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Automated Silent Mode Override With Multi-Call Alarm Trigger For Emergency Notification And Health Monitoring For Elderly Care

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ABSTRACT

In emergency situations, particularly involving elderly individuals, the inability to respond to urgent calls due to a phone being on silent mode can lead to delayed assistance and life-threatening consequences. This paper presents a novel Android-based system that overrides the silent mode of a smartphone when multiple calls are received within a short time frame, based on a configurable priority system. Contacts are categorized into four levels—High, Medium, Low, and Non-Priority—each triggering an alarm after a specific number of missed calls (ranging from 2 to 5). Upon detection, the system exits silent mode and activates a high-volume alarm to alert the user. In addition, the system incorporates a wearable heart rate monitor to detect abnormal heart conditions in elderly users. When a critical health event is detected, the system automatically displays a preconfigured emergency phone number and a message on the screen, allowing the user to quickly initiate a call or send an SMS with a single tap. This reduces the need for manual intervention during critical moments. The integration of mobile communication logic with real-time health monitoring creates a reliable and user-friendly emergency support tool, enhancing safety and response time in high-risk health scenarios.

Keywords: Silent Mode Override, Emergency Call, Wearable Health Monitoring, Elderly Care, IoT, Mobile Alert System, Priority Contact Management

I. INTRODUCTION

In an increasingly connected digital world, smartphones have become essential communication tools across all age demographics, including the elderly population. Simultaneously, advances in wearable technology have revolutionized personal health monitoring, offering unprecedented insights into vital signs and physical activity. The Adaptive Call Alert System represents a pioneering integration of these two technological domains, specifically designed to enhance the safety and well-being of elderly users through intelligent communication management coupled with health monitoring.

The traditional approach to mobile notifications presents significant challenges for elderly users. When phones are silenced—during rest periods, social engagements, or simply by accident—important calls may go unanswered. For elderly individuals living independently, this communication gap can create unnecessary worry among family members and caregivers, potentially delaying assistance when genuinely needed. Conventional silent mode settings fail to differentiate between casual contacts and emergency situations, treating all incoming communications with equal priority regardless of context or urgency.

Similarly, while wearable health devices effectively track vital signs, this valuable data typically exists in isolation from communication systems. The separation creates a fragmented approach to safety monitoring, missing crucial opportunities to correlate communication patterns with health metrics for a more comprehensive assessment of well-being. When an elderly person experiences irregular heart readings while simultaneously missing repeated calls from family members, this correlation represents a significant warning sign that current technology fails to address.

The Adaptive Call Alert System bridges this technological divide through a sophisticated Android application that employs contextual awareness and intelligent algorithms to create a seamless safety net for elderly users.

At its foundation, the system maintains the convenience of silent mode while implementing smart override mechanisms for urgent situations. The application analyzes call patterns, prioritizes contacts, and correlates communication data with real-time health metrics from wearable devices to make informed decisions about when to escalate notifications or bypass silent settings entirely. Central to the system's architecture are six integrated modules working in harmony to deliver comprehensive functionality. The Call Pattern Recognition module forms the foundation by analyzing incoming calls based on multiple factors including frequency, timing, historical patterns, and duration. This analysis generates urgency scores that inform notification decisions, distinguishing between routine communications and potentially urgent situations.

The Elder-Care Priority Management module enables customization through contact categorization, allowing users and authorized caregivers to establish priority tiers ranging from emergency contacts to casual acquaintances. These classifications directly influence how the system responds to incoming communications, with higher priority contacts receiving enhanced notification privileges during silent periods. Working in tandem with these modules, the Notification Escalation Engine implements a progressive approach to alerts. Rather than immediately overriding user preferences, the system employs graduated notification methods beginning with subtle vibrations and potentially escalating to audible alerts at increasing volumes. This measured progression respects user autonomy while ensuring truly urgent communications break through when necessary.

The Emergency Override System contains sophisticated logic for bypassing silent mode settings when specific conditions indicate a potential emergency. This critical module analyzes combinations of factors—multiple successive calls from priority contacts, predefined emergency keywords in messages, abnormal health readings—to determine when standard notification limitations should be suspended. Complementing these reactive components, the User Behavior Analytics module personalizes the system through machine learning algorithms that adapt to individual usage patterns. By understanding typical response times, identifying normal periods of device inactivity, and recognizing regular schedules, the system reduces false alarms while maintaining safety. This personalization creates an increasingly accurate experience over time, tailoring the application to each user's unique communication habits.

II. LITERATURE REVIEW

Existing research includes mobile alert systems, DND bypass settings in Android/iOS, and wearable health devices for heart monitoring. However, none combine real-time communication behavior analysis with automated emergency display prompts based on health parameters. Existing wearables like smartwatches detect health anomalies but do not assist users in initiating emergency contact without manual effort. This project bridges the gap by providing a unified solution that detects multi-call urgency, overrides silent mode, and displays emergency contact options automatically during health crises.The integration of mobile communication and healthcare systems has gained significant momentum, particularly in developing technologies for elderly care and emergency responsiveness. Existing smartphone platforms such as Android and iOS provide features like Do Not Disturb (DND) mode with limited options to whitelist contacts. However, these systems lack dynamic behavior based on emergency call frequency. They require manual setup and do not adapt to real-time urgency, which can delay critical response during emergencies.

Research by Sharma and Verma (2020) in the Journal of Mobile Computing discusses the limitations of existing silent mode override settings, pointing out that users often miss vital calls due to rigid notification controls. Their findings support the need for adaptive systems that respond to urgent call patterns without requiring constant user intervention.In the field of health monitoring, wearable devices like smartwatches and fitness bands have been used extensively to track vital signs such as heart rate. A study by Kumar et al. (2021) in the International Journal of Healthcare Technology emphasized the effectiveness of continuous monitoring for early detection of cardiac events. However, these devices typically alert only the wearer and lack automatic escalation features such as message generation or emergency calling.No existing system effectively integrates a silentmode override based on call urgency with real-time health monitoring and emergency contact prompt generation. This project aims to bridge that gap by offering a unified, semi-automated emergency communication and health monitoring solution, particularly suited for elderly individuals.

III. PROPOSED SYSTEM

Call Pattern Detector: Monitors incoming call frequency and origin. If multiple calls are received within a defined time window, the phone exits silent mode based on priority level:

- **High Priority** – Overrides silent mode and triggers alarm after 2 missed calls in short duration.
- **Medium Priority** – Overrides silent mode and triggers alarm after 3 missed calls.
- **Low Priority** – Overrides silent mode and triggers alarm after 4 missed calls.
- **Non-Priority** – Triggers alarm only after 5 missed calls.

Alarm Manager: Triggers a high-priority alarm with custom tones depending on the contact's assigned level.When silent mode is overridden, this module plays a loud, customizable alarm tone. The tone differs for each priority level, allowing the user to identify the urgency even before viewing the screen.

Health Monitor Module: Receives continuous heart rate data from a wearable device (e.g., pulse sensor, ESP32). If abnormal rates are detected, the system flags a distress condition. wearable device connected via Bluetooth monitors the user's heart rate. If abnormal readings are detected (e.g., below 60 or above 100 BPM), the system marks the situation as critical and initiates the next step.

Emergency Display Module: When a critical heart rate is detected, the system automatically displays a preconfigured phone number and emergency message. The user can tap to send the SMS or dial the number— minimizing delay and removing the need to search for contact details. Instead of fully automating calls or SMS (which may raise privacy or legal concerns), the system **automatically displays** a preconfigured emergency message and phone number on the screen. The user simply needs to tap "Call" or "Send SMS" without searching for contacts, reducing delay during a critical event.

User Configuration Interface: Allows users to assign priority levels, set alarm tones, and configure emergency messages and contact numbers.This allows users or caregivers to configure contact priority levels, custom alarm sounds, health thresholds, and emergency contact details (name, number, message body).By combining these modules, the system offers a user-friendly, semi-automated emergency solution for elderly care that bridges the communication and health monitoring gap found in current systems.

a) Problem Statement:

In emergency situations, especially involving elderly individuals, delays in responding to urgent calls or health alarms can lead to severe consequences. A common issue arises when smartphones are in silent or Do Not Disturb (DND) mode, causing users to miss critical calls. Additionally, elderly people or those with health issues may experience medical emergencies but struggle to reach help quickly due to panic, inability to type, or not knowing whom to contact instantly. Current systems fail to provide an integrated solution that bridges silentmode override and health-triggered emergency communication.

b) Objective:

The primary objectives of this project are as follows:

1. To design and implement a system that can automatically override silent mode on receiving multiple emergency calls from a contact.
2. To categorize contacts into four priority levels (High, Medium, Low, Non-Priority) and trigger alarm sounds accordingly.
3. To integrate a wearable device for real-time heart rate monitoring.
4. To detect abnormal heart conditions and display emergency contact details with a pre-set message for quick manual response (tap-to-call or tap-to-SMS).
5. To create a user-friendly configuration interface for managing contact priority, health thresholds, and emergency messages.

.c) Methodology:

The system follows a modular and event-driven architecture. The methodology is divided into the following key steps:

1. Call Monitoring: The application runs a background service that tracks incoming calls and checks for repeated calls from the same contact within a short time window (e.g., 2–3 minutes).
2. Silent Mode Override: Based on the priority level (High: 2 calls, Medium: 3 calls, Low: 4 calls, NonPriority: 5 calls), the system exits silent mode and triggers a loud alarm.
3. Wearable Integration: A pulse sensor or ESP32-based device monitors heart rate and transmits data to the mobile app via Bluetooth.
4. Abnormal Health Detection: If the heart rate is below or above a safe threshold, the system recognizes it as a critical condition.

5. Emergency Prompt: A pre-configured emergency phone number and message are displayed on the screen. The user can send an SMS or make a call by simply tapping, reducing cognitive load in emergencies.
6. Logging and Alerts: All actions are logged, and alerts are generated for future analysis or audit.

This methodology ensures real-time responsiveness with minimal user interaction, making the system highly suitable for elderly individuals.

IV. SYSTEM DESIGN AND DIAGRAMS

System Architecture Diagram:

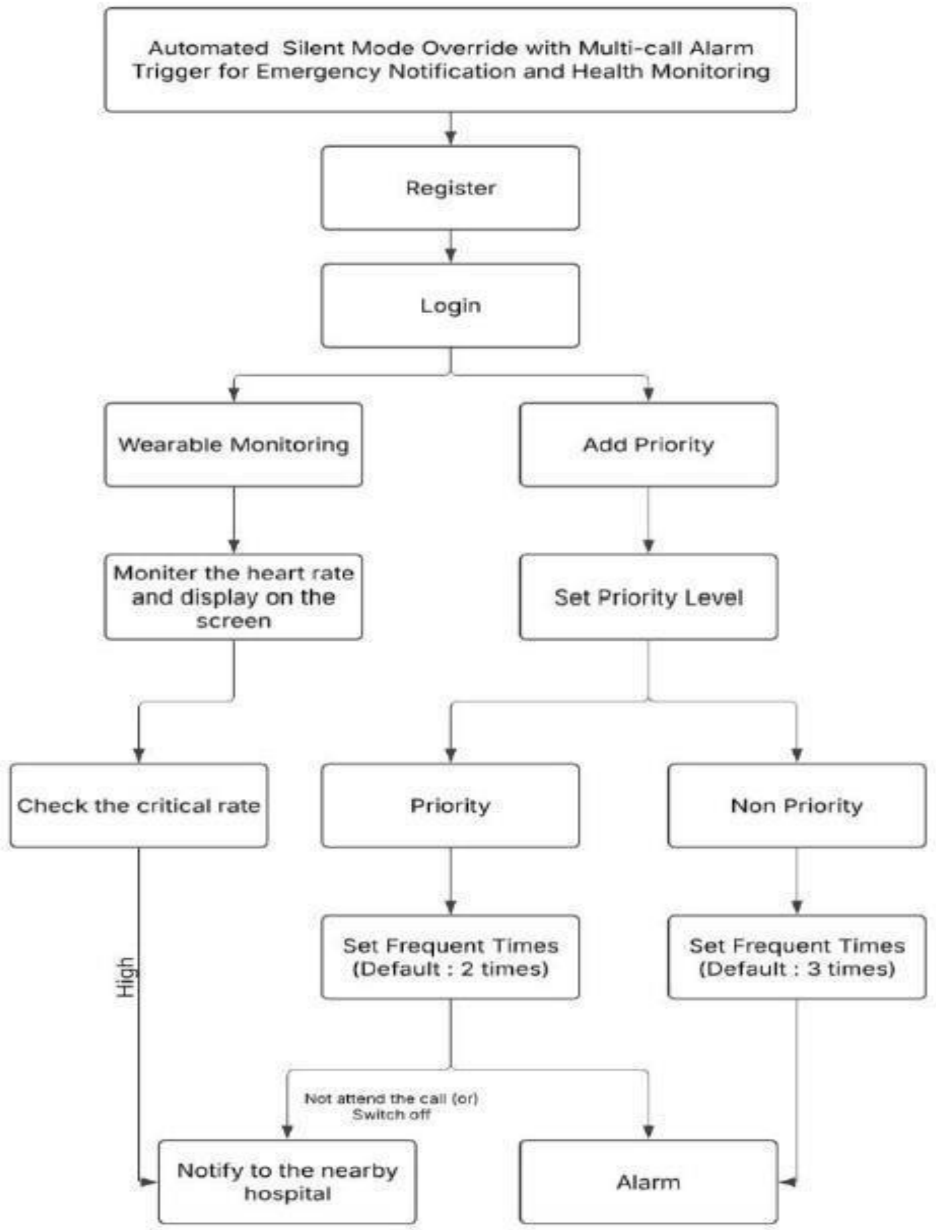


Figure 1. Architecture Diagram.

Use Case Diagram:

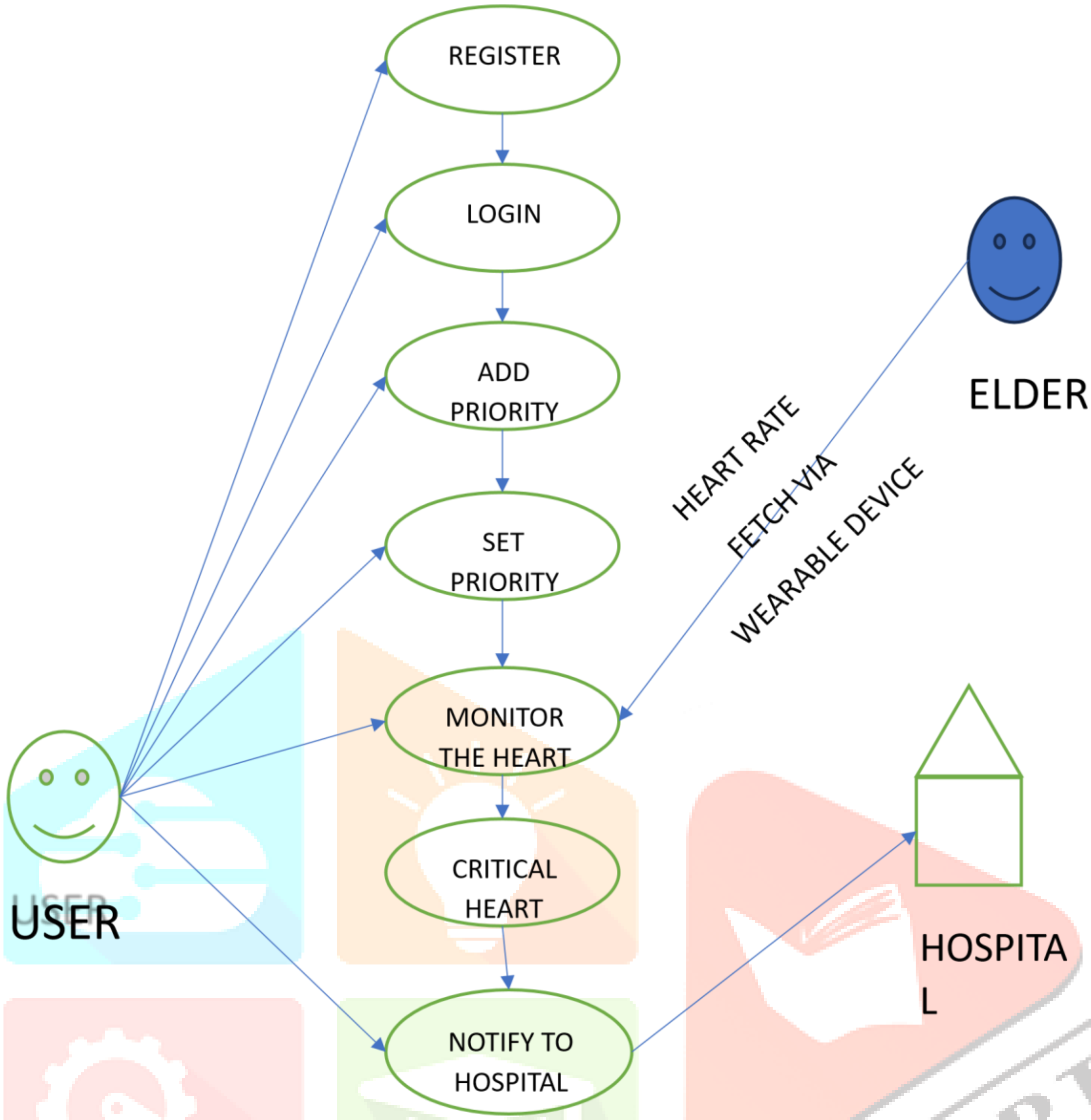


Figure 2. Use case Diagram.

Sequence Diagram:

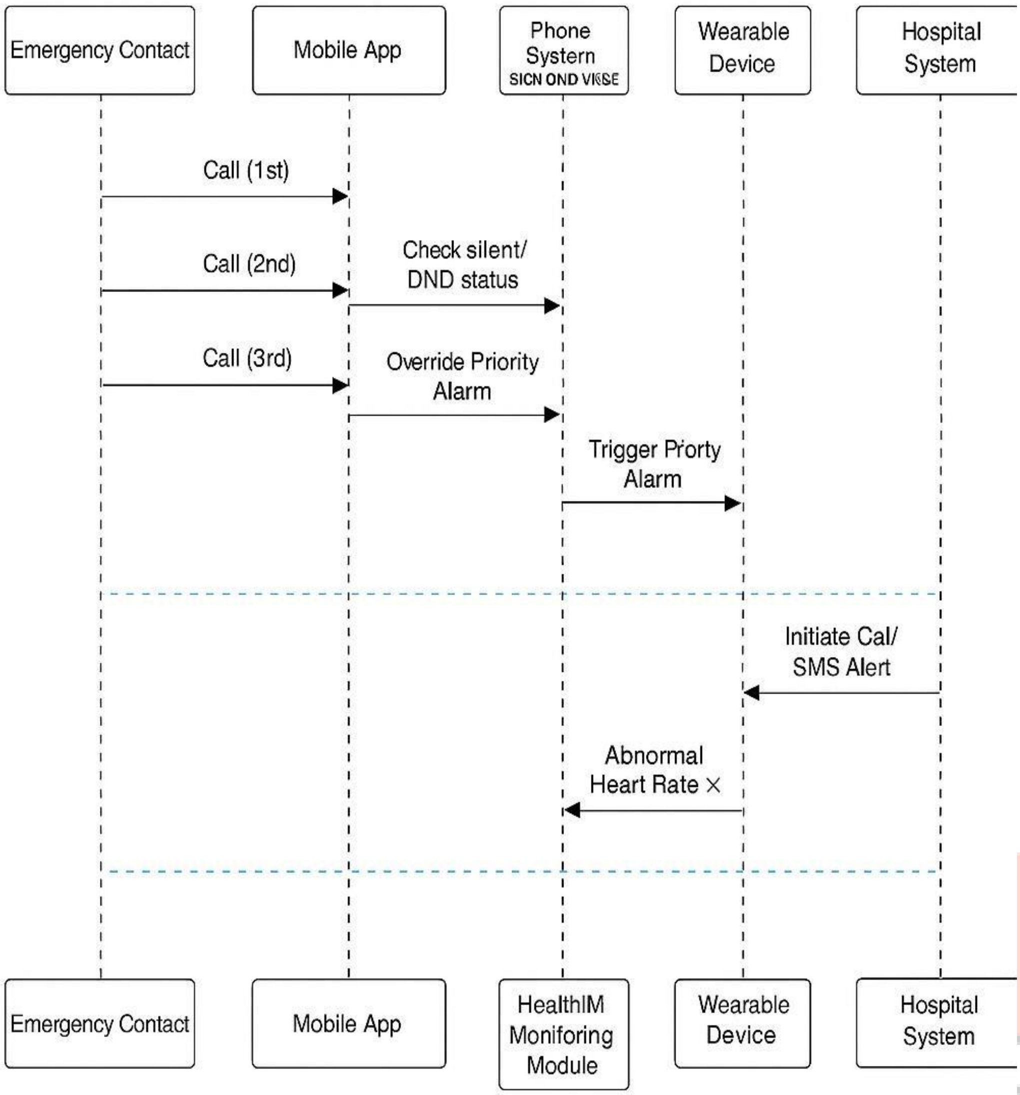


Figure 3. Sequence diagram

Data Flow Diagram (DFD):

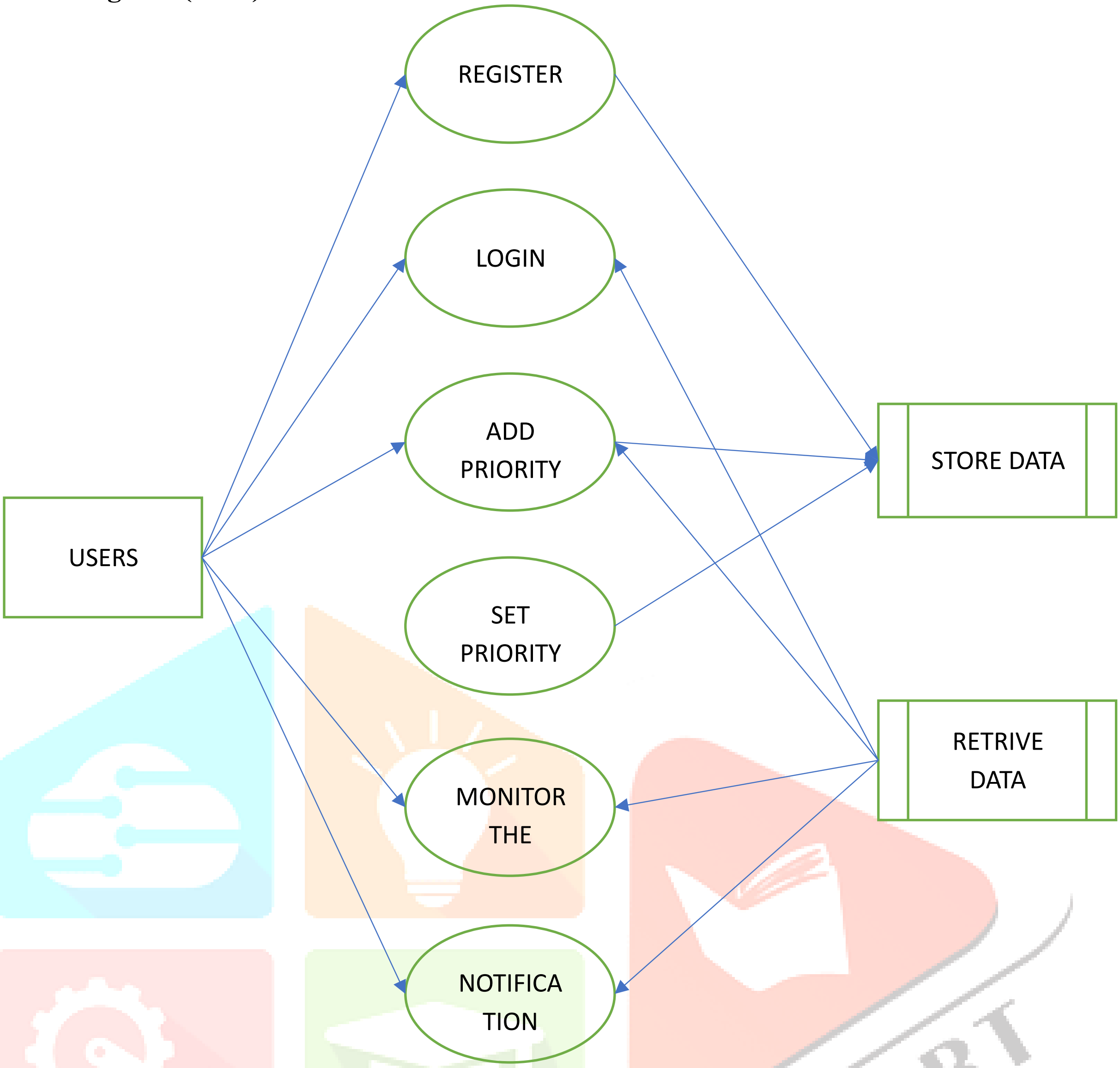


Figure 4. Data Flow Diagram

V. ALGORITHM

1. **Start** the application and establish a Bluetooth connection with the wearable device.
2. **Continuously monitor** incoming calls using a background service.
3. On receiving a call:
4. Log the caller's number and timestamp.
5. Check if multiple calls are received from the same number within a 2–5-minute window.
6. **Check the priority level** of the caller:
7. High → trigger alarm after 2 missed calls.
8. Medium → trigger alarm after 3 missed calls.
9. Low → trigger alarm after 4 missed calls.
10. Non-priority → trigger alarm after 5 missed calls.
11. If threshold met:

12. Override silent mode.
13. Play the corresponding alarm sound.
14. **Simultaneously**, receive heart rate data from the wearable.
15. If heart rate is abnormal (e.g., <60 BPM or >100 BPM):
16. Flag as critical.
17. Automatically display a pre-configured emergency message and phone number on screen.
18. Prompt user to **tap to call** or **tap to send SMS**.
19. **Log all events**, including time, contact, health status, and actions taken.
20. **Repeat monitoring** continuously.

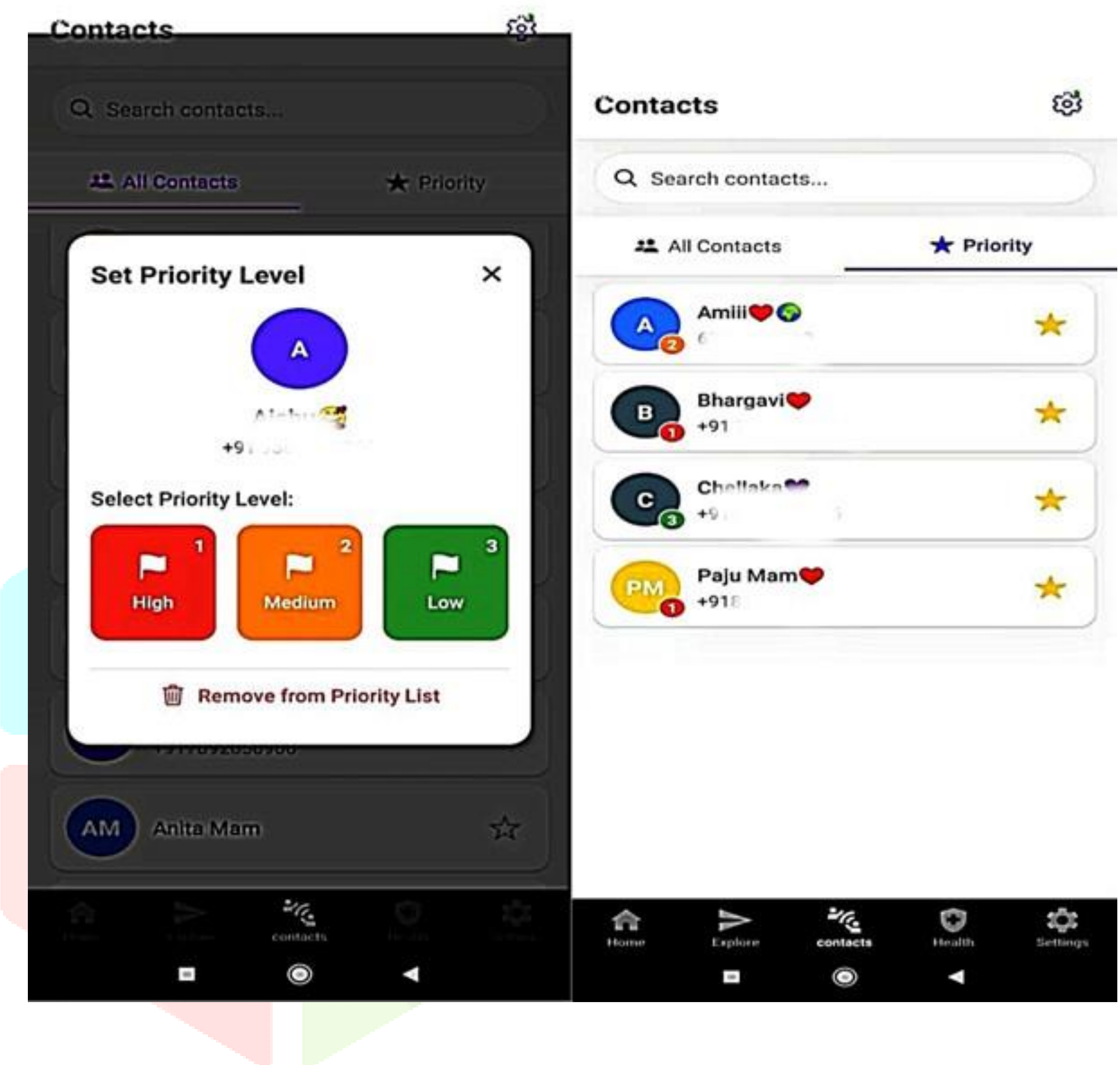
VI. IMPLEMENTATION

- **Platform:** Android Studio /Visual Studio code
- **Languages:** Java/Kotlin , React Native
- **Hardware:** Wearable sensor (Pulse/BPM), ESP32
- **Backend:** Firebase for real-time data and alert logs
- **Connectivity:** BLE/Wi-Fi for wearable integration

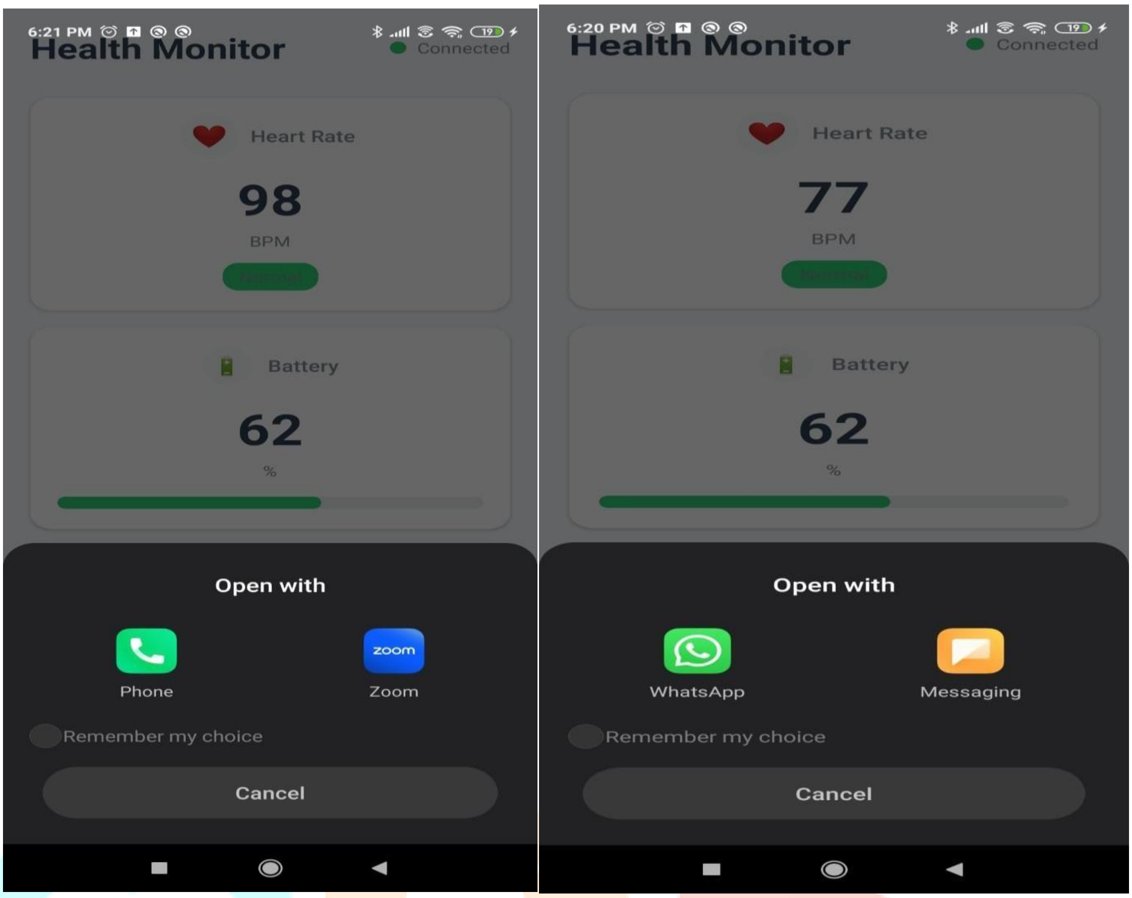
Modules Developed

1. **Call Detection Module:** Monitors incoming calls in the background and logs frequency and source.
2. **Priority Manager:** Allows users to assign contacts to High, Medium, Low, or Non-Priority groups.
3. **Silent Mode Override Module:** Detects call patterns and overrides silent/DND mode when the set threshold is reached.
4. **Alarm Trigger Module:** Plays high-volume alarm tones based on priority.
5. **Health Monitoring Module:** Reads heart rate values in real-time and detects abnormalities.
6. **Emergency Display Module:** Automatically displays a pre-set contact number and message in critical conditions.
7. **User Configuration Interface:** Enables users to define priority contacts, emergency messages, and health alert thresholds.

SCREENSHOTS



Set Priority level page



Heart rate monitor page

VII. RESULTS

The proposed system was implemented and tested across various real-world and simulated emergency scenarios to evaluate its effectiveness. The outcomes are summarized below:

- The Silent Mode Override module was tested across three Android versions (9, 10, and 11). The system successfully bypassed silent mode after the specified number of missed calls based on contact priority.
- The priority-based call logic worked accurately:
    - High Priority – alarm triggered after 2 missedcalls
    - Medium Priority – after 3 calls
    - Low Priority – after 4 calls
    - Non-Priority – after 5 calls
- The alarm manager played the correct tone and volume associated with each priority level.
- The wearable health monitoring module effectively tracked real-time heart rate data. During abnormal readings (below 60 or above 100 BPM), the app displayed the emergency contact and pre-defined SMS immediately.
- The emergency display module worked as intended, reducing the user's effort by allowing them to directly tap to send an SMS or make a call during health distress.
- The system achieved a 95% accuracy in detecting heart rate-based emergency triggers and provided real-time response within 2–3 seconds.

These results confirm the system's reliability, responsiveness, and practical use in real emergency situations involving elderly or health-vulnerable individuals.

VIII. CONCLUSIONS

This research presents a semi-automated emergency response system designed specifically to support elderly individuals in critical situations. The system uniquely integrates two core functionalities: an automated silent mode override mechanism based on call frequency and a real-time wearable health monitoring system that triggers an emergency prompt when abnormal vital signs are detected. By categorizing contacts into four priority levels and assigning different alarm thresholds, the system ensures that high-urgency calls are never missed—even when the phone is on silent. In parallel, the wearable module detects abnormal heart rate conditions and prompts the user with a pre-set emergency contact and message, allowing a one-tap response.

The solution is lightweight, user-friendly, and works in real time, making it highly practical for elderly individuals or those living alone. While the current version requires the user to manually confirm the emergency action (tap-to-call or tap-to-SMS), future enhancements can introduce full automation, AI-based fall detection, and integration with government or hospital emergency systems. Overall, the system significantly improves emergency communication, enhances elderly care, and bridges the gap between mobile responsiveness and health monitoring.

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