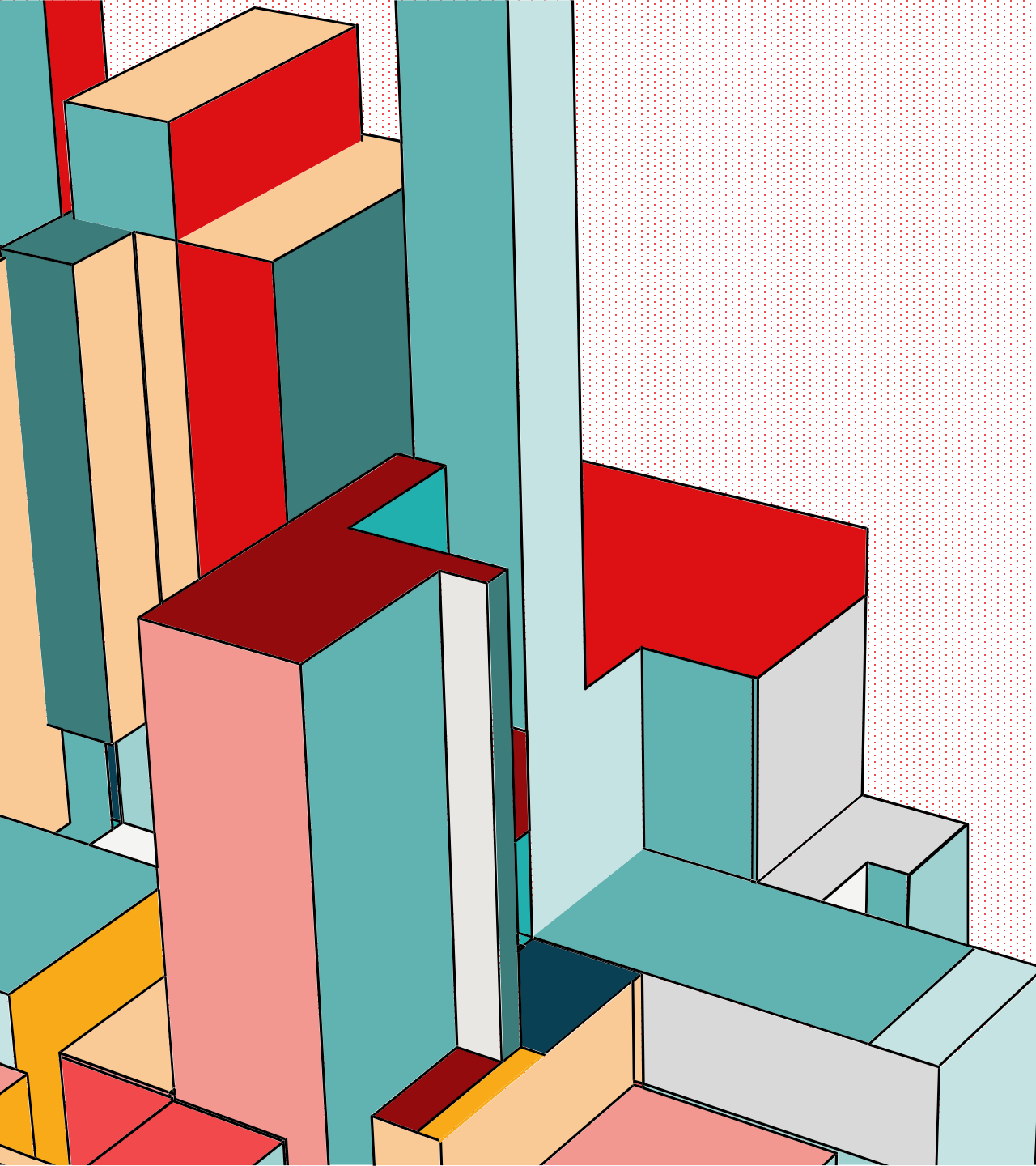


RESCUE PULSE:

**REAL-TIME HEART CONDITION
MONITORING AND EMERGENCY
ALERT SYSTEM USING MOBILE
AND WEARABLE DEVICES**

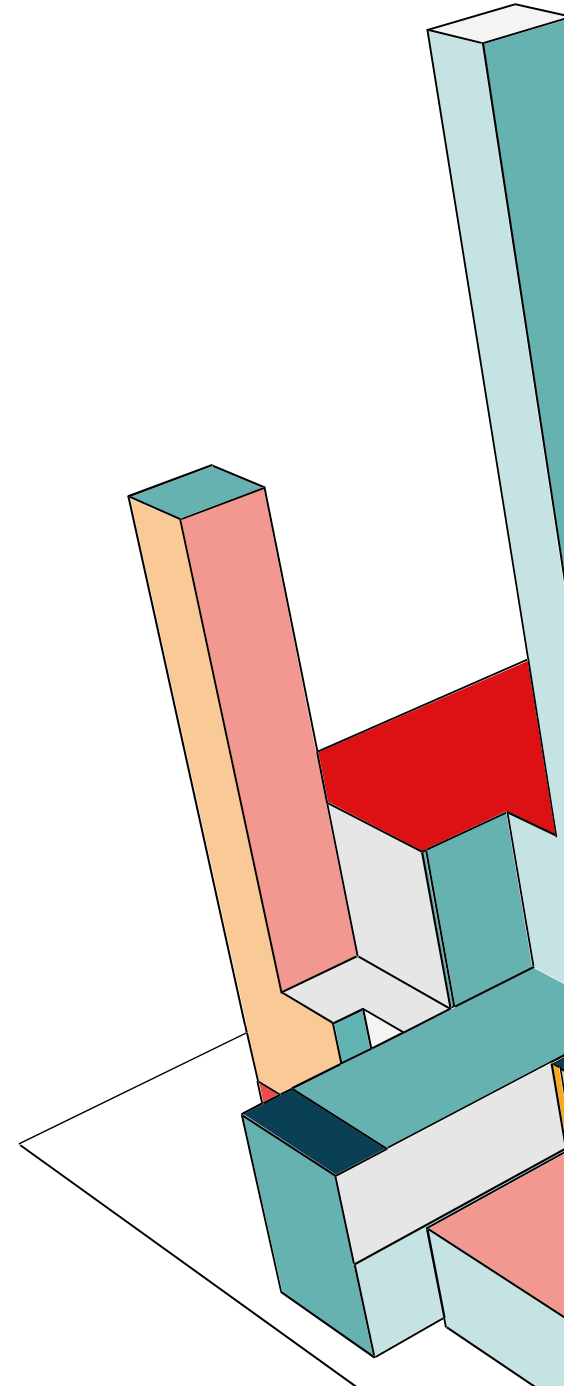
Presented by:
• Arsalen Bidani

16 June, 2024



CONTENTS

- I. Introduction
- II. Problematic & Objectives
- III. System Architecture
- IV. Anomaly Detection System
- V. User Interface
- VI. Conclusion & Future Work



I. INTRODUCTION

- Continuous heart rate monitoring is a **vital** tool for managing cardiovascular health, particularly for individuals at high risk of heart disease.
- Globally, it is estimated that more than **17 million** people die each year from cardiovascular diseases, with a large fraction due to sudden cardiac events.
- Studies suggest that up to **40%** of sudden cardiac deaths could be preventable with early detection and timely intervention.



II. PROBLEMATIC

- **Traditional Monitoring Limitations:**
ECG-based devices, though effective, require electrode placement and are cumbersome for continuous use, limiting their practicality for everyday monitoring.
- **Need for Continuous Monitoring:**
High-risk patients, particularly those with a history of heart attacks, require constant monitoring to detect anomalies early and respond promptly.



II. OBJECTIVES

- **Develop a Comprehensive Monitoring System:** Create a system that leverages wearable technology to continuously monitor heart rate using the PPG sensor.
- **Integrate Emergency Response:** Ensure the system can detect anomalies and immediately alert the user and emergency contacts, initiating calls and sending messages with relevant information.
- **Improve Accessibility and Usability:** Design a user-friendly solution that works seamlessly in the background, providing reliable monitoring without disrupting the user's daily activities.

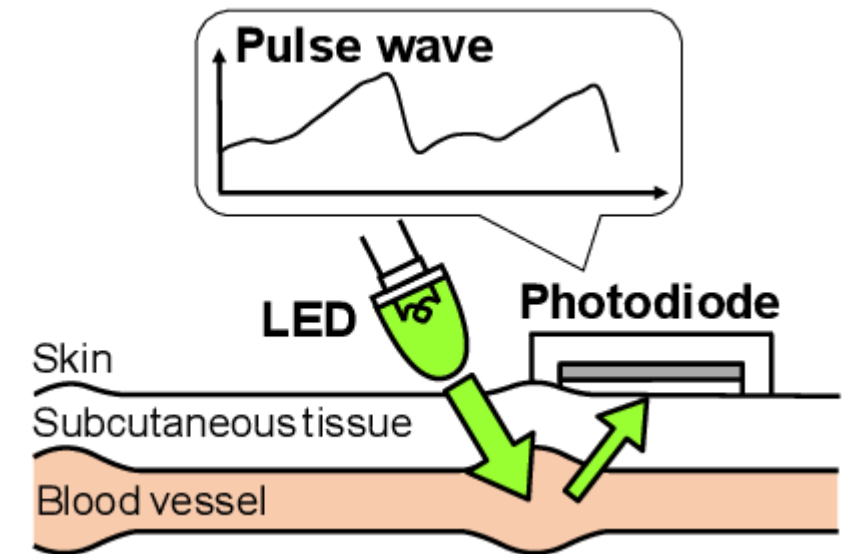


Figure 1. Overview of PPG sensor

III. SYSTEM ARCHITECTURE

- RescuePulse consists mainly of three actors:
 1. Potential victim
 2. Wearable device application
 3. Mobile companion application

- Hardware Utilized:



TCL T506G
running on Android 13



Google Pixel Watch 2
running Wear OS 4.0

III. WEARABLE DEVICE APPLICATION

1. PPG Sensor Integration:

- Utilizes the PPG (Photoplethysmography) sensor for continuous heart rate monitoring.
- Integrated directly on the Google Pixel Watch 2 for real-time data collection, non-invasive, continuous tracking of the user's heart rate.

2. Foreground Services:

- Employs foreground services to ensure the app remains active and responsive.
- Allows continuous data monitoring and immediate alerting without interruption.

3. Alarming :

- The integration of additional hardware components as the **vibrator** and **audio manager**.
- Upon detecting anomalies in heart rate, the vibrator provides **tactile feedback** to the user, ensuring alerts are noticed even in noisy or silent environments.



Figure 2. A PPG sensor placement on Google Pixel Watch 2

III. MOBILE DEVICE APPLICATION

1. Emergency Alert Management:

1. Manages emergency contacts and service for rapid response.
2. Initiates calls to predefined emergency services in case of detected anomalies.
3. Sends SMS notifications to designated contacts with the user's GPS location.

2. Data Synchronization:

1. Receives real-time heart rate data from the wearable device application.
2. Syncs data securely via **MessageClient API** for timely monitoring and alerts.
3. Ensures seamless communication between the wearable and mobile applications.

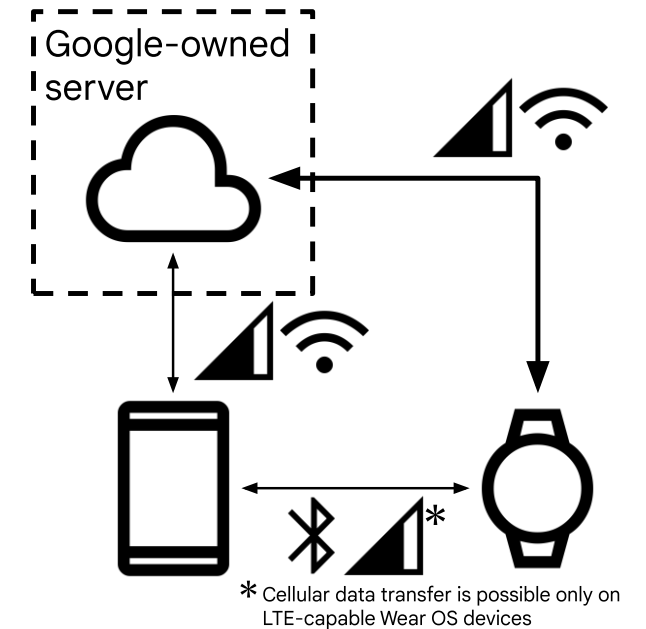
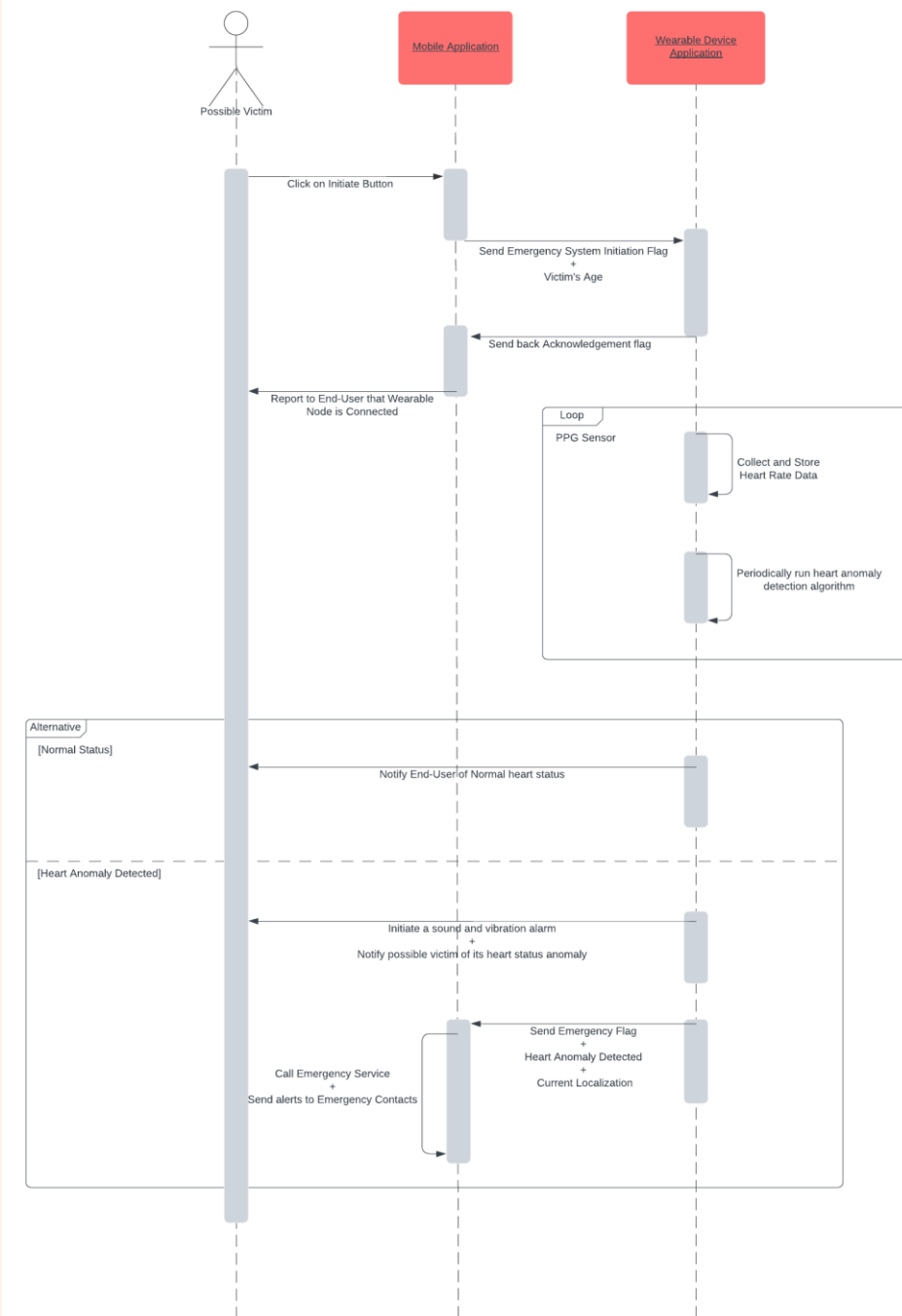


Figure 3. A sample of network of nodes with handheld and Wear OS devices.

III.GENERAL SYSTEM WORKFLOW

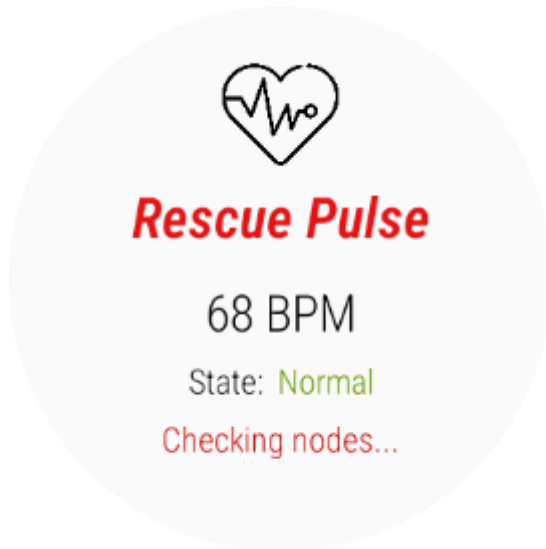




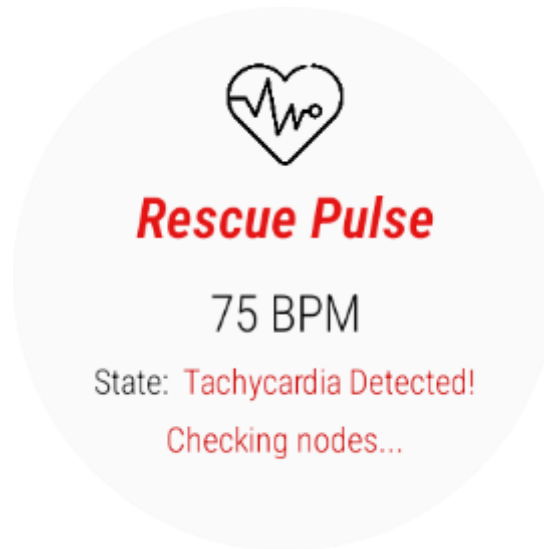
IV. ANOMALY DETECTION SYSTEM

- Methodology:
 - Uses Gellish formula to calculate Maximum Heart Rate (MHR), it reflects individual variability in observed HRmax due to age.
$$\text{MHR} = 208 - (0.7 * \text{Age})$$
- Anomalies Detected:
 1. Bradycardia:
Defined as heart rate below a threshold depending on age (e.g., 60 bpm) for more than 10 minutes.
 2. Tachycardia:
Heart rate above the MHR threshold (e.g., 180 bpm) for more than 10 minutes.
- Implementation:
 - The anomaly detection algorithm continuously monitors heart rate data against predefined thresholds, ensuring rapid detection and notification of abnormal heart rhythms.

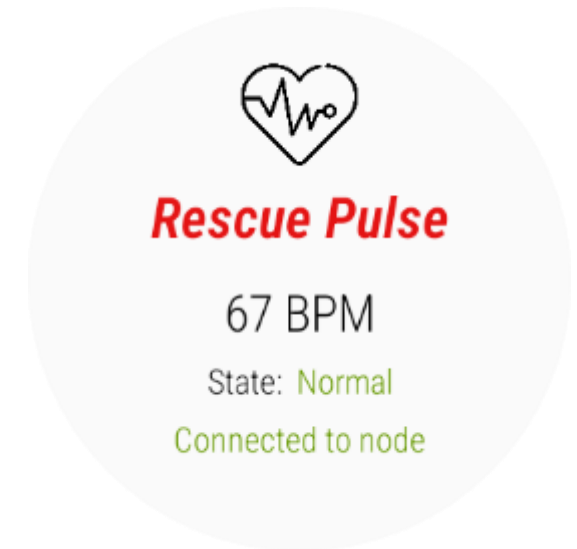
V. USER INTERFACE



Wearable denoting normal status of heart but not connected to mobile companion

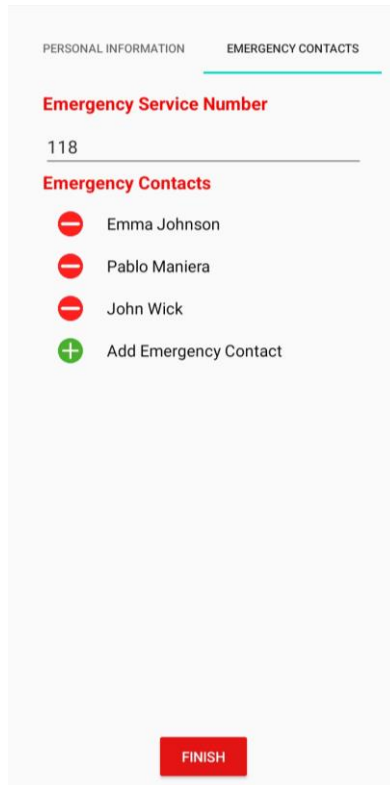


Arrhythmia Alert of Tachycardia



Normal Heart Status with Mobile Node Connected

V. USER INTERFACE



PERSONAL INFORMATION EMERGENCY CONTACTS

Emergency Service Number

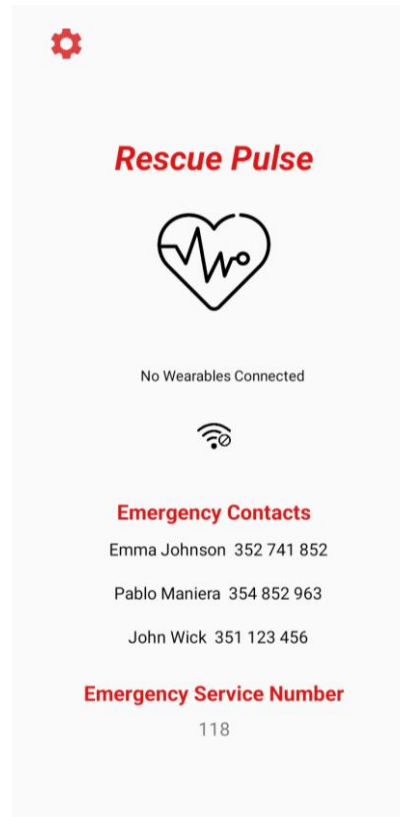
118

Emergency Contacts


- Emma Johnson
- Pablo Maniera
- John Wick
- + Add Emergency Contact

FINISH


*Emergency Contacts and
Service Management*



Rescue Pulse



No Wearables Connected



Emergency Contacts

Emma Johnson 352 741 852

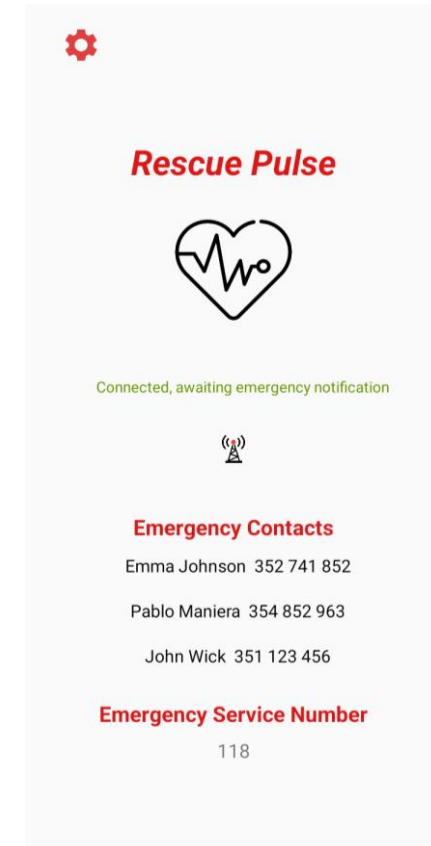
Pablo Maniera 354 852 963

John Wick 351 123 456


Emergency Service Number

118


*Mobile Companion Post Setup
Screen
Wearable Not Connected*



Rescue Pulse



Connected, awaiting emergency notification



Emergency Contacts

Emma Johnson 352 741 852

Pablo Maniera 354 852 963

John Wick 351 123 456

Emergency Service Number

118

*Mobile Companion Post Setup
Screen
Wearable Node Connected*



CONCLUSION & FUTURE WORK

Overview:

- RescuePulse provides an efficient and user-friendly solution for continuous heart rate monitoring.
- Enhances early detection of bradycardia and tachycardia, potentially saving lives.
- Beneficial for individuals in remote or underserved areas with limited access to clinical facilities.

Future Improvements:

- Integrating more sophisticated algorithms for detecting a wider range of heart anomalies.
- Incorporating additional sensors for more comprehensive health monitoring.
- Implementing cloud-based storage and advanced analytics for long-term health data tracking.



THANK YOU

LIVE DEMO