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**DEPARTMENT OF COMPUTER ENGINEERING**

**CEF440: Internet Programming and Mobile Programming**

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**SOFTWARE REQUIREMENT SPECIFICATION**

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# Software Requirement Specification (SRS)

## 1. Introduction

### 1.1 Purpose

This Software Requirements Specification (SRS) defines the functional and non-functional requirements for a mobile application that monitors mobile network quality of experience (QoE) for subscribers in Cameroon. It outlines what the application will do and the conditions it must satisfy.

### 1.2 Scope

The application will:

* Collect real-time network performance metrics.
* Allow users to report service issues manually.
* Offer data privacy controls to users.
* Notify users of network problems.
* Provide multilingual support (English and French).
* Offer optional integration with operator support systems (e.g., MTN Zigi).
* Continuously measure and display network performance (speed, latency, stability).

### 1.3 Intended Audience

* Mobile Subscribers (End Users)
* Mobile Network Operators (e.g., MTN, Orange)
* App Development Team
* Regulatory Authorities (e.g., ART Cameroon)

### 1.4 Definitions, Acronyms, and Abbreviations

* QoE: Quality of Experience
* CPU: Central Processing Unit
* GDPR: General Data Protection Regulation

## 2. Overall Description

### 2.1 Product Perspective

The application will work independently but may optionally link to operator support systems (e.g., MTN Zigi). It will work on Android and iOS platforms.

### 2.2 Product Functions

* Real-time measurement of network speed, latency, and stability.
* Background monitoring with minimal battery impact.
* Manual feedback system with geolocation tagging.
* Notification alerts for service disruptions.
* Privacy dashboard for controlling data permissions.
* Multilingual user interface.

### 2.3 User Classes and Characteristics

* End Users: Students, workers, urban and rural residents.
* Network Operators: Technical staff and support managers.
* Regulators: Analysts overseeing mobile service standards.

### 2.4 Constraints

* Must comply with data privacy laws.
* Must maintain high performance on low-end devices.
* Data collection must be opt-in and transparent.

### 2.5 Assumptions and Dependencies

* Availability of mobile data/Wi-Fi for data transmission.
* Users willing to share anonymous feedback.
* Access to mobile OS APIs for network measurements.

## 3. Specific Requirements

### 3.1 Functional Requirements (FR)

|  |  |
| --- | --- |
| ID | Requirement |
| FR-1 | The system shall monitor and display real-time internet speed (upload/download). |
| FR-2 | The system shall allow users to submit manual feedback reports. |
| FR-3 | The system shall notify users when a network drop is detected. |
| FR-4 | The system shall allow users to set privacy preferences. |
| FR-5 | The system shall display service history and logs. |
| FR-6 | The system shall link users to existing operator support tools (optional). |
| FR-7 | The system shall support both English and French languages. |

### 3.2 Non-Functional Requirements (NFR)

|  |  |
| --- | --- |
| ID | Requirement |
| NFR-1 | The system shall consume less than 3% battery usage per hour. |
| NFR-2 | The system shall encrypt user data during transmission. |
| NFR-3 | The system shall support 99.9% uptime availability. |
| NFR-4 | The system shall be usable on Android 8+ and iOS 12+ devices. |
| NFR-5 | The system shall offer an intuitive, minimalistic user interface. |

## 4. Appendices

### A. Survey Questionnaire for Stakeholder Validation of Mobile Network QoE Monitoring App

**Introduction**

Thank you for participating in this survey to help validate the requirements for a new mobile application that will monitor network quality in Cameroon. Your feedback will ensure the app meets real user needs. This survey should take about 5-7 minutes to complete.

**Section 1: General Information**

1. Which of the following best describes you?

☐ Mobile subscriber (end user)

☐ Mobile network operator representative

☐ Regulatory authority representative

☐ Other (please specify): \_\_\_\_\_\_\_\_\_

2. Which mobile network(s) do you currently use? (Select all that apply)

☐ MTN

☐ Orange

☐ Nexttel

☐ Camtel

☐ Other: \_\_\_\_\_\_\_\_\_

**Section 2: Functional Requirements Validation**

3. How important is it for you to see real-time internet speed measurements (upload/download) in a network monitoring app?

☐ Very important

☐ Important

☐ Neutral

☐ Not very important

☐ Not important at all

4. Would you use a manual feedback feature to report network issues?

☐ Yes, frequently

☐ Yes, occasionally

☐ Probably not

☐ Definitely not

5. How valuable would you find automatic notifications when the app detects network problems?

☐ Extremely valuable

☐ Valuable

☐ Somewhat valuable

☐ Not valuable

6. How important is having control over your data privacy settings in this app?

☐ Extremely important

☐ Important

☐ Somewhat important

☐ Not important

7. Would you find value in viewing historical data about your network performance?

☐ Yes, very useful

☐ Somewhat useful

☐ Not useful

8. How important is multilingual support (English/French) for this application?

☐ Essential

☐ Important

☐ Nice to have

☐ Not important

**Section 3: Non-Functional Requirements Validation**

9. What maximum battery usage would you find acceptable for continuous background monitoring?

☐ Less than 3% per hour (as proposed)

☐ 3-5% per hour

☐ 5-7% per hour

☐ More than 7% per hour

10. How important is data encryption for your personal information in this app?

☐ Extremely important

☐ Important

☐ Somewhat important

☐ Not important

11. What minimum app availability (uptime) would you expect?

☐ 99.9% (as proposed)

☐ 99%

☐ 95%

☐ Less than 95%

12. Do you primarily use:

☐ Android device (version \_\_\_\_\_\_\_)

☐ iOS device (version \_\_\_\_\_\_\_)

**Section 4: Additional Feedback**

13. Are there any features missing from the proposed requirements that you would find valuable?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

14. What concerns, if any, would you have about using this application?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

15. Would you be willing to participate in future testing of this application?

☐ Yes

☐ No

If yes, please provide contact email: \_\_\_\_\_\_\_\_\_

**Section 5: Demographic Information (Optional)**

16. Your age group:

☐ Under 18

☐ 18-25

☐ 26-35

☐ 36-45

☐ 46+

17. Your general location:

☐ Urban area (City)

☐ Suburban area (small town)

☐ Rural area (Village)

18. Your primary use of mobile data:

☐ Social media

☐ Work/business

☐ Education

☐ Entertainment

☐ Other: \_\_\_\_\_\_\_\_\_

Thank you for your valuable feedback! Your responses will help shape a better network monitoring application for Cameroon.

### Interview Guide for Mobile Network Operators (Secondary Stakeholders)

**Introduction**

Thank you for taking the time to discuss the proposed Mobile Network Quality of Experience (QoE) Monitoring Application. Your expertise as a network operator is valuable in ensuring this tool meets industry needs while benefiting both subscribers and service providers. This interview will focus on your perspectives on functional requirements, technical feasibility, regulatory compliance, and potential collaboration opportunities.

**Section 1: Functional Requirements Deep Dive**

4. The app will collect real-time speed/latency data and allow manual user reports. How could this complement or conflict with your existing monitoring systems?

(Probe: Would duplicate data be an issue? Could this reduce support ticket volume?)

5. How might geolocation-tagged reports help your team diagnose network problems more efficiently?

(Probe: Are there areas where user-reported data would be uniquely helpful, like rural coverage gaps?)

6. The app proposes optional integration with operator support tools (e.g., MTN Zigi). What technical or business challenges might this raise?

(Probe: API access, data ownership, response protocols.)

**Section 2: Technical & Regulatory Concerns**

7. What security or privacy risks do you foresee in collecting user-generated network data? How should the app mitigate these?

(Probe: Anonymization, encryption, compliance with Cameroon’s data laws.)

8. The app aims for minimal battery impact (<3%/hour). Is this feasible given the need for background data collection? What trade-offs might be necessary?

9. How should the app handle discrepancies between user-reported issues and your internal network metrics?

(Probe: Automated alerts for your team? User education on network variability?)

**Section 3: Collaboration & Business Value**

10. Would your organization consider sharing anonymized data with regulators (e.g., ART Cameroon) to improve industry transparency? Under what conditions?

11. Could incentivizing users to share data (e.g., rewards for reports) improve data quality? What incentives would align with your business model?

12. Would you support this app through official partnerships (e.g., co-branding, API access)? What would motivate or discourage this?

(Probe: Brand reputation, cost, competitive concerns.)

**Closing & Future Steps**

13. What critical feature or policy is missing from the current proposal?

14. Would your team be available for a follow-up discussion or pilot testing?

Thank you for your insights. Your feedback will directly shape the app’s development. We’ll share a summary of key findings and next steps. Do you have any final questions or concerns?

## **Validation & Compliance**

### 5.1 Steps for Validation of Requirements with Stakeholders

|  |  |
| --- | --- |
| Step | Action |
| 1 | Present the SRS document to stakeholders (students, network operators, regulatory body representatives). |
| 2 | Conduct feedback sessions (meetings, online surveys) to verify if the listed requirements meet their expectations. |
| 3 | Use acceptance criteria: for each requirement, stakeholders will agree it is necessary, clear, achievable, and testable. |
| 4 | Make updates to the SRS document based on stakeholder feedback. |
| 5 | Obtain a formal sign-off from major stakeholders (e.g., MTN representatives, Regulatory Body ART Cameroon, Project Supervisors). |

### 5.2 Stakeholder Approval

Sign-off required from:

* Mobile operators (MTN, Orange).
* Regulatory body .
* End-user representatives.

### 5.3 Acceptance Criteria

Each requirement must be:

* **Testable**: Verifiable via automated or manual testing.
* **Traceable**: Linked to stakeholder needs.

## VALIDATION OF REQUIREMENTS FROM QUESTIONNAIRE RESULTS

### 1. Functional Requirement Validation

* **FR-1: Display real-time upload/download speeds**
  + **Survey Question**: "How important is it for you to see real-time internet speed measurements (upload/download) in a network monitoring app?"
  + **Response Distribution** (from histogram):
    - "Not important at all" (1): 0
    - "Not very important" (2): 2
    - "Neutral" (3): 3
    - "Important" (4): 8
    - "Very important" (5): 20
  + **Trend**: Average score increased from ~4.28 (May 4) to ~4.50 (May 5).
  + **Validation**:
    - **Completeness**: Fully addressed; 28/33 (85%) rated it "Important" or "Very important," aligning with high priority.
    - **Clarity**: Clear, no ambiguities reported.
    - **Feasibility**: Technologically feasible (e.g., Speedtest apps).
    - **Alignment**: Strong stakeholder support justifies high priority.
    - **Conclusion**: Validated as a core feature.
* **FR-2: Allow manual reports with geolocation tagging**
  + **Survey Question**: "Would you use a manual feedback feature to report network issues?"
  + **Response Distribution**:
    - "Definitely not" (1): 1
    - "Probably not" (2): 14
    - "Neutral" (3): 0
    - "Yes, occasionally" (4): 10
    - "Yes, frequently" (5): 5
  + **Trend**: Average score decreased from ~3.00 (May 4) to ~2.75 (May 5).
  + **Validation**:
    - **Completeness**: Partially addressed; only 15/33 (45%) are willing to use it occasionally or frequently, suggesting limited interest.
    - **Clarity**: Clear, but some stakeholders may not understand its value (e.g., one respondent suggested transparency, which might relate to usage).
    - **Feasibility**: Feasible with geolocation APIs.
    - **Alignment**: Mixed support; current high priority may be overstated given 15/33 reluctance.
    - **Conclusion**: Partially validated; consider lowering priority or improving usability based on feedback.
* **FR-3: Notify users of detected network outages**
  + **Survey Question**: "How valuable would you find automatic notifications when the app detects network problems?"
  + **Response Distribution**:
    - "Not valuable" (1): 1
    - "Somewhat valuable" (2): 3
    - "Neutral" (3): 0
    - "Valuable" (4): 13
    - "Extremely valuable" (5): 13
  + **Trend**: Average score stable at ~4.17 (May 4) to ~4.25 (May 5).
  + **Validation**:
    - **Completeness**: Fully addressed; 26/33 (79%) rated it "Valuable" or "Extremely valuable."
    - **Clarity**: Clear, though "network outages" should be defined (e.g., total loss vs. degradation).
    - **Feasibility**: Feasible with real-time monitoring.
    - **Alignment**: Supports medium priority; consistent demand justifies inclusion.
    - **Conclusion**: Validated, but clarify "outages" definition.
* **FR-4: Provide privacy controls (opt-in data sharing)**
  + **Survey Question**: "How important is having control over your data privacy settings in this app?" (inferred from survey context, not directly asked, but related to "How important is data encryption?").
  + **Response Distribution** (for data encryption as proxy):
    - "Not important" (1): 0
    - "Somewhat important" (2): 1
    - "Neutral" (3): 0
    - "Important" (4): 2
    - "Extremely important" (5): 30
  + **Trend**: Stable at ~4.88 (both days).
  + **Validation**:
    - **Completeness**: Fully addressed; 30/33 (91%) rated encryption "Extremely important," implying strong support for privacy controls.
    - **Clarity**: Clear, no reported ambiguities.
    - **Feasibility**: Feasible with AES-256 encryption.
    - **Alignment**: High priority aligns with overwhelming support.
    - **Conclusion**: Validated as a critical feature.
* **FR-5: Support English and French interfaces**
  + **Survey Question**: "How important is multilingual support (English/French) for this application?"
  + **Response Distribution**:
    - "Nice to have" (1): 3
    - "Important" (2): 8
    - "Essential" (3): 22
  + **Trend**: Stable at ~2.66 (May 4) to ~2.75 (May 5).
  + **Validation**:
    - **Completeness**: Fully addressed; 22/33 (67%) rated it "Essential."
    - **Clarity**: Clear, no ambiguities.
    - **Feasibility**: Feasible with localization support.
    - **Alignment**: Medium priority is appropriate; strong support justifies inclusion.
    - **Conclusion**: Validated, supports medium priority.

### 2. Non-Functional Requirement Validation

* **NFR-1: Battery efficiency (<3% hourly usage)**
  + **Survey Question**: "What maximum battery usage would you find acceptable for continuous background monitoring?"
  + **Response Distribution**:
    - "More than 7%" (1): 3
    - "5-7%" (2): 1
    - "3-5%" (3): 7
    - "Less than 3%" (4): 21
    - "I don’t understand" (0): 1
  + **Trend**: Decreased from ~3.55 (May 4) to ~3.50 (May 5).
  + **Validation**:
    - **Completeness**: Fully addressed; 21/33 (64%) prefer "<3%," aligning with the metric.
    - **Clarity**: Clear, though 1 respondent didn’t understand, suggesting a need for education.
    - **Feasibility**: Achievable with optimization, though 10/33 accept higher usage.
    - **Alignment**: Supports the metric; high preference justifies the constraint.
    - **Conclusion**: Validated, but consider user education on battery usage.
* **NFR-2: Data security (AES-256 encryption)**
  + **Survey Question**: "How important is data encryption for your personal information in this app?"
  + **Response Distribution**:
    - "Not important" (1): 0
    - "Somewhat important" (2): 1
    - "Neutral" (3): 0
    - "Important" (4): 2
    - "Extremely important" (5): 30
  + **Trend**: Stable at ~4.88 (both days).
  + **Validation**:
    - **Completeness**: Fully addressed; 30/33 (91%) rated it "Extremely important."
    - **Clarity**: Clear, no ambiguities.
    - **Feasibility**: Feasible with standard encryption protocols.
    - **Alignment**: High stakeholder demand supports inclusion.
    - **Conclusion**: Validated as a critical non-functional requirement.
* **NFR-3: Device compatibility (Android 8+, iOS 12+)**
  + **Survey Question**: "Do you primarily use:" (Android device or iOS device)
  + **Response Distribution**:
    - Android: 29 respondents
    - iOS: 4 respondents
  + **Trend**: No significant change over time.
  + **Validation**:
    - **Completeness**: Fully addressed; covers 100% of respondents (Android 88%, iOS 12%).
    - **Clarity**: Clear, no reported issues.
    - **Feasibility**: Feasible with cross-platform development (e.g., Flutter, React Native).
    - **Alignment**: Matches market dominance in Cameroon (Android-heavy).
    - **Conclusion**: Validated, appropriately broad compatibility.
* **NFR-4: Uptime reliability (99.9% availability)**
  + **Survey Question**: "What minimum app availability (uptime) would you expect?"
  + **Response Distribution**:
    - Less than 95% (2): 1
    - 95% (3): 8
    - "99%" (4): 4
    - 99.9% (5): 19
    - I don’t understand (1): 1
  + **Trend**: Stable with a slight increase from ~4.52 (May 4) to ~4.75 (May 5).
  + **Validation**:
    - **Completeness**: Fully addressed; 19/33 (58%) expect 99.9%, aligning with the metric.
    - **Clarity**: Clear, though 1 respondent didn’t understand, suggesting clarification.
    - **Feasibility**: Achievable with cloud hosting and redundancy.
    - **Alignment**: Supports the 99.9% target; majority preference justifies it.
    - **Conclusion**: Validated, with minor need for user education.