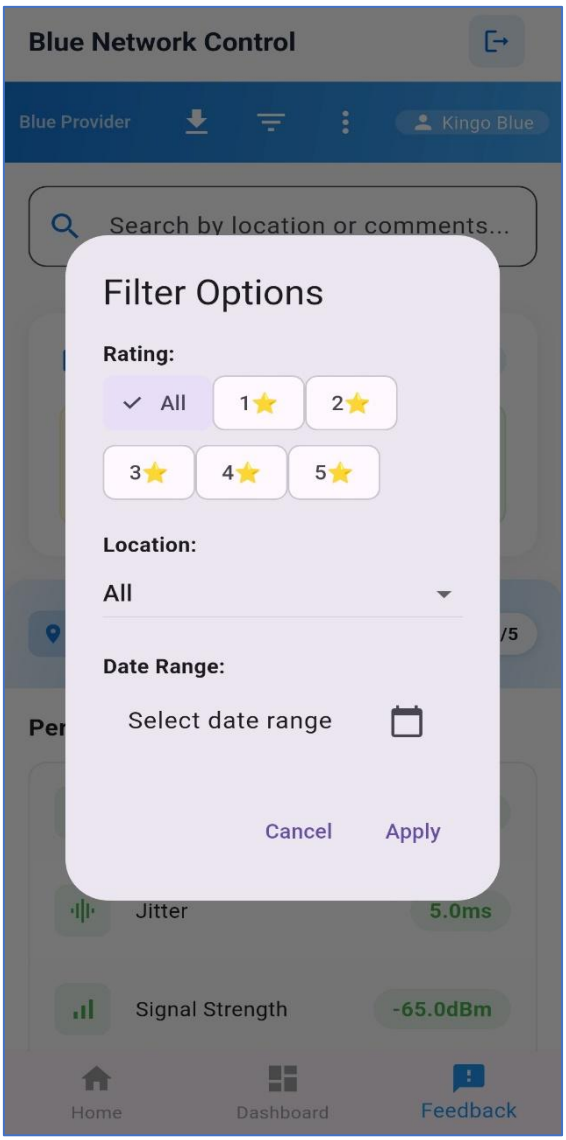
Advanced search functionality enables administrators to locate specific feedback entries based on multiple criteria including geographic location, time ranges, network conditions, and issue categories. The interface includes export capabilities that support data analysis in external tools while maintaining data security and privacy compliance.

Sentiment analysis algorithms process textual feedback to identify emotional indicators and satisfaction trends that complement quantitative performance metrics. These insights are presented through intuitive visualizations that highlight areas requiring immediate attention and track improvement progress over time.





Here, they can search and even filter based on comments. They can export this data to a CSV file using the download icon. They can as well filter this by clicking the filter icon. Also, they can clear these logs. Or feedback once exported.

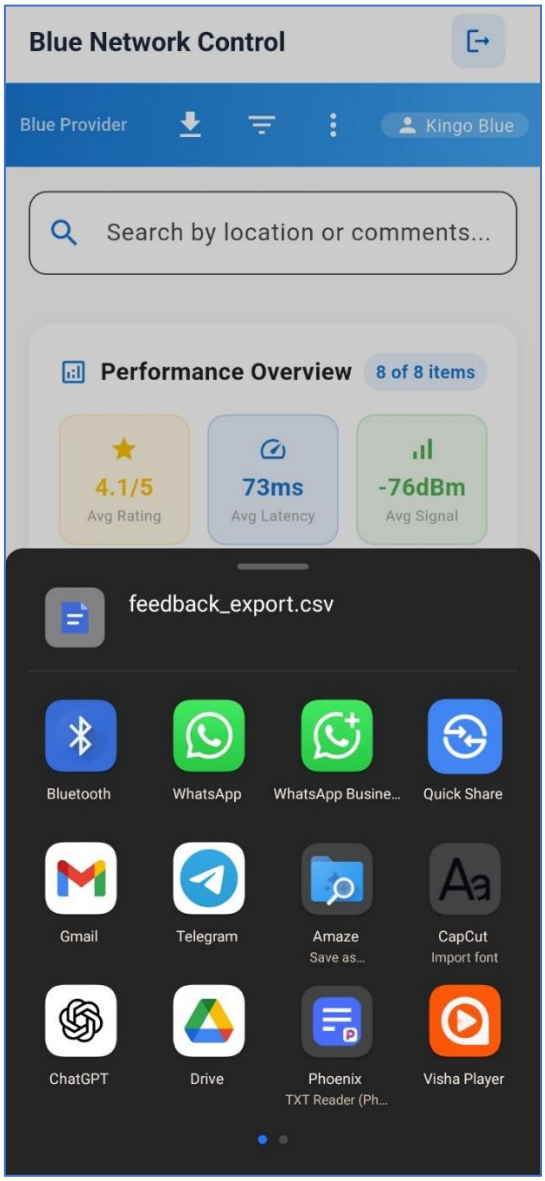


The filter options here could be based on the stars, Location or the date (Date range).

5.5 Data Export and Reporting Capabilities

The reporting system generates comprehensive performance reports that support executive decision-making and regulatory compliance requirements. Report generation includes flexible template systems that can be customized for different stakeholder audiences while maintaining consistent data accuracy and presentation quality.

Export functionality supports multiple data formats including CSV, format that integrate with existing business intelligence tools and workflows. The implementation includes scheduled reporting capabilities that automatically generate and distribute performance summaries to relevant stakeholders according to predefined schedules.



This is the feedback being exported as CSV file which can then be analysed to get better insights.

It is from the user feedback and logs that the AI model will be trained.

6. Business Impact and Return on Investment

6.1 Operational Benefits for Network Operators

The system provides network operators with unprecedented visibility into actual user experiences, enabling proactive network optimization and customer satisfaction improvement. Operators can identify performance issues before they impact large user populations, reducing customer churn and support costs while improving service quality metrics.

Data-driven decision-making capabilities support infrastructure investment optimization through identification of high-impact improvement opportunities. The system enables operators to prioritize network upgrades based on actual user impact rather than theoretical performance metrics, improving return on infrastructure investments.

Competitive intelligence capabilities provide insights into market positioning relative to other operators through comparative performance analysis. This information supports strategic planning and marketing initiatives while identifying opportunities for service differentiation and market expansion.

6.2 Customer Experience Enhancement

Improved network performance transparency builds customer trust and satisfaction through clear communication of service quality and improvement efforts. Users gain valuable insights into network performance patterns that help optimize their mobile usage while feeling heard and valued by their service provider.

Reward systems encourage user participation while providing tangible value that improves customer loyalty and retention. The implementation creates positive feedback loops where users benefit from participation while providing valuable data that enables service improvements.

Issue resolution acceleration improves customer satisfaction through faster identification and resolution of network problems. The system enables operators to address issues proactively rather than reactively, reducing customer frustration and support interaction requirements.

7. Future Enhancement Opportunities

7.1 Advanced Analytics and Machine Learning

Machine learning capabilities can be expanded to include predictive analytics that forecast network performance issues before they occur. These capabilities would enable even more proactive network management while optimizing maintenance scheduling and resource allocation.

Advanced pattern recognition could identify complex relationships between network performance, user behaviour, and external factors such as weather, events, and demographic patterns. These insights would support sophisticated optimization strategies that consider multiple variables simultaneously.

Automated optimization recommendations could suggest specific network configuration changes, infrastructure investments, and operational procedures based on collected data analysis. These recommendations would accelerate improvement implementation while reducing the expertise required for effective network optimization.

7.2 Platform Integration and Ecosystem Expansion

Integration with existing network management systems would streamline operator workflows while maximizing the value of collected data. These integrations would eliminate manual data transfer requirements while enabling comprehensive network management through unified interfaces.

Third-party service integration could expand system capabilities through partnerships with complementary service providers such as customer service platforms, business intelligence tools, and network infrastructure vendors. These integrations would create comprehensive solutions that address broader operational requirements.

API development would enable custom integrations and extensions that address specific operator requirements while supporting ecosystem growth through third-party development opportunities. Open API strategies could create new revenue streams while accelerating feature development through community contributions.

8. Conclusion

Through its dual-interface design—one for subscribers and one for administrators—WaveWatch delivers a balanced system that empowers both everyday users and telecom operators. This document has detailed the complete frontend implementation of WaveWatch, including its design philosophy, user interface components, technical architecture, and accessibility features. With a clean, intuitive user experience and a robust technical foundation, the system is now frontend-ready for integration with backend services.

9. References

1. Link to Figma Design
https://www.figma.com/proto/VMCV47Bg0o6rkkvhao2tAs/InternetProgramming?node-id=0-1&t=iS7tVvIYMtGLqz8U-1