

AI POWERED PERSONAL ASSISTANT FOR DEMENTIA PATIENTS

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Keywords:

Artificial Intelligence (AI), Dementia Care, IoT-Based Healthcare, Fall Detection, GPS Tracking, Voice Assistance, Real-Time Monitoring, Assistive Technology.

Introduction:

Dementia is a progressive neurological condition that gradually weakens memory, reasoning, and the ability to perform everyday tasks. As the condition advances, individuals often struggle with communication, orientation, and decision-making, leading to growing dependence on caregivers. The rising number of dementia cases worldwide has highlighted the need for innovative, technology-driven solutions that can offer safe, consistent, and personalized support.

Artificial Intelligence (AI), Internet-of-Things (IoT) devices, and sensor-based monitoring systems now make it possible to deliver continuous assistance, detect emergencies, and provide emotional comfort to individuals with cognitive decline. While several assistive tools exist, most lack adaptability, personalization, real-time safety features, and caregiver integration.

The proposed AI-Powered Personal Assistant is designed to function as a reliable digital companion that assists dementia patients with reminders, safety alerts, behaviour monitoring, communication, and orientation support. By combining Raspberry Pi-based hardware, motion sensors, GPS tracking, voice interaction, and cloud connectivity, the system aims to improve patient independence while reducing the emotional and physical load on caregivers.

Objectives:

1. To design a smart assistant capable of delivering voice-based reminders for meals, medicines, appointments, and daily routines.
2. To implement continuous safety monitoring using fall detection, GPS tracking, and motion analysis.
3. To create a caregiver application for real-time alerts, location tracking, and daily activity updates.

4. To support memory recall using photos, personalised prompts, and simple communication tools.
5. To enable core functionalities to work even offline, ensuring reliability in low-connectivity environments.
6. To protect user data through secure on-device processing and encrypted cloud communication.
7. To provide an intuitive, accessible, and elderly-friendly interface that can adapt to changing cognitive abilities.

Methodology:

The proposed AI-based Dementia Assistance System is designed to provide secure, adaptive, and reliable support for dementia patients. The system integrates AI, IoT sensors, and cloud services to enable continuous monitoring, personalized assistance, and caregiver communication.

- **Data Security:** Patient data is protected using encryption techniques and role-based access control. Edge processing is used to reduce cloud dependency and enhance privacy.
- **Adaptive Learning:** The system uses AI algorithms to learn user behavior and provide personalized reminders, alerts, and predictive assistance.
- **Offline Functionality:** Core features such as fall detection, reminders, and monitoring operate without internet connectivity, with data synchronized when the network is available.
- **User-Friendly Interface:** The system provides voice-based interaction, simple navigation, and multilingual support to ensure ease of use for elderly users.

The system integrates hardware sensors, AI models, and cloud services into a unified support framework:

1. **Raspberry Pi 4** acts as the central processing controller, managing sensor readings, fall-detection algorithms, GPS data, voice output, and communication with the caregiver app.
2. **MPU-6050 Accelerometer and Gyroscope** continuously track movement patterns to detect falls or sudden instability.
3. **NEO-6M GPS Module** monitors real-time location to prevent wandering and assist families in emergencies.
4. **16×2 LCD Display** provides simple, clear information such as reminders, safety alerts, and status notifications.
5. **Bluetooth/Wired Speaker** delivers voice messages, guidance, and conversational assistance for users with vision or literacy difficulties.
6. **Flutter Mobile Application** displays alerts, location updates, reports, and reminders for caregivers.
7. **Firestore Cloud** stores activity logs, push notifications, and real-time updates in a secure, structured manner.

The system operates on a hybrid approach: critical modules (fall detection, reminders) run locally on the device, while additional data is synced to the cloud when connectivity is available.

Result and Conclusion:

1. The proposed AI-Powered Personal Assistant for Dementia Patients successfully demonstrates the use of intelligent technology to support individuals with cognitive decline. The system provides key functionalities such as fall detection, GPS-based location tracking, voice-assisted reminders, and real-time monitoring, ensuring improved safety and continuous assistance.
2. The integration of AI, IoT sensors, and cloud connectivity enables efficient caregiver–patient communication and reduces the need for constant supervision. The hybrid architecture, combining local processing with cloud support, ensures reliable performance even in low-connectivity environments.
3. Overall, the system enhances patient independence, improves quality of life, and reduces caregiver burden. It proves to be a scalable and user-friendly solution for modern dementia care.
4. The system can be further enhanced by integrating advanced health monitoring sensors, wearable devices, and smart home automation. Future improvements may include emotion recognition, personalized interaction, multilingual support, and data analytics for better healthcare insights.

References:

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Future Scope:

The future scope of this project includes:

1. Integration of advanced health monitoring sensors (heart rate, oxygen level, sleep tracking)
2. Use of wearable devices for continuous and real-time patient monitoring
3. Smart home automation for improved safety and assisted living
4. Implementation of emotion recognition for better mental health support
5. Development of personalized AI-based interaction and communication
6. Addition of multilingual support for wider accessibility
7. Use of data analytics for tracking disease progression and improving care plans