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A Privacy-Focused Multilingual Chat Assistant for Android

Advanced Mobile Systems – Design, Development, and Evaluation

CO666
2026

Motivation & Problem

- Loss of tone and intent in multilingual messaging.
- Literal translation often results in misunderstandings.
- Cloud-based AI introduces privacy and latency concerns.
- Constraints of strict Android lifecycle and background limits.

Project Aim

> Design a privacy-first mobile assistant that improves message understanding under modern Android system constraints.

Key Features

- Real-time Translation
- Tone Analysis
- Reply Generation
- Overlay Interface
- Local Persistence
- Visual Suggestions

Design Principles

On-device Processing
Local execution with zero cloud dependency

Deterministic Behaviour
Predictable system state and outputs

Android 14 Compliance
Android 14 foreground service compliance

System Architecture

Layered Android architecture ensuring clear separation of concerns.

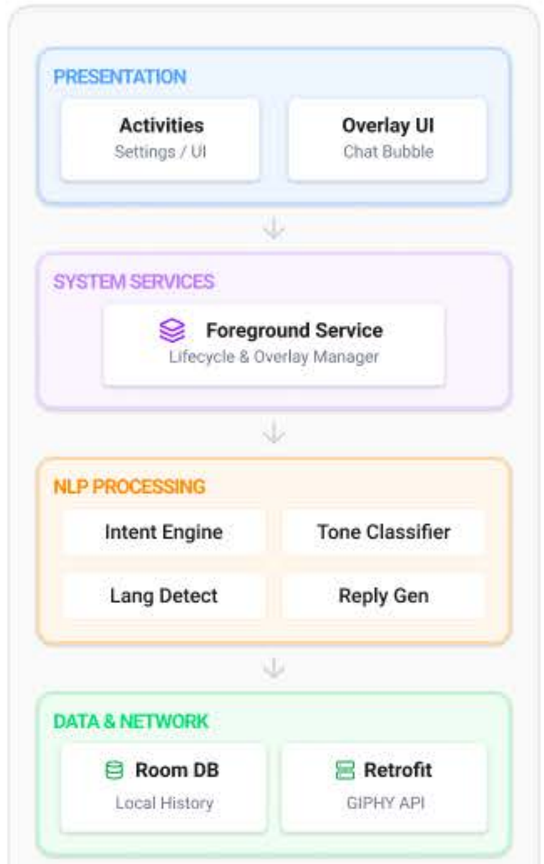
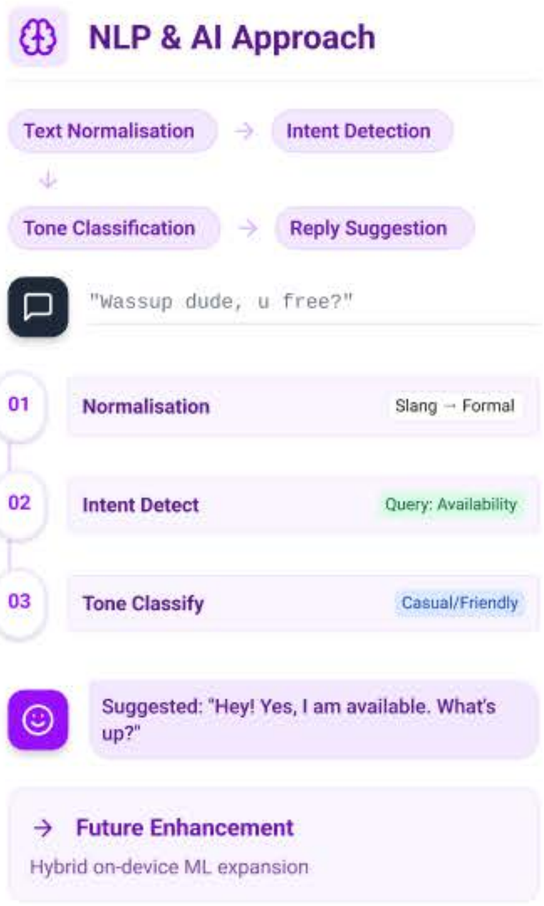


FIGURE 1: SYSTEM ARCHITECTURE

NLP & AI Approach



Future Enhancement
Hybrid on-device ML expansion

Advanced Mobile Concepts

Lifecycle Management
Process lifecycle management

Foreground Services
Foreground service with persistent notification required for compliance

Overlay Permissions
SYSTEM_ALERT_WINDOW overlay permission

Background Constraints
Android 14 background execution constraints

Testing & Evaluation

RESPONSE TIME
Fast on-device response (tested)

STABILITY
Stable across Android lifecycle transitions (tested)

PRIVACY
Core NLP processed locally on-device

Limitations & Future Work

- Limited coverage of rule-based NLP algorithms
- Complexity in handling cultural nuances
- Future integration of on-device Machine Learning

Conclusion

This project demonstrates practical application of advanced mobile system design by balancing **privacy**, **usability**, and **Android platform constraints**.