SOEN6841: Software Project Management

Winter 2025

PROBLEM IDENTIFICATION

FOR

AI-DRIVEN HEALTH MONITORING APP

Date of Submission: February 02, 2025

Submitted to:

JOUMANA DARGHAM

Team Information

Student Name	Student ID
Jayanth Apagundi	40291184
Priyadarshine Kumar	40293041
Swathi Priya Pasumarthy	40322468
Jayasurya Pazhani	40289512

1. Problem Identification

Title: AI-Driven Mobile App for Personalized Health Monitoring

Objective:

AI-Driven Mobile App for Personalized Health Monitoring is an intelligent health monitoring app that provides real-time, comprehensive health tracking using state-of-the-art artificial intelligence and wearable technology. It tracks physical health (heart rate, temperature, exercise) and mental health (stress, fatigue) via smartwatch sensors. Yet, it's important to note that mental health awareness of conditions comes from voice and facial analysis.

This project will incorporate machine learning in the following ways:

Random Forest will be used to detect the type of exercise, **Support Vector Machines (SVM)** will be used for heart disease acquisition detection and assessment and heart disease risk assessment, and **Convolutional Neural Network (CNN)** will be used for emotion and fatigue detection. When this application provides users with a true assessment of their health, they can be preventative in lifestyle changes by no longer ignoring symptoms or truths.

Content:

Problem/Opportunity Statement:

Chronic conditions are increasing, and a senior population wants to take a proactive approach to any diagnosis relative to health management. Assessment and better devices should be more integrated and technologically advanced. However, wearable technology that would facilitate such things is not as prevalent as it should be. The assessment, therefore, comes from fallible blood pressure readings from seldom-frequented doctor's offices or pharmacy chains and an inability to get accurate, 24-hour blood pressure readings when someone complains at their semi-annual or annual check-up. In addition, the blood pressure measurements that do exist are more worn as pedometers and heart rate monitors with no medical oversight than supported by the artificial intelligence (AI) technology needed to provide accurate, comprehensive diagnosis.

The core problem this project addresses is the absence of an intelligent, integrated health monitoring solution that combines both physiological and behavioral data for a holistic view of

an individual's health. The system aims to overcome the limitations of current technologies by utilizing AI-driven models capable of analyzing data from smartwatches and mobile applications. This includes monitoring vital signs such as heart rate, body temperature, and step count, as well as detecting psychological states like stress and fatigue through speech and facial recognition analysis.

The goal is to create a robust, dependable, and efficient health monitoring system that not only collects data but also processes it intelligently to provide timely health assessments and actionable advice. By incorporating machine learning algorithms like Random Forest for activity recognition, Support Vector Machines (SVM) for cardiovascular risk assessment, and Convolutional Neural Networks (CNN) for mood and fatigue detection, the system seeks to deliver high accuracy in health evaluations. This comprehensive approach empowers users to actively manage their health, make informed decisions, and adopt preventive measures, ultimately contributing to improved health outcomes and quality of life.

Project Scope:

In-Scope:

- Development of AI models for health predictions.
- Secure API integration with wearable devices.
- UI/UX design for user-friendly experience.
- Compliance with medical regulations (HIPAA, GDPR).
- Mobile application development (Android & iOS).

Out-of-Scope:

- Direct medical consultation or prescriptions.
- Hardware manufacturing (third-party wearable integration only).
- Diagnosis of complex medical conditions without human oversight.

Significance in Healthcare Domain:

Early Detection & Prevention: AI-driven analytics can identify potential health risks before they become critical, reducing hospital admissions and emergency cases.

Personalized Health Insights: AI models can provide recommendations tailored to an individual's lifestyle, medical history, and daily activities.

Reduced Healthcare Costs: By preventing major illnesses and reducing doctor visits through self-monitoring, individuals can significantly lower healthcare expenses.

Improved Accessibility: The app ensures continuous health monitoring for individuals in remote or underserved areas who have limited access to medical facilities.

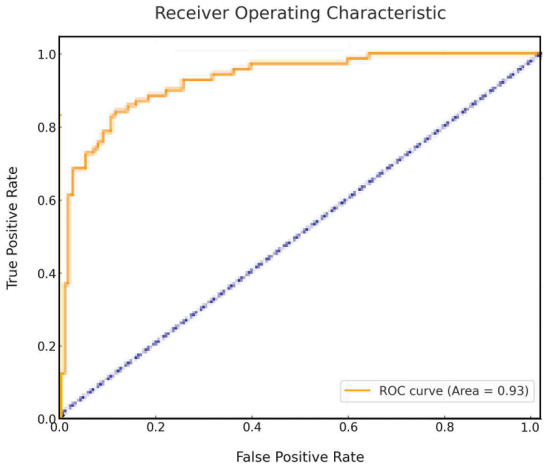

Fig 1: ROC Curve Analysis for the SVM Model

The figure related to ROC Curve Analysis for the SVM Model, showing an **AUC (Area Under the Curve) of 93%**, which indicates excellent model performance in distinguishing between different cardiovascular risk levels. This suggests that the model is highly effective at predicting heart health risks, making it a valuable tool for early detection of potential cardiovascular conditions.

The findings highlight the feasibility of AI-driven mobile health applications in providing real-time, highly accurate personalized health monitoring.

Stakeholder Analysis

Stakeholder	*Role & Impact*	*Interest & Concerns*
Individual Users	Primary beneficiaries using the app for health tracking and recommendations.	Accuracy of AI predictions, ease of use, data privacy, and integration with wearable devices.
Healthcare Professionals	Doctors and specialists who can use the app's insights for improved patient care.	Reliability of AI-generated recommendations, data sharing compliance, and reducing misdiagnosis.
Hospitals & Clinics	Institutions that can integrate the app for remote patient monitoring.	Integration with existing systems, regulatory compliance, and potential cost savings.
Insurance Company	Firms that may use the app for policy adjustments based on health metrics.	Risk assessment, fraud prevention, and customer engagement through incentives for healthy habits.
Regulatory Bodies	Government agencies ensure data security and compliance with health regulations.	Data privacy, ethical AI use, and adherence to medical standards (e.g., HIPAA, GDPR).
Tech Companies & Developers	Developers building the AI algorithms and infrastructure for the app.	Scalability, AI model accuracy, security, and ongoing maintenance.

Relevance to Software Solution:

How the Problem Can Be Addressed through Software Development?

The health monitoring challenges identified in this project are comprehensively addressed through the development of an advanced software solution that integrates artificial intelligence (AI) with wearable technology. The Smart Health Monitoring App (SHMA) leverages software to bridge the gap between raw physiological data collection and actionable health insights, ensuring real-time, accurate, and personalized health monitoring.

At the core of the solution is a **React Native mobile application** that provides a user-friendly interface for individuals to interact with their health data. This app seamlessly communicates with a Google Pixel Watch, which collects real-time physiological metrics such as heart rate, body temperature, and physical activity levels. The mobile application is designed not only to display this data but also to process it through sophisticated AI algorithms, transforming raw information into meaningful health insights.

The software incorporates multiple machine learning models tailored to different health parameters:

- Random Forest algorithms are used for activity recognition, classifying user activities like walking, running, or sitting with an accuracy of 98%.
- Support Vector Machines (SVM) assess cardiovascular risk by analyzing physiological data patterns, achieving an accuracy of 86% and an AUC (Area Under the Curve) of 93%.
- Convolutional Neural Networks (CNN) handle mood detection through speech analysis and facial fatigue recognition, with accuracies of 97% and 93%, respectively.

The scope of the software solution extends beyond simple data visualization. It integrates behavioral health monitoring by analyzing speech for stress detection and facial expressions for fatigue recognition. These AI-driven insights allow for proactive health management, providing personalized recommendations and early warnings about potential health issues. Furthermore, the app is designed for scalability and adaptability, capable of integrating with additional

wearable devices and expanding its monitoring capabilities to cover more complex health metrics in the future.

The backend infrastructure, powered by **Node.JS**, ensures efficient data processing and secure communication between the smartwatch and the mobile app. The software architecture is built to handle real-time data streams, ensuring continuous monitoring without compromising performance. Additionally, the use of Figma for front-end design ensures an intuitive user experience, making complex health data easily accessible and understandable for users.

The SHMA shows how software development can transform wearable health technology into a comprehensive, intelligent health management system. It addresses the limitations of traditional health monitoring methods by providing a scalable, user-centric, and AI-powered solution that empowers individuals to take control of their health proactively.

Initial Thoughts on Scope

- ➔ **Core Features:**
  - ◆ AI-driven analysis of vital signs (heart rate, blood pressure, oxygen levels, etc.).
  - ◆ Personalized health insights and recommendations.
  - ◆ Real-time alerts for potential health issues.
  - ◆ Secure data storage and encryption.
  - ◆ Integration with wearable devices.
- ➔ **Advanced Features:**
  - ◆ Chatbot-powered health guidance.
  - ◆ Integration with telemedicine platforms.
  - ◆ Predictive analytics for disease prevention.
  - ◆ Gamification for user engagement.
- ➔ **Target Users:**
  - ◆ Individuals with chronic conditions.
  - ◆ Fitness enthusiasts and wellness-conscious users.
  - ◆ Elderly individuals who require regular health monitoring.

Flow Chart:

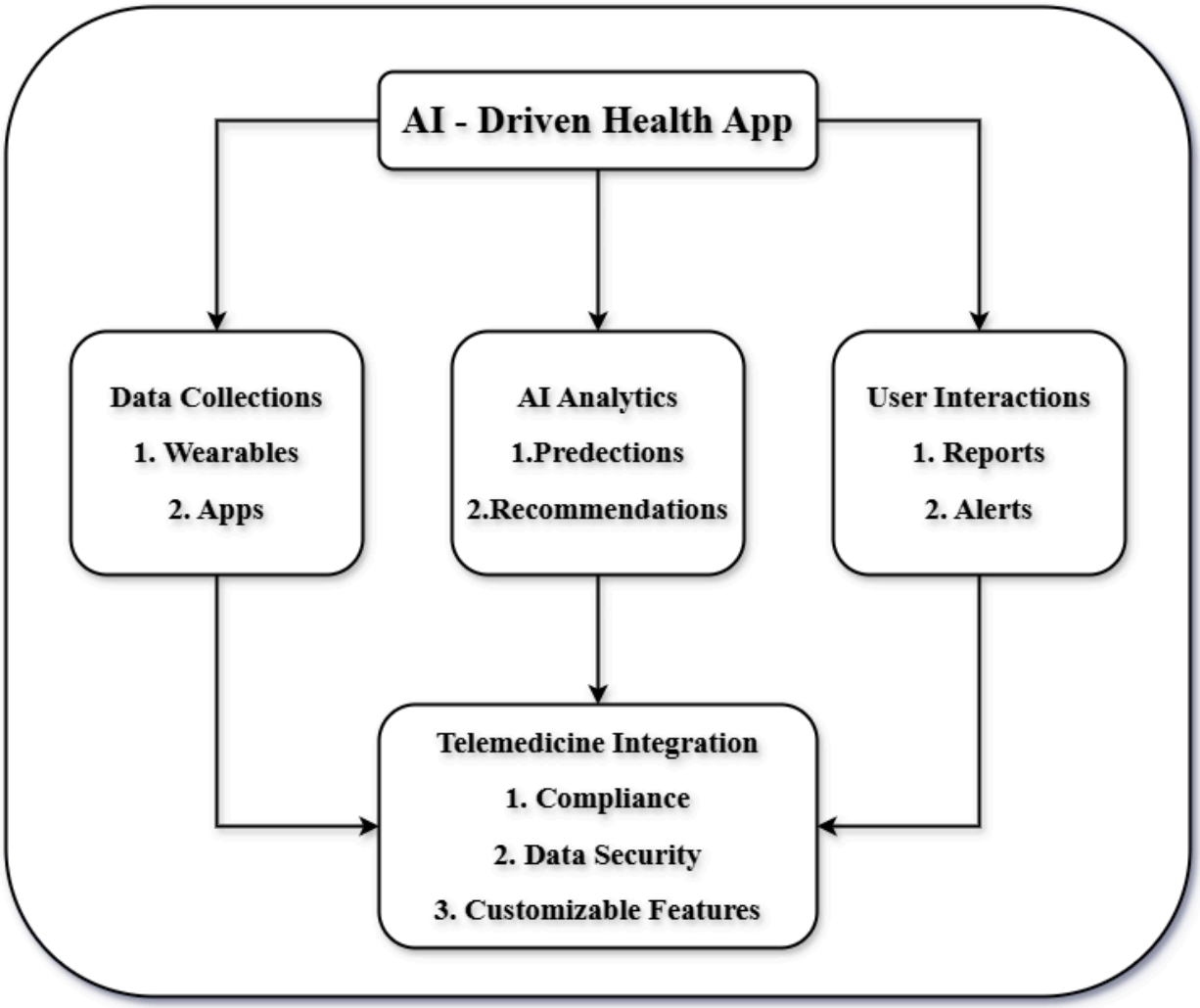

Fig 2: Flow Chart for AI - Driven Health App

Project Charter:

The AI-Driven Health Monitoring App project aims to develop a cutting-edge software solution that leverages artificial intelligence to analyze health data, provide personalized recommendations, and alert users to potential health concerns. This application will integrate with wearable devices, allowing users to monitor their health in real time while ensuring data privacy and compliance with regulations such as HIPAA and GDPR. The project will cater to individual users, healthcare providers, and regulatory bodies, addressing their needs through

secure data storage, AI-driven analytics, and an emergency alert system. Key deliverables include a fully functional mobile app, AI-powered insights engine, and secure cloud-based storage. The project will follow a structured timeline, starting with research and planning (Month 1), UI/UX design and prototyping (Month 2), AI model development and testing (Months 3-4), integration with wearables and backend development (Month 5), beta testing and feedback (Month 6), and final deployment (Month 7). Potential risks include data security concerns, AI accuracy and bias, and user adoption challenges, which will be mitigated through robust encryption, continuous model training, and an intuitive user experience. Success will be measured by high user adoption rates, regulatory compliance, seamless wearable integration, and accurate AI-driven health insights, ensuring that users receive timely and actionable health alerts to improve their well-being.