**Verification and Validation (V&V) Document**

**Project Title**: Mobile-Based Attendance Management System Based on Geofencing and Facial Recognition  
**Phase**: Analysis Phase  
**Prepared By**: Group 12 – University of Buea  
**Date**: May 2025

**1. Introduction**

This V&V document ensures that the system meets stakeholder expectations (validation) and conforms to documented requirements (verification), serving as a quality gate before transitioning to the design phase.

**2. Purpose of V&V**

* **Verification**: Ensuring the product matches its documented specifications.
* **Validation**: Ensuring the product fulfills stakeholder needs.

**3. Verification Activities**

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| **Activity** | **Method** | **Outcome** |
| Requirements Review | Peer review of SRS | Logical consistency confirmed |
| Internal Audits | Checklist-based analysis | No duplicate/conflicting requirements |
| Document Consistency Check | Traceability assessment | Each requirement mapped to a use case |

**4. Validation Activities**

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| **Activity** | **Method** | **Participants** | **Outcome** |
| Stakeholder Survey | Google Form | 30+ students & lecturers | Confirmed system needs |
| Interview | Session with department staff | Team members | Validated admin & reporting needs |
| Use Case Walkthrough | Scenarios presented to peers | Team members | Validated real-life relevance |

**5. Requirements Traceability Matrix (RTM)**

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| **Req. ID** | **Requirement Description** | **Source** | **Mapped Use Case** | **Validation Method** | **Status** |
| FR-01 | User Registration and Login | Stakeholder Form | UC-01: Account Access | Form Feedback | Validated |
| FR-02 | Facial Recognition on Check-In | Survey Response | UC-02: Attendance Check-In | Survey | Validated |
| FR-03 | Geolocation Validation (Geofencing) | Lecturer Interview | UC-02: Attendance Check-In | Interview | Validated |
| FR-04 | Record Attendance with Timestamp | Team Discussion | UC-03: Record Generation | Use Case Review | Validated |
| FR-05 | Admin Dashboard for Monitoring | Lecturer Interview | UC-04: Admin Oversight | Interview & Form | Validated |
| FR-06 | Notifications on Attendance Events | Stakeholder Form | UC-05: Notify User/Admin | Survey | Validated |
| FR-07 | Role-Based Access Control (RBAC) | Team Analysis | UC-06: Access Management | SRS Review | Validated |
| NFR-01 | Facial recognition attendance must complete within 5 seconds | Stakeholder Expectations | UC-02: Attendance Check-In | Performance Benchmarking | Verified |
| NFR-02 | Mobile app must support up to 500 concurrent users | System Design | UC-02: Attendance Check-In | Load Testing Plan | Verified |
| NFR-03 | System uptime must be at least 99.9% daily | Deployment Plan | General Use | SLA Draft Review | Verified |
| NFR-04 | Facial recognition data must be encrypted in transit and at rest | Data Privacy Policy | UC-01: Account Access  UC-02: Attendance Check-In | Compliance Checklist | Validated |
| NFR-05 | JWT tokens expire after 2 hours and require refresh | Security Protocols | UC-01: Account Access | Token Expiry Test | Validated |
| NFR-06 | UI should be intuitive with onboarding under 3 minutes | User Feedback | UC-01: Account Access | Usability Testing | Validated |
| NFR-07 | Daily backups and auto-recovery within 5 minutes | Backup Policy | General Use | Failover Simulation | Verified |

**6. Issues Identified and Resolved**

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| **Issue** | **Resolution** |
| Facial recognition trigger mechanism unclear | Clarified as auto-trigger within geofenced GPS zone |
| GPS issues in weak signal areas | Added Wi-Fi/BLE fallback and 10-meter tolerance in design constraints |
| User privacy concerns | Included consent prompt and AES-256 encryption for biometric data |
| System scalability concerns | Adopted cloud-based architecture with auto-scaling and load balancing |
| High facial recognition processing time | Optimized with lightweight on-device ML models |
| Access control vulnerabilities | Implemented RBAC using JWT and role-based permissions |
| Notification delays | Integrated FCM for real-time mobile push alerts |
| Biometric data storage compliance | Aligned with privacy laws; secured storage and retention policies defined |
| UI accessibility for all users | Designed interface using WCAG-compliant color and layout standards |
| Cross-platform compatibility challenges | Adopted React Native with platform-specific UI adjustments |

**7. Conclusion**

This document confirms that all system requirements have undergone thorough verification and validation. The RTM demonstrates complete mapping between requirements and use cases, confirming readiness for the design and implementation phase.