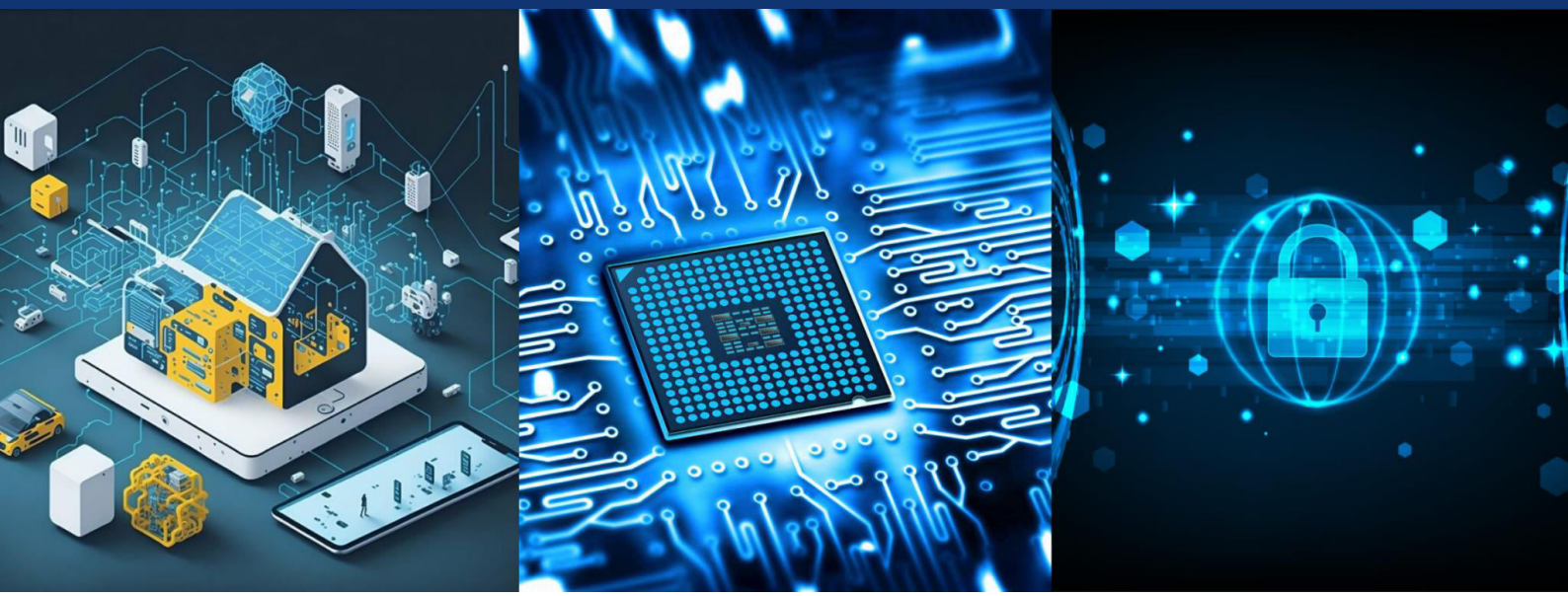
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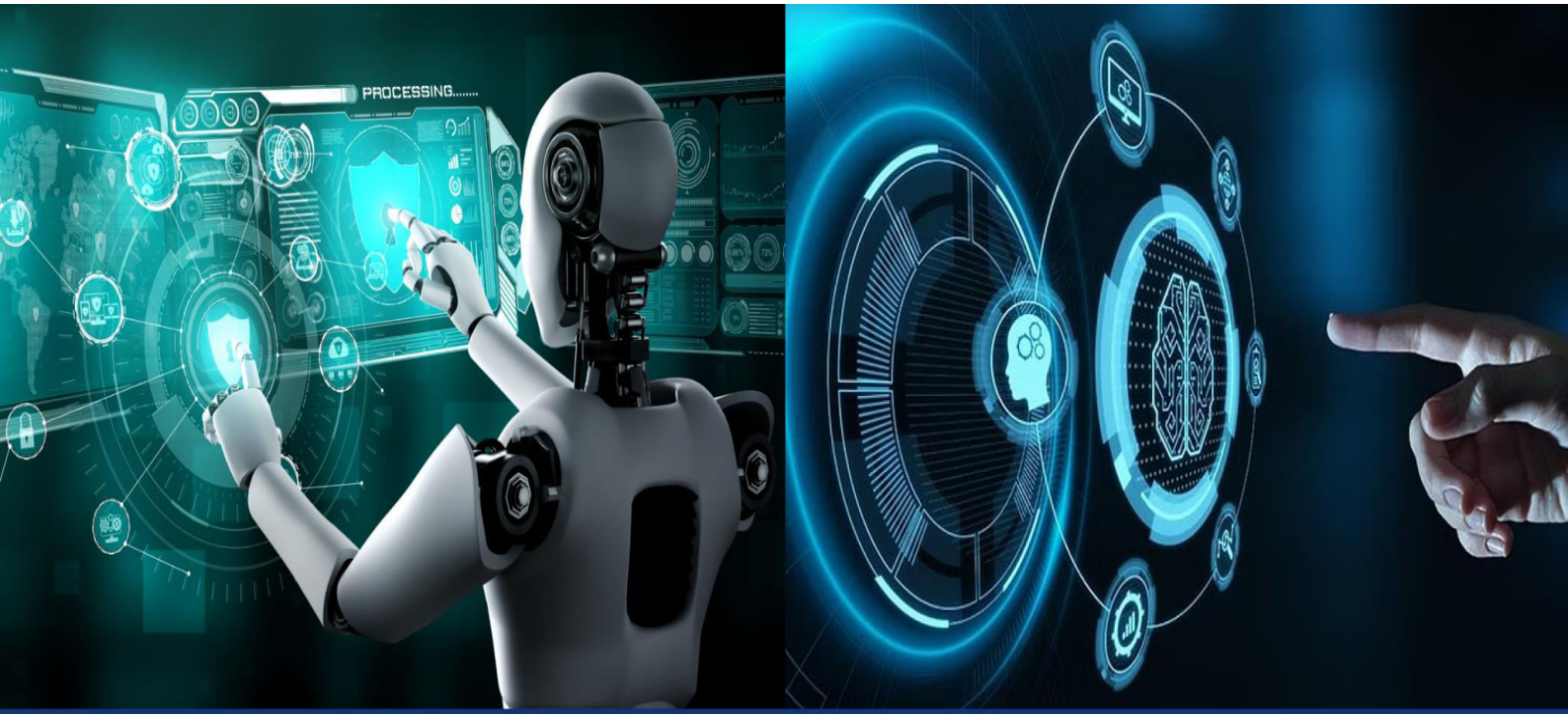
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HER SHIELD: A Voice-Activated Women's Safety System using Offline Speech Recognition

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ABSTRACT: Women may be unable to unlock a phone or manually activate an emergency application when they face a threat. This paper presents Her Shield, a mobile safety application designed to initiate an emergency workflow through voice-triggered keywords and complementary safety controls. The application combines a Flutter/Dart user interface with Android-specific Kotlin background functionality and the Vosk offline speech-recognition engine. When configured distress words such as "HELP" or "SOS" are recognized, the application is designed to activate the selected safety workflow, which can include contacting trusted emergency contacts, sending an SMS with the available location, and activating a siren. Additional functions include a manual SOS option, emergency calling, location sharing, and a safety timer. Offline keyword recognition reduces dependence on a cloud speech-recognition service for the recognition step; however, calls and SMS still depend on device permissions and mobile-network availability. This paper describes the motivation, architecture, implementation approach, and functional testing considerations of Her Shield. The system is intended as a practical assistance tool rather than a replacement for emergency services. Recognition accuracy, false activations, Android background restrictions, battery consumption, and location/network availability remain important limitations that require further evaluation.

KEYWORDS: Women's safety, voice recognition, offline speech recognition, Vosk, Flutter, Kotlin, SOS, location sharing, Android application.

I. INTRODUCTION

Personal safety remains an important concern in situations where a person may need help quickly and may not be able to operate a smartphone manually. Conventional safety applications commonly provide panic buttons, emergency contacts, GPS-based location sharing, or SMS alerts. These functions can be useful, but accessing them may be difficult if the phone is inside a bag, the user's hands are occupied, or the situation does not allow time to navigate an application.

Her Shield is proposed as an integrated mobile safety application that supports voice-triggered emergency activation in addition to manual controls. The system listens for configured keywords using an offline speech-recognition model and initiates the associated workflow when a recognized keyword matches the configured command. The application is built with Flutter and Dart for the user interface, Kotlin for Android-specific service integration, and Vosk for offline speech recognition.

The principal contribution is the integration of voice-based activation with multiple emergency functions in one Android application. These include an SOS action, emergency calling, SMS alerts to predefined contacts, location sharing, a siren, and a configurable safety timer. The approach aims to reduce the number of manual steps required to request help, while retaining user-controlled settings and conventional activation options.

II. RELATED WORK

Existing mobile safety solutions often combine a panic button with GPS and message delivery. The literature reviewed during this project includes mobile applications for women's safety that store emergency contacts, retrieve the user's

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location, and send alerts to trusted contacts. Such systems emphasize rapid communication but can depend on manual activation and reliable network access.

Other approaches integrate Bluetooth-enabled wearable devices with mobile applications. A wearable button can provide an alternative trigger when accessing a phone is inconvenient, but it introduces a dependency on an additional device and its Bluetooth connection. AI-assisted safety concepts, including voice or behavioural cues, seek to make activation more accessible. Their practical usefulness depends on reliable detection, manageable false-positive rates, and appropriate safeguards.

Her Shield focuses on offline voice keyword recognition on the smartphone, while retaining manual SOS and other safety features. Unlike a system that relies on a cloud speech service for keyword recognition, the Vosk-based recognition component can process speech locally. This does not make the complete emergency workflow fully offline: SMS and calls require cellular service, and location acquisition depends on device settings and available positioning signals.

III. OBJECTIVES AND SYSTEM DESIGN

3.1 Objectives

The objectives are: (i) to provide an alternative voice-based method for initiating an SOS workflow; (ii) to integrate voice activation with manual SOS controls; (iii) to support emergency calls and SMS notifications to user-configured contacts; (iv) to include location sharing, siren, and safety-timer functions; and (v) to use offline speech recognition for keyword detection without requiring a cloud recognition API.

3.2 System Architecture

The system can be viewed as five cooperating components. The user-interface layer, implemented with Flutter and Dart, provides registration or setup screens, safety settings, emergency contacts, and manual controls. The voice-detection layer uses the Vosk model to recognize configured keywords from microphone input. Android-specific Kotlin service logic manages the recognition service and its lifecycle subject to operating-system restrictions. The emergency-response controller maps a recognized keyword or manual SOS action to the selected actions. Finally, device services provide location, telephony, SMS, and siren functionality, subject to permissions and connectivity.

Operational flow: (1) the user grants the required permissions and configures trusted contacts and safety settings; (2) voice detection is started where Android permits it; (3) incoming audio is processed by the offline recognizer; (4) a recognized keyword is checked against the configured trigger words; (5) the emergency workflow is invoked; and (6) the application attempts the enabled actions, such as obtaining location and preparing an alert. A safe implementation should provide a test mode, visible service status, and a way to stop or cancel accidental activation.

3.3 Technology Stack

Flutter and Dart are used to build the cross-platform-style interface, while Kotlin supports Android-specific background behaviour. Vosk provides offline speech recognition. Android location and telephony APIs support location retrieval, calling, and SMS workflows. The application relies on runtime permissions for microphone, location, calling, SMS, notifications, and the relevant foreground-service types. The precise behaviour can vary by Android version, device manufacturer, battery optimisation settings, and permission state.

IV. IMPLEMENTATION AND TESTING

4.1 Implementation

The application is organised around configuration, detection, and response. During setup, the user specifies emergency contacts and enables or disables available safety features. The voice service loads the speech model and creates a recognizer configured for the intended sampling rate and trigger vocabulary. When a recognition result contains a configured distress keyword, the service passes the event to the emergency-response logic. The response logic then invokes the enabled actions and uses available location information to prepare a message for trusted contacts.

Because Android limits background microphone use, voice detection should be started transparently through a supported foreground-service workflow and accompanied by an appropriate notification. The application must request

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permissions at runtime and handle denial or revocation gracefully. If location is unavailable, the system should not imply that an accurate location has been sent. If cellular service is absent, SMS or calls may fail even when keyword detection succeeds.

4.2 Functional Test Plan

Functional testing should cover both normal use and failure conditions. The following test cases provide a reproducible test plan; they are not numerical performance claims.

Test case	Expected behaviour
Valid “HELP” / “SOS” keyword	Recognized trigger invokes the configured emergency workflow.
Unrelated speech	No emergency action should be triggered by unrelated speech.
Manual SOS control	The emergency workflow starts without voice recognition.
Location permission denied	The app handles denial and does not claim to share a location.
Microphone permission denied	Voice detection remains unavailable and the user is informed.
Network unavailable	Recognition may work locally; call/SMS delivery is reported as unavailable or failed.
Foreground service stopped	The app indicates that background voice detection is not active.
Safety feature disabled	The disabled feature is not invoked by the workflow.

Testing should be performed on multiple supported Android devices and OS versions, in quiet and noisy environments, and with different speaking distances and accents. Recognition accuracy, false activation rate, missed-trigger rate, response latency, battery use, and successful message delivery should be measured before making quantitative claims.

V. DISCUSSION, LIMITATIONS AND CONCLUSION

Her Shield combines an offline voice-trigger mechanism with several familiar mobile safety features. Its key usability benefit is an additional way to request help when manually navigating a phone may be difficult. Local speech processing can reduce reliance on internet connectivity for keyword recognition and can limit the need to transmit audio to a remote recognition service. The integration of manual SOS, emergency contacts, location sharing, siren, and safety timer offers alternative routes to initiate assistance.

The design has important limitations. Speech recognition may miss a keyword or incorrectly recognize ordinary conversation, particularly in noisy environments or with unfamiliar accents. Continuous microphone use can affect battery life and must be transparent to the user. Background execution depends on Android permissions and service restrictions. Location accuracy can vary indoors, and emergency communication can fail without cellular coverage or when permissions are denied. For these reasons, the app should not be presented as guaranteeing rescue or replacing official emergency services.

5.1 Future Enhancement

Future work should evaluate the recognizer systematically using a consent-based dataset and report precision, recall, false-trigger rate, and detection latency. Additional improvements may include configurable trigger phrases, a cancellation window to reduce accidental alerts, secure handling of contact data, clear delivery-status feedback, battery optimisation, accessibility testing, and optional integration with wearable triggers. Any automatic calling or messaging behaviour should be tested carefully and designed to avoid accidental emergency calls.

VI. CONCLUSION

This paper presented Her Shield, a women’s safety application that uses Vosk-based offline keyword recognition with Flutter/Dart and Kotlin Android functionality. The system is designed to respond to configured distress words and

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integrate the voice trigger with SOS activation, emergency calls and SMS, location sharing, siren, and a safety timer. The architecture provides a practical foundation for voice-assisted emergency interaction, while its effectiveness depends on recognition quality, permissions, background-service availability, location access, and network connectivity. Further device-based testing and quantitative evaluation are necessary to establish reliability in real-world conditions.

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