Smart Reminder with Wearable Device for Alzheimer's Patient

Megha V
Department of Electronics and Communication Engineering, HKBK College of Engineering, Bengaluru, Karnataka, India
meghaverker143@gmail.com

Sara Taskeen
Department of Electronics and Communication Engineering, HKBK College of Engineering, Bengaluru, Karnataka, India

Shamika R Gowda
Department of Electronics and Communication Engineering, HKBK College of Engineering, Bengaluru, Karnataka, India

Shreya Revankar
Department of Electronics and Communication Engineering, HKBK College of Engineering, Bengaluru, Karnataka, India

Syeda Saniya
Department of Electronics and Communication Engineering at HKBK College of Engineering, Bengaluru, Karnataka, India

Abstract - Intelligent reminders with wearable equipment for patients with Alzheimer is a wearable solution designed to increase the safety and tasks of individuals with Alzheimer's disease. The device that is equipped with an accelerometer detects falls and immediately alerts carers and ensures timely help. The panic button allows patients to convene help during emergencies. To observe the tasks of the device, it offers audibly reminded via the speaker and visually on the OLED screen. The web application allows caregivers to manage reminders for medicines, meetings and routines. By integrating safety elements and personalized tasks management, this system improves the patient's autonomy and supports carers and offers a practical solution for Alzheimer's care.

Intelligent reminders with wearable equipment for Alzheimer's disease patients is an innovative solution that increases the safety and management of individuals with Alzheimer's disease. This wearable device has an accelerometer for falling detection and immediately alerts carers for timely assistance. It includes a panic button for emergencies and provides audio and visual reminders for medicines, meetings and daily routines. Carers can manage these reminders via a web application and promote the patient's autonomy while supporting carers in their roles. This system effectively integrates safety features with personalized task management, making it a practical solution for the care of Alzheimer.

Keywords - intelligent reminders, wearable devices, Alzheimer's, fall detection, panic button, career warning.

I. Introduction

Alzheimer's disease (AD) is an age-related disorder of the nervous system that predominately strikes people in old age. It produces a progressive lowering of intellectual processes, rendering the simplest daily functions more and more difficult. Successively, forgetting, reasoning disability, and other declines in brain functions are realized. Currently, almost 6.9 million Americans over 65 live with Alzheimer's disease, and researchers estimate it will almost double to 13.8 million by 2060 as the country's population continues to age.

The disease has distinct stages, and every stage poses different challenges. In the early stage, individuals are slightly confused and forgetful now and then. When Alzheimer's advances to the middle phase, it is harder to recognize known individuals or locations, and one faces problems with communication as well. Mood swings, such as withdrawal or irritability in interactions with others, touch the majority of individuals. In the last stage, the cognitive impairment is so pronounced that individuals need daily help with everything.

Alzheimer's not only impacts the diagnosed, but also impacts caregivers on a huge emotional and physical level. Giving twenty-four-hour care can be extremely taxing, resulting in extremely high stress levels, since the individual loses their independence. This indicates the immense need for early detection and efficient management strategies specific to patients and caregivers. Early detection of symptoms enables early intervention, which can prevent the decline in mental function and enhance the quality of life. Alas, conventional methods usually do not offer the one-to-one care and total care that Alzheimer's patients really require.

With progress in technology, it is still emphasizing the creation of auxiliary tools aimed at increasing care standards for patients Alzheimer's disease. Wearable devices equipped with monitoring capabilities can offer information about the well -being of the patient's real -time and also serve as Reminder for important activities such as taking medication or participating in meetings. These devices are designed not only to strengthen the patient's autonomy, but also to alleviate some burden on carers by providing timely warnings that help everyday tasks. The emergence of mobile applications for health also shows how technology can help carers by allowing them to monitor their loved ones remotely and offer functions that help manage their own levels of stress through integrated support mechanism mechanisms within these platforms.

Historically, Alzheimer's disease was important challenges due to its complex nature and unpredictable development, which complicated families of families to develop effective strategies of long -term care. This continuing struggle underlines the urgent need for innovative technological solutions specifically focused on this demographic group - solutions that promote safety, independence and improved quality of life. Given that research on progress in understanding the pathology of Alzheimer and technological innovation aimed at improving nursing procedures continues to evolve, there is

a hope for the development of more sophisticated systems capable of effectively solving medical needs and requirements for emotional support. See references: [10], [8], [5] and [3].

Ensuring the safety and effective management of tasks for individuals with Alzheimer is essential as the condition proceeds. Patients often face confusion, disorientation and memory loss, which significantly affects their ability to perform everyday activities and navigate in their environment. This cognitive decline can lead to the behavior of the journey, threatening patients and increasing the anxiety of the carer. The carers prefer the well -being of those who have Alzheimer's disease by preventing accidents and supporting a safe living space.

Wearable technology designed for safety and task management can significantly improve the lives of patients with Alzheimer's disease. Wearable devices may remind patients with important daily tasks such as drug plans and meetings. These reminders help to create a structure in their routines and support the cognitive function by encouraging adherence to habits. For example, auditory allusions may induce individuals to engage in the necessary activities in the area of self -care, which they could otherwise forget.

Technological advances also improve home security monitoring. Intelligent domestic systems equipped with sensors can detect unusual movements or behavior indicating potential risks such as fall or unwavering exits. This ability allows caregivers to respond quickly and at the same time provide patients with greater independence in a controlled environment. The comments of drugs built into these systems ensure adherence to therapeutic plans without relying on memory.

Digital task management not only increases individual autonomy, but also increases the effectiveness of the carer by reducing stress related to constant supervision. Carers often deal with different obligations and technological support simplifies challenges by automating reminders and monitoring of tasks, allowing them to relax without risk of patient safety. In addition, effective task management includes educational resources for patients and carers about changes in the behavior associated with the Alzheimer procedure. Recognition of early warning signals is facilitated by early interventions and appropriate adjustments to care strategies.

In short, the integration of technology aimed at safety and robust task management procedures benefits patients Alzheimer's disease and their careers. Such innovations support an environment where individuals can Keep autonomy and at the same time allow caregivers to effectively play their roles. Through continuous monitoring, this effort creates safe conditions for individuals with Alzheimer's, allowing them to prosper despite cognitive challenges. Use the references [8],[1],[3],[4],[14],[15],[16] and [17].

II. LITERATURE REVIEW

- **Elfaki and Alotaibi (2018):**
  This study examines how mobile health (m-health) applications can help in the fight against Alzheimer's disease. It points out the potential of these apps to offer real-time monitoring, reminders, and support for individuals with Alzheimer's. The research also emphasizes the value of combining these apps with wearable devices to improve patient care and enhance the quality of life for both patients and caregivers [1].

- **Salehi et al. (2022)**:
  This paper explores the development of wearable devices using IoT technology specifically personalized for individuals with Alzheimer's. Their study emphasizes how these smart devices can monitor critical signs, help locate patients, and send medication reminders. Overall, the paper emphasizes the positive impact of such technology in enhancing patient safety and independence, while also easing the responsibilities of caregivers [2].

- **Murphy (2024):**
  Murphy's study investigates the ways in which remote patient monitoring can help people with Alzheimer's disease. The research closely examines various technologies, such as wearable devices, and assesses their effects on patient care. The findings reveal that remote monitoring significantly enhances the quality of care by providing real-time information and notifications to caregivers, facilitating easy and timely responses to patients' needs [3].

- **Boyd (2023):**
  This article looks into how smart home monitoring systems can really support individuals with Alzheimer's and dementia. It covers how IoT sensors and smart devices can track daily activities, alert caregivers to emergencies, and are reminders. Overall, the research shows that smart home technology has the potential to make spaces safer for patients and ease the burden on caregivers [4].

- **Omar et al. (2019):**
  This study introduces an intelligent assistive device designed specifically for Alzheimer's patients. By combining IoT and AI, it monitors health metrics, offers timely reminders, and detects emergencies. The findings emphasize how using advanced technology can improve patient care and better support caregivers managing Alzheimer's disease [5].

- **Ahmed and AI - Neami (2020):**
  The researchers propose a smart biomedical system that uses wearable devices along with IoT to keep track of critical signs, locate patients, and send emergency alerts. Their work emphasizes the major role such systems can play in enhancing safety and quality of life for Alzheimer's patients [6].

- **Pennic (2024):**
  This article examines the ways in which AI-driven smart glasses may potentially significantly support individuals with dementia to make day-to-day challenges less difficult to resolve. Smart glasses are wearable, provide on-demand reminders, direct navigation, and send notifications in the event of an emergency—enhancing security while facilitating increased independence. Placing AI-based solutions into dementia care, this technology offers a potential avenue to improve quality of life and redefine support for people with cognitive decline.

- **Kim et al. (2021):**
  In this review, the authors assess how mobile health (mHealth) apps can enable caregivers of people with Alzheimer's. The study finds that these applications can reduce caregiver stress and lead to better patient outcomes, emphasizing the benefits of digital support tools [8].

- **AI – Nami et al. (2021):**
  This research presents a new prototype of a wearable monitoring system personalized for Alzheimer's patients. It combines IoT and AI to track health, issue reminders, and identify emergencies, illustrating how innovative technologies can advance caregiver support and patient safety [10].

- **Gargiono et al. (2024):**

conducted an in-depth review of pill and medication dispensers, considering a human-centered perspective. The project focused on various smart dispensers customized for individuals with Alzheimer's, assessing how well they support medication adherence and improve patient safety. The results indicate that these smart dispensers can make a meaningful difference in managing medications more effectively and help reduce the likelihood of errors [19].

III. PROPOSED METHODOLOGY

This System integrates five primary components:

1. **Raspberry Pi**
2. **Speaker**
3. **ADXL345 Accelerometer**
4. **OLED Display**
5. **Panic Button**

BLOCK DIAGRAM

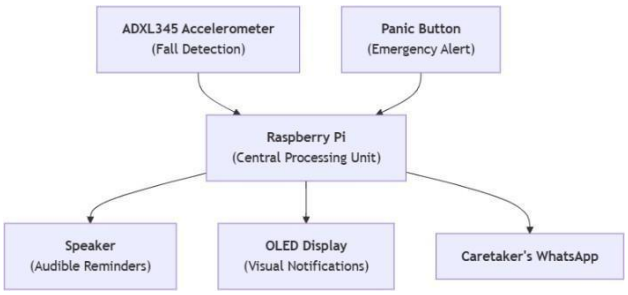

Fig. 1. Block diagram 0f smart reminder system

HARDWARE COMPONENTS

1. Raspberry Pi

   Serves as the central processing unit, controlling the wearable device and managing communication with the web application.

2. Speaker

   Delivers audible reminders to assist patients in remembering tasks and schedules.

3. ADXL345 Accelerometer

   Monitors motion to detect falls and triggers automatic alerts to caregivers in case of emergencies.

4. OLED Display

   Provides a visual interface to display icons and notifications for reminders, ensuring intuitive interaction for users.

5. Panic Button

   Permits patients to manually trigger emergency alerts for caregivers, offering a rapid response in urgent situations.

SOFTWARE REQUIREMENTS

The software is designed to ensure smooth integration between the hardware and user interfaces, with the following components:

1. Raspberry Pi Firmware

   Python-based scripts to manage device hardware, process sensor data, and handle communication.

2. Web Application

   Developed using modern frameworks (e.g., React.js and Django/Flask), it provides an interface for caregivers to set reminders, receive alerts, and monitor activity.

3. Cloud Backend

   Firebase or an alternative cloud platform to store and synchronize patient data, reminders, and alert logs.

4. APIs

   Restful APIs to facilitate seamless communication between the Raspberry Pi, cloud, and caregiver interfaces

SOFTWARE DESIGN

The architecture of the software is modular for efficiency, reliability, and scalability.

Key design features include:

1. Device Software
   - Sensor Module: Interfaces with the ADXL345 Acceleration to detect falls and trigger alerts.
   - Reminder Module: Controls the speaker and OLED display to provide reminders and notifications.
   - Communication Module: Manages data exchange with the web application via Wi-Fi or Bluetooth.
2. Web Application Design
   - User Interface (UI): offers an intuitive dashboard for caregivers.
   - Data Management: Secure storage and retrieval of reminders and alert data from the cloud backend.
3. Alert Mechanism
   - Instant alerts are sent to caregivers via WhatsApp

HARDWARE IMPLEMENTATION

- Central Processing Unit (Raspberry Pi):
  - Configured the Raspberry Pi as the primary controller for the system.
  - Installed necessary libraries and drivers to communicate with peripheral devices, including I²C and GPIO configurations.
- Peripheral Integration:
  - ADXL345 Accelerometer:
    - Interfaced with the Raspberry Pi using the I²C protocol.
    - Calibrated for precise fall detection by setting threshold and duration parameters.

- Speaker:
  - Connected through the Raspberry Pi's audio output.
  - Programmed to deliver clear audible reminders based on predefined schedules.
- OLED Display:
  - Integrated via I²C communication.
- Designed to display icons and messages, such as upcoming reminders or emergency alerts.

- Panic Button:
  - Configured as a GPIO input.
  - Programmed to send immediate notifications to the caregiver interface upon activation.

Software Implementation

- Embedded Software:
  - Developed Python scripts for each hardware component to manage functionality and data flow.
  - Implemented interrupt-based programming for real-time responsiveness of the panic button and accelerometer.
- Web Application:
  - Built a responsive web interface using HTML, CSS, and JavaScript for caregivers to manage reminders and monitor alerts.
  - Integrated with Firebase for real-time data synchronization between the wearable device and the web application.
- Data Management:
  - Configured Firebase Realtime Database to store reminder schedules, patient data, and emergency alerts.
  - Ensured secure data handling through authentication and role-based access.
- Cloud Communication:
  - Established communication between the Raspberry Pi and Firebase using REST APIs.
  - Implemented efficient data transfer protocols to minimize latency in alert notifications and reminder updates.

System Workflow

- Reminder Notifications:
  - Caregivers configure reminders via the web application, which are synchronized with the Raspberry Pi in real time.
  - The Raspberry Pi triggers the speaker and displays notifications on the OLED display at the scheduled time.
- Fall Detection:
  - The ADXL345 continuously monitors motion. Upon detecting a fall, it sends data to the Raspberry Pi, which generates an alert for the caregiver.
  - Alerts are sent via the web application as push notifications or emails.
- Panic Button Activation:
  - When the panic button is pressed, an immediate emergency notification is triggered.
  - Visual and audio feedback are provided on the wearable device for acknowledgment.

IV. FLOW CHART OF THE SYSTEM

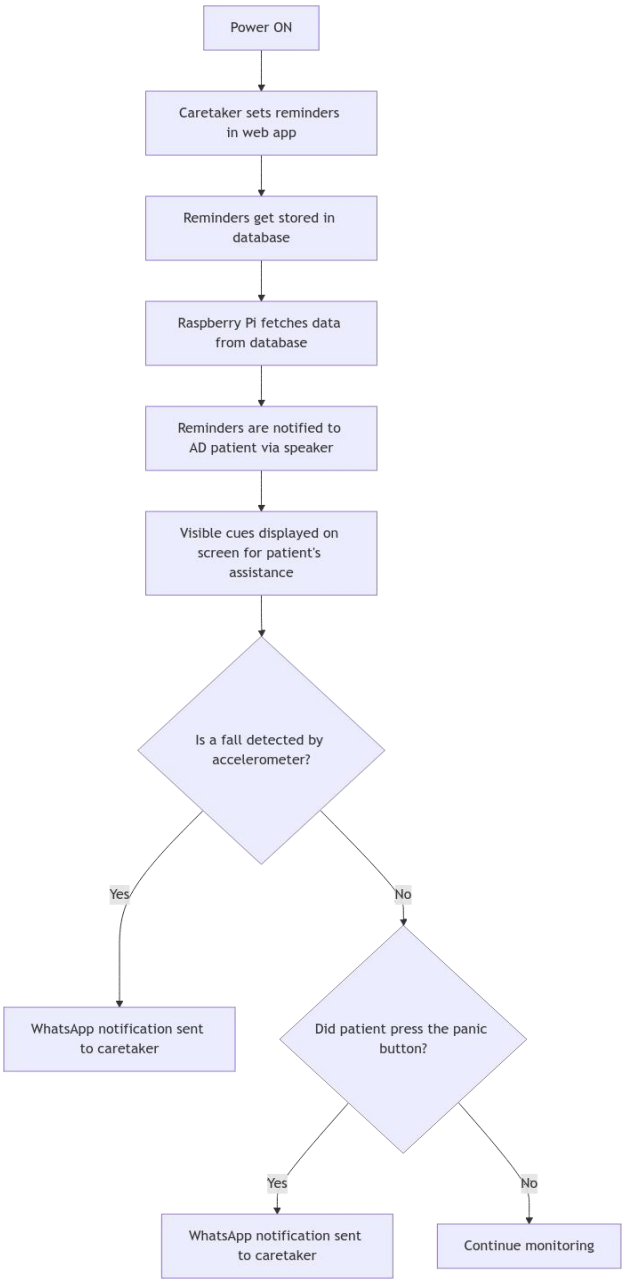

Fig. 2. Process flow of the improved smart reminder

V. CONCLUSION

Integration of intelligent reminder technologies through wearable devices for individuals with Alzheimer represents significant progress in health innovation. These devices are engaged in the basic needs of those facing Alzheimer's disease, increasing the patient's independence, while providing vital support for carers. Their ability to monitor key metrics such as heart rate, oxygen level and body temperature, along with the ability to alert carer during waterfalls or health events, reflects a comprehensive approach to driving daily challenges facing individuals with dementia.

These devices that are designed with a user experience like a priority have an intuitive interface and include advanced technologies such as Wi-Fi microcontrollers. These bearers are smoothly associated with web applications that make it easier to control the reminder, whether for drug plans or medical meetings, which supports patients in maintaining their daily routines.

By allowing continuous monitoring and notifications systems, these devices seize patients Alzheimer with tools that support both independence and safety. The multifunctional design promotes immediate communication between patients and carers and ensures timely assistance if necessary. This not only improves the quality of life for those who have been affected by Alzheimer's disease, but also helps to reduce the risks of loss and memory confusion.

Looking into the future, upcoming innovations can represent even more sophisticated functions within the wearable technology focused on Alzheimer's care. With advances in artificial intelligence and machine learning, smarter algorithms could adapt the reminder systems to individual behavior or patient preferences. In addition, improved monitoring technologies can offer improved position monitoring while preferring the patient's comfort.

In conclusion, the development and implementation of intelligent reminder systems through wearable devices signals a promising way to improve care for patients with Alzheimer and support their careers. Since the efforts to improve these technologies are proceeding, they are ready to evolve in a way that better resolves the changing needs of patients and their families. See references: [10], [2] and [13].

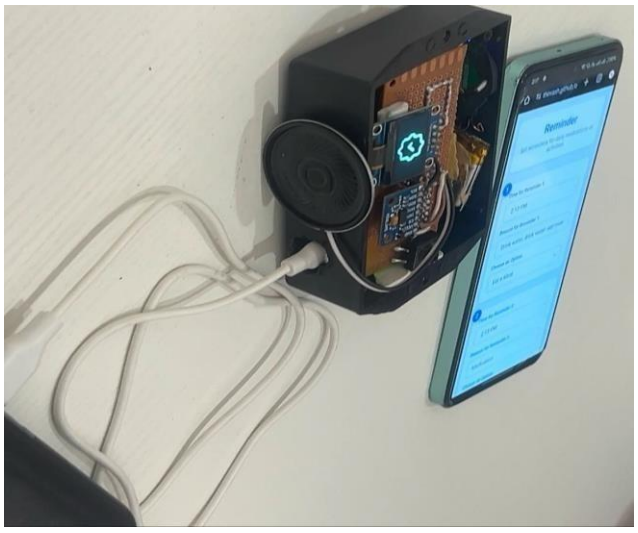

Fig. 3. Completed Model.

VI. FUTURE DEVELOPMENT

The progress in intelligent reminders for individuals with Alzheimer shows a significant promise, especially with the integration of artificial intelligence (AI) and machine learning into wearable devices. These innovations could lead to personal reminders that adapt to the routine and behavior of patients, which would increase memory support.

Integration of intelligent reminders of the home Internet Ecosystems (IoT) represents a number of options. By connecting wearable devices with household appliances - for example, lights or safety systems. This interconnection increases safety and alleviates concerns about the carer of the well -being of their beloved person.

Future development may include platforms for multiple users that allow caregivers to remotely send reminders and monitor patient activities through cloud applications, which, if necessary, supports the support network between immediate assistance.

In addition to reminding, the upcoming version could integrate the functions of health monitoring that follow physiological indicators such as heart rate and activity level. This knowledge could alert carer of unusual symptoms indicating potential health problems.

Efforts to collaborate with robotics can lead to innovative solutions, such as robotic companions, which remind patients everyday tasks while providing society to support memory and loneliness that people with Alzheimer's disease often experience.

Improved communication skills are another critical area of development. Future devices may include messaging systems or voice command function, allowing patients to easily ask for help and giving carers peace in the mind even if they are not physically present.

Design optimization for comfort and usability among older adults is essential and focuses on light materials, user - friendly interfaces and attractive aesthetics to support technology adoption.

As Telehealth proceeds, there is an opportunity for intelligent reminders to integrate telemedicine functions and facilitate consultations between healthcare providers and real-time carers without requiring physical visits- especially important in persistent global health challenges.

When shaping these innovations, the design focused on users will be essential. The involvement of patients with Alzheimer's disease, their families and healthcare professionals during the design process will provide inspection of their specific challenges, which will lead to a solution adapted to their needs.

The aim of these progress eventually not only improves compliance with treatment plans, but also to increase the overall quality of life of patients with Alzheimer's disease and their carers through complex support systems. See references: [8], [1], [18] p. 11-12, [19] and [2].

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