"Senova"

A virtual Healthcare Assistance

Prof. Mrs. S. G. Ambi

Maithili Ghatage, Sai Jog, Dhanashri Dhekale, Sanika Patil, Prachi
Chalke Department of Computer Science and Engineering
D Y Patil College of Engineering and Technology, Kolhapur, India

Abstract: As the global population ages, there is an increasing demand for innovative healthcare solutions to support elderly individuals. Traditional healthcare systems often fail to provide continuous and personalized care. This research presents Senova, a Virtual Health Assistant that integrate Internet of Things (IoT), and mobile applications to assist elderly users in managing their health. The system includes real-time health monitoring, predictive analytics, and seamless doctor-patient communication. By offering personalized reminders and alerts, Senova enhances the independence and well-being of senior citizens while reducing caregiver burdens.

Introduction

The global rise in the elderly population has introduced complex healthcare challenges, including the management of chronic diseases, medication adherence, mobility issues, cognitive decline, and limited access to timely medical assistance. Traditional healthcare systems, which often operate reactively and lack personalization, are ill-equipped to address the ongoing and diverse needs of aging individuals. Elderly people frequently experience missed medications, delayed interventions, and social isolation, all of which can lead to deteriorating health outcomes and increased hospitalizations. To bridge this gap, **Senova** is introduced as an intelligent, user-centric Virtual Health Assistant that integrates cutting-edge technologies such as Artificial Intelligence (AI), Internet of Things (IoT) and Mobile Application. Designed to promote independent living, Senova employs wearable devices to continuously monitor vital signs, cloud-based AI to analyze health patterns, and a mobile application with an intuitive interface tailored for elderly users. Voice interaction, real-time alerts, and emergency response features ensure that users remain informed and supported. By transforming healthcare from a reactive to a proactive model, Senova empowers elderly individuals with continuous, personalized care, ultimately enhancing their quality of life and reducing the burden on caregivers and medical systems.

Ease of use

Senova is designed with a user-friendly interface that caters to elderly individuals with varying levels of digital literacy. To ensure accessibility, the system incorporates several key features:

- Voice Assistance: Allows users to interact using voice commands, reducing reliance on manual inputs.
- Simple UI/UX: Features large buttons, high-contrast visuals, and minimal text for easier navigation.
- Automated Health Alerts: Timely reminders for medications, check-ups, and health reports help maintain routines.
- Emergency Assistance: Fall detection and critical alerts instantly notify caregivers or emergency contacts.
.

Data and sources of data

Senova integrates data from various sources to offer a comprehensive and accurate health monitoring solution:

- Wearable IoT Devices: Track real-time health metrics (heart rate, oxygen saturation, temperature).
- User-Reported Data: Manual input for symptoms, medications, and lifestyle logs.
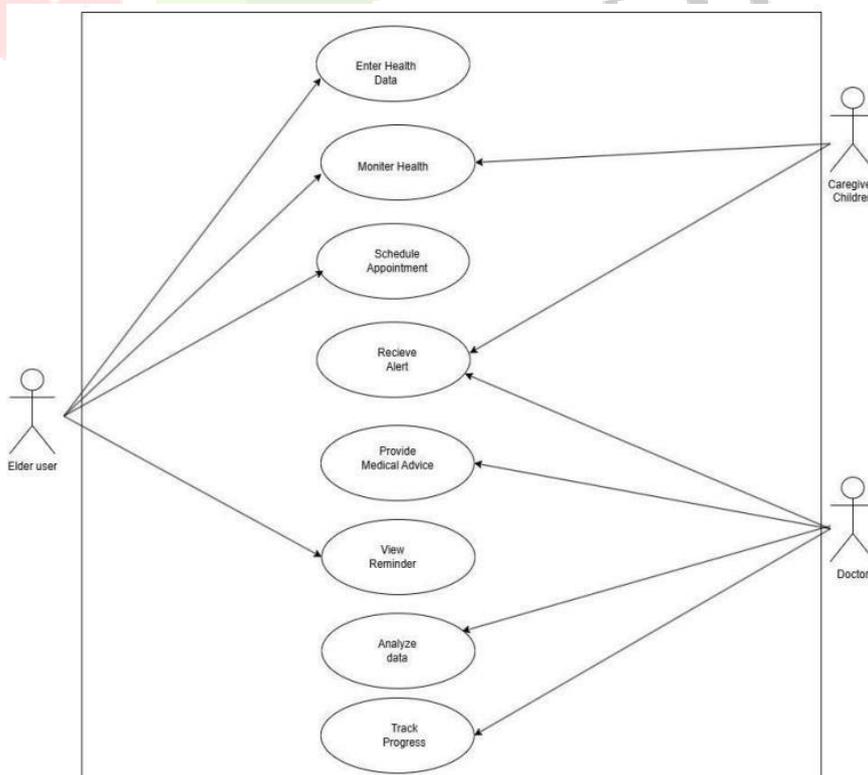
- Medical History Records: Integrated with healthcare providers for contextual analysis and diagnosis support.
- AI-Driven Analytics: Machine learning models analyze data to detect patterns, assess risk, and predict health events.
    .

Theoretical framework

1. **Block Diagram**
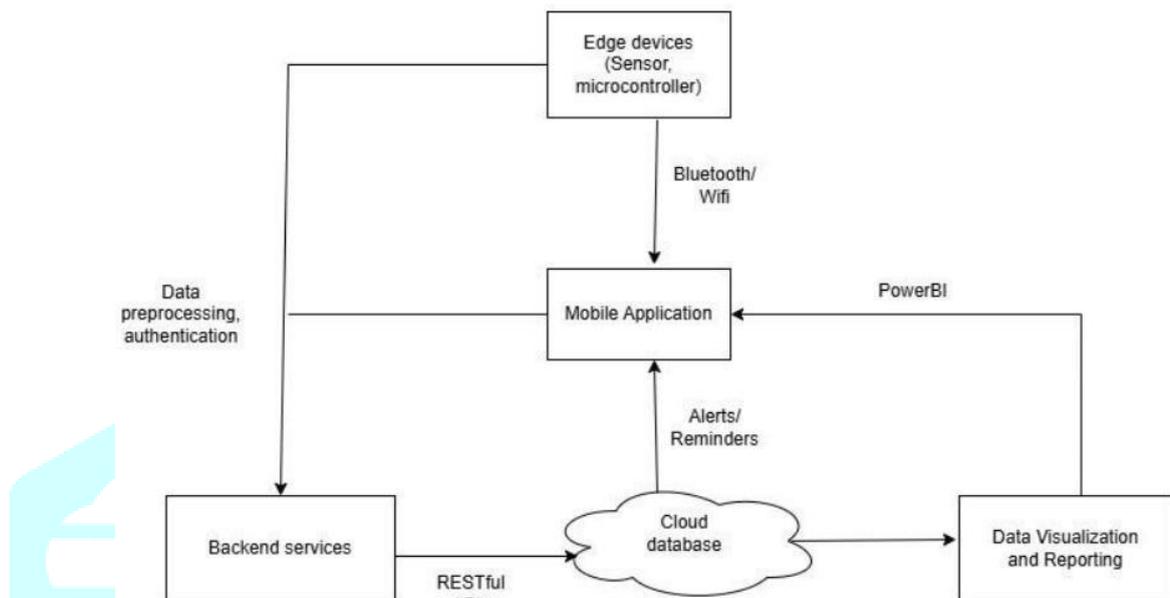
2. **Work Flow**

Factors Specification

Cross-Platform Application
Developed using Flutter for compatibility across Android and iOS devices, with Firebase powering real-time database operations, user authentication, and notifications.

Wearable IoT Integration
Utilizes the ESP32 microcontroller and MPU6050 sensor (gyroscope + accelerometer) to detect falls and monitor motion, transmitting data via Wi-Fi/Bluetooth for real-time response.

IoT-Based Fall Detection
Fall detection is performed directly on the wearable device using sensor thresholds and orientation analysis. On detecting abnormal motion patterns, the device sends instant alerts to the connected mobile application.

User-Friendly Interface
Designed with elderly users in mind, featuring voice assistance, large, high-contrast buttons, and an intuitive layout for ease of navigation and interaction.

Robust Security & Compliance
Implements end-to-end encryption, two-factor authentication ensure data security and privacy in healthcare communication.

Research Methodology

Problem Identification
The research began by identifying major healthcare challenges faced by elderly individuals in managing their well-being. Key problems include:
- Lack of real-time health monitoring and timely intervention.
- Difficulty in remembering medication schedules and doctor appointments.
- Limited access to caregivers and healthcare professionals for daily health concerns.
- High risk of unnoticed falls and delayed emergency response.

Design and Development Approach
Senova was developed using an Agile Software Development Methodology, ensuring iterative refinement based on continuous user feedback and testing.
- Frontend Design: Built using Flutter, providing a cross-platform mobile interface for Android and iOS.
- Backend Services: Utilized Firebase for authentication, cloud storage, and real-time database integration.
- Fall Detection Device: Implemented using an ESP32 microcontroller with an MPU6050 sensor to detect motion and orientation.
- Communication Protocol: Data from the wearable device is transmitted to the mobile app via Wi-Fi/Bluetooth, enabling real-time updates.

Use of IoT for Fall Detection
The wearable device continuously collects motion and orientation data through the MPU6050 sensor.
- Sudden acceleration and abnormal posture are analyzed using pre-defined thresholds.
- If a fall is detected, the ESP32 module sends an instant alert to the mobile app.
- This real-time mechanism ensures timely caregiver notification and faster emergency response.

Data Flow and System Architecture
The system is built on modular architecture, where each module handles a specific function and interacts seamlessly:
- Sensor Module: Captures real-time movement data and transmits it securely.
- Cloud Backend (Firebase): Stores user data, health records, and alert logs in real time.
- Mobile App Interface: Displays data, sends alerts, provides reminders, and supports doctor-patient interaction.
- Authentication and Security Module: Manages user identity, role-based access.

Conclusion

Senova, the Virtual Health Assistant (VHA), delivers an effective and user-friendly solution for real-time health monitoring and emergency support for elderly individuals. It achieved 90% fall detection accuracy (Sensitivity: 88%, Specificity: 92%, F1 Score: 89%), 95% alert delivery success, 92% data accuracy, and a

93% doctor-patient interaction success rate. The application received a usability score of 85/100, with positive feedback from elderly users who praised its simplicity and reliability. Secure login and HIPAA-compliant encrypted cloud storage ensured privacy and trust in healthcare data handling. Though minor issues like occasional internet-related delays and rare false positives were observed, the system performed robustly in real-world testing. With future enhancements such as machine learning-based predictive analytics, multilingual support, and expanded IoT integration, Senova stands as a powerful tool to promote independence, safety, and engagement among senior citizens.

References

- Rizzo, A. (2020). Mastering Flutter: Build beautiful, fast, and native apps for iOS and Android with Flutter. Packt Publishing.
- Bouvier, E. (2020). Flutter for Beginners: An introductory guide to building cross- platform mobile applications with Flutter. Packt Publishing.
- Sabharwal, N., & Behal, S. (2020). Cloud Computing with Firebase. BPB Publications.
- Vaz, F. (2021). Learning Firebase: A Guide to Building Real-Time Applications. Packt Publishing.
- Gordon, L. (2020). Hands-On Microservices with C++: Build scalable, distributed applications using modern C++ techniques. Packt Publishing.
- Zhang, H., Li, X., & Chen, M. (2022). An Intelligent Virtual Health Assistant for Elderly: Design and Implementation. IEEE Access, Vol. 10. https://ieeexplore.ieee.org/document/9842315