Caringcompanion: Empowering Alzheimer Patient With Assistance

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Abstract— **This paper introduces AlziCare, a comprehensive web platform designed to enhance the quality of life for individuals with Alzheimer's disease through the integration of IoT, AI, and web technologies. AlziCare offers a range of features tailored to address the cognitive, emotional, and practical needs of patients and their caregivers. The platform includes mind games, music therapy, mime performances, access to e-books, and guided meditation sessions, providing cognitive stimulation and emotional support. A personal voice assistant offers assistance with daily tasks, reminders, and personalized information. Moreover, AlziCare incorporates IoT devices such as a lost item tracker using Raspberry Pi and a medicine dispenser utilizing servo motors controlled by Raspberry Pi, aiding in practical management and safety. The AI component of AlziCare enables personalized recommendations and adaptive assistance based on user interactions and preferences, creating a tailored experience for each patient. Additionally, the web interface allows seamless communication and appointment scheduling with healthcare professionals, promoting timely access to medical assistance and support. AlziCare represents a holistic approach to Alzheimer's care, leveraging IoT, AI, and web technologies to provide comprehensive support and enhance the overall well-being of patients and caregivers. This paper discusses the design, implementation, and potential impact of AlziCare in improving the lives of individuals affected by Alzheimer's disease.**

Keywords—**Alzheimer, Web Application, Medicine Dispenser, Lost Item Tracker, intelligent system, Raspberry Pi, servo motors, Piezo buzzer ,IoT, Personal AI Assistance, Alzheimer Caring Intelligent Website.**

I. INTRODUCTION

Alzheimer's is a progressive neurodegenerative disease affecting memory, cognition, and behaviour [3]. It poses significant challenges for both individuals diagnosed and their dedicated caregivers. Impact on Individuals and Caregivers is that the individuals experience memory loss, confusion, and difficulty in daily activities where as the caregivers struggle with increased responsibilities, emotional stress, and the need for continuous support [4]. The technological interventions enhance quality of life. Technology offers innovative solutions to alleviate daily challenges faced by Alzheimer's patients, promoting independence and comfort [8]. Alzheimer's disease, a progressive neurodegenerative disorder, presents profound challenges for individuals diagnosed with the condition and their caregivers. As the global population ages, the prevalence of Alzheimer's disease continues to rise, highlighting the urgent need for innovative solutions to support those affected by this debilitating illness. In response to this growing demand, we

introduce AlziCare, a pioneering web platform that harnesses the power of IoT, AI, and web technologies to provide comprehensive care and support for Alzheimer's patients. AlziCare represents a paradigm shift in Alzheimer's care, moving beyond traditional approaches to offer a holistic and personalized experience. By integrating a diverse range of features, including mind games, music therapy, mime performances, access to e-books, guided meditation sessions, and a personal voice assistant, AlziCare addresses the multifaceted needs of patients, catering to their cognitive, emotional, and practical requirements.Furthermore, AlziCare leverages IoT devices such as Raspberry Pi-based solutions to enhance safety and management for both patients and caregivers. The inclusion of a lost item tracker and a medicine dispenser controlled by servo motors offers practical solutions to common challenges faced by individuals living with Alzheimer's disease, promoting independence and peace of mind.The AI capabilities of AlziCare further elevate its functionality, providing personalized recommendations and adaptive assistance tailored to each patient's unique preferences and interactions. By harnessing the power of machine learning algorithms, AlziCare continuously learns and adapts to the evolving needs of its users, ensuring a tailored and responsive experience.Through its intuitive web interface, AlziCare facilitates seamless communication and coordination between patients, caregivers, and healthcare professionals. Appointment scheduling with doctors and other healthcare providers is streamlined, enabling timely access to medical assistance and support.In this paper, we present the design, implementation, and potential impact of AlziCare in revolutionizing Alzheimer's care. By embracing IoT, AI, and web

Figure 1: Shrinking of brain size in humans withadvancement in Alzheimer's

technologies, AlziCare aims to enhance the quality of life for individuals affected by Alzheimer's disease, fostering independence, engagement, and well-being

Section II discusses the related researches previously done in this area. Section III presents the conceptual framework of the system. The detail implementation of the proposed system is discussed in Section IV followed by the evaluation of the system in section V. Finally, section VI concludes the article.

II. PROBLEM DESCRIPTION

Challenges Faced by Alzheimer's Patients include memory impairment, cognitive decline, communication barriers and the challenges faced by caregivers include increased responsibilities, emotional stress, monitoring and safetyconcerns [4].

Additionally, Alzheimer care givers have to manage the constant change in behaviour like depression, anxiety, hallucinations, aggression or wandering behaviour. The need for technological intervention is essential since the traditional approaches fall short in providing the level of support required to ensure the safety and well-being of Alzheimer's patients. Leveraging IoT and AI technologies can bridge these gaps [7], offering innovative solutions to enhance the quality of life for both patients and caregivers.

III. LITERATURE REVIEW

- Automatic Medicine Dispenser using IOT: Merits of the proposed system include improved medication assistance, capability in dispensing both solid and liquid medication, integration with mobile application enabling Medicare for remote control andmonitoring, an added notification system for both caregiver and patient in case of missed medicineintake, emphasis on cost-effectiveness for accessibility to larger people. Limitations of the proposed system include increased dependency on technology, potentially challenging for elderly users, need for consistent internet connectivity IoT gateway, firebase, problems of using of the touchscreen interface on the mobile application lack of steps on maintenance and durability aspects, success barriers on user acceptance and adoption of technology- driven medication management [3].

- Design and Implementation of Smart Voice Assistant and Recognising Academic Words: Merits of the proposed system include psychological support services, image classification with Convolutional neural network, location tracking for monitoring, steganography for image security, communication via voice messages, integration with google assistant, effectiveness in image detection. Limitations of the proposed system include limited scope (mild andmoderate ad), dependency on technology, privacy concerns, generalizability not discussed, incomplete development details, ethical considerations not explored [2].

- Secure IOT Assistant- Based System for Alzheimer'sDisease: Merits of the proposed system include virtual assistant integration (Alice), comprehensive approach hot word detection, voice to text conversion, intent recognition, text to voiceconversion, Linux and python integration for flexibility communication with IoT devices, speech recognition system using Ann, mfcc feature extraction technique, comparison of training algorithms (lm and bgfs quasi-newton resilient backpropagation). Limitations of the proposed system include limited scope discussion, dependency on external accounts (wit, wolfram alpha, snow boy), confidence-based interaction challenges, specific Linux operating system requirement limited discussion on user interaction, external Api dependence [1].

- A Review and Analysis of Mobile Health Applications for Alzheimer Patients and Caregivers: Merits of the proposed system include a collection ofover 60 prevailing mobile applications build for assistance, the extraction of important features from each of those applications like learning and caregiving, medicine dispenser or the pill box, schedule for performing daily activities, doctor

remote monitoring in the form of doctor dairy whichis accessible for the clinician. Limitations of the proposed system include availability of merely 5 applications which possess the necessary set of features for both caregivers and patients, although the required features were prevalent there frequency in each of the applications was limited, not cost- effective [5]. A summary of the previous works is shown in Table I. In sum, the previous studies suggested separate modules to assist the patients from different angles. It is certain that no collaborative system was developed to help the patients integrated with physical health monitoring, smart medication system, smart tracker for lost items and locating patient both inside and outside home. In addition, inclusion of caregiver and smart phones were also missing parts of the puzzle. Thus, this research aimed to develop an autonomous system integrat- ing all necessary features (constant monitoring, reminder for taking medicine, monitoring heart condition and finding lost items) including relatives and caregiver to make Alzheimer's patient's life easier.
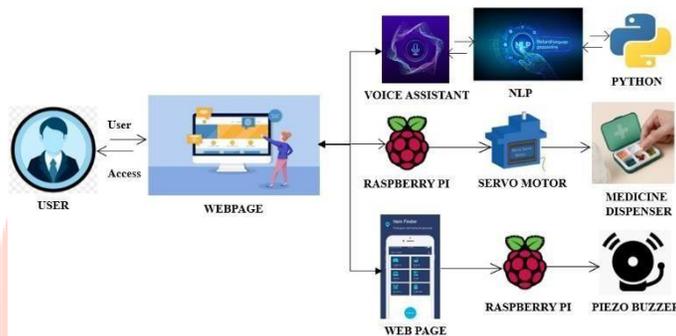
IV. SYSTEM ARCHITECTURE

Figure 2: System Architecture for CaringCompanion

- Data Transmission: Data is transmitted securely to the cloud-based backend for processing.
- Data Collection: IoT devices continuously collect data on patient activities, vital signs, and location.
- AI Analysis: AI algorithms analyze the data to detect anomalies, provide cognitive assistance, and generate insights.
- Alert Generation: The system generates alerts and notifications based on AI analysis, sending them to caregivers and relevant parties.
- User Interaction: Caregivers and family members interact with the system through the web or mobile application, receiving alerts and accessing real-time and historical data.

TABLE 1
COMPONENTS OF MODULE

Module	Components
Smart Medicine Dispenser	Raspberry Pi, Servo motor, wires, batteries, power source
Lost Item Tracker	Raspberry Pi, Battery, Piezo buzzer, Power Source
AI Assistance	NLP, Python

Functional Modules:

Break down the system into its main functional modules:

- Lost Item Finder
- Smart Medicine Dispenser
- Location Tracking
- Virtual Assistants

V. METHODOLOGY

A. Medicine Dispenser

A smart medicine box was developed to keep track of the pill intakes by the patient. Whenever it is time for the patient to take medicine, the medicine box will automatically open. Also, a buzzer will make sound to remind the patient that it is pill intake time. If the patient still does not take medicine, then an alert message will be sent to patient's caregiver. After the patient takes medicine, the box will be closed again. It will again open when the next pill intake time will come. An OLED display is also attached with the medicine box that displays the time remaining for next pill intake

B. Lost Item Tracker
Alzheimer's sufferers find it difficult to remember where they put their wallet, keys, or glasses. Accordingly, a tracker is fastened to their essential accessories so that, in the event that they misplace something, they may locate it by using a smartphone programme that will sound an alarm to that particular item using buzzer and Raspberry Pi[29]. Alzheimer's patient loses their belongings very easily. The object finder helps the patient to find the lost items. If the lost items are at Wifi range of Their Mobile and the Application.

C. Lost Item Trackerr
Developing an AI system to assist Alzheimer's patients with personal information involves prioritizing privacy and security. The implementation should adhere to data protection regulations, such as GDPR and HIPAA, and employ encryption and access controls. Personal data should be minimized and, when possible, anonymized or de-identified to reduce privacy risks. User transparency is crucial, necessitating clear communication on how personal information will be used, stored, and protected. Regular security audits, ethical considerations, and collaboration with legal and healthcare experts are essential for creating a trustworthy and effective AI system for Alzheimer's care.

- ✓ Natural Language Processing (NLP) capabilities for effective communication.
- ✓ Integration with a knowledge base for providing relevant information.
- ✓ Voice or text-based interaction for user convenience
- ✓ Reminders for daily activities and medication schedules

VI. IMPLEMENTATION

HARDWARE REQUIREMENTS

[1] Raspberry Pi (for lost item tracker and medicine dispenser
[2] RFID tags (for lost item tracker)
[3] Servo motors (for medicine dispenser)
[4] Piezo buzzer (for lost item tracker)
[5] Computer or tablet (for accessing the web platform)
[6] Speakers or headphones (for music therapy)

SOFTWARE REQUIREMENTS

[7] Operating system for Raspberry Pi (e.g., Raspbian)
[8] Python programming language (for coding Raspberry Pi functionalities)
[9] Web development tools (HTML, CSS, JavaScript) for creating the web platform
[10] Web server software (e.g., Apache, Nginx)
[11] Database management system (e.g., MySQL, MongoDB) for storing user data and appointments
[12] AI algorithms and libraries (e.g., TensorFlow, scikit-learn) for personalization and adaptive assistance
[13] Voice assistant technology (e.g., Google Assistant API, Amazon Alexa Skills Kit)
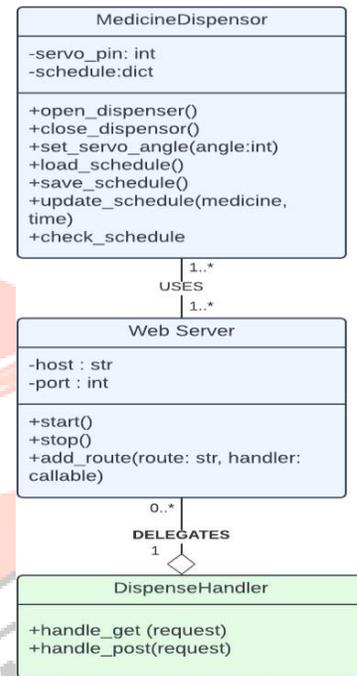
CLASS DIAGRAMS FOR ALL MODULES

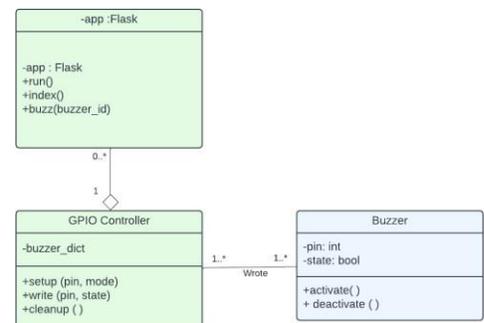**Figure 3**: Class Diagram for Medicine Dispenser

Figure 4: Class Diagram for Lost Item Tracker

Fig 5.3.3.1: Class diagram for AI Assistance

Fig 5.3.3.2: Sequence diagram for AI Assistance

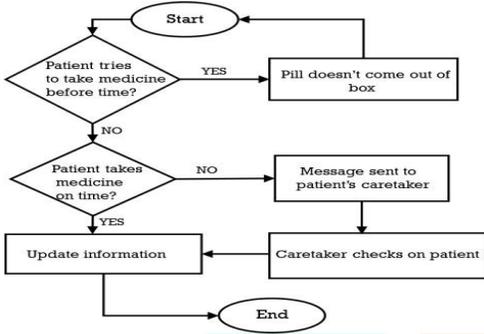**Figure 7:** Class Diagram and Sequence Diagram for AI Assistance
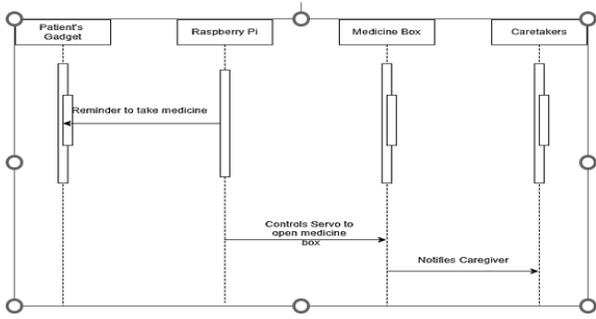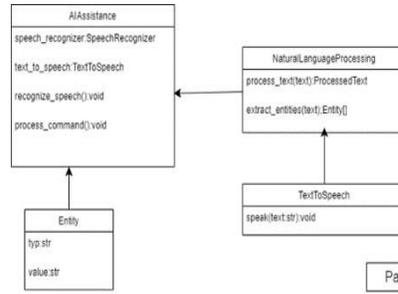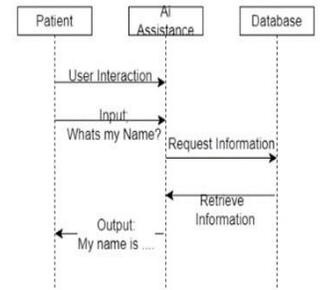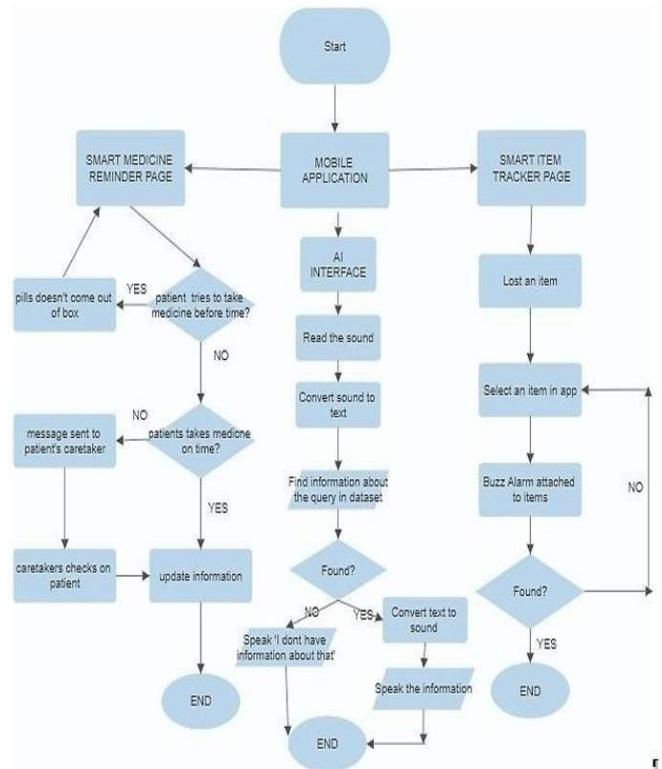
Figure 5: Sequence Diagram and Flow Diagram for Medicine Dispenser
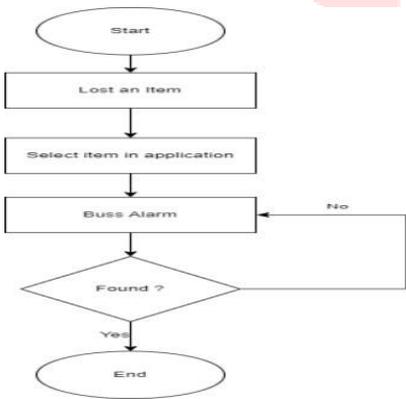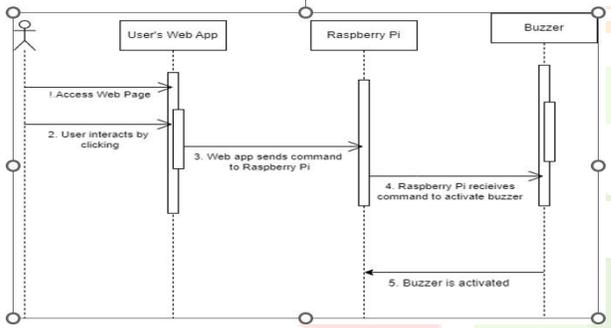
Figure 6: Sequence Diagram and Flow Diagram for Lost Item Finder

Figure 8: Flowchart for Integrated Modules
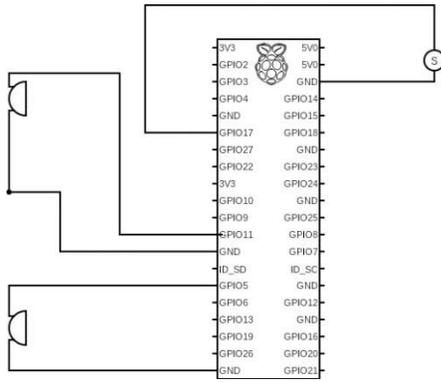
VI. DEMONSTRATION

Figure 9: Circuit connection of Raspberry Pi with piezo Buzzer and Servo Motor.

The above shown circuit diagram depicts the connection between Raspberry Pi 4 Model B with the Piezo Buzzer and Servo Motor.

- The Raspberry Pi's GPIO pin is connected to anode and ground the other

side.

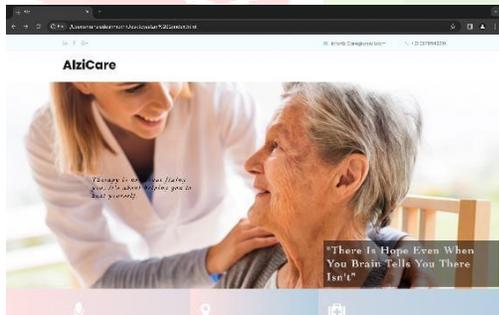**Figure 10:** Circuit connection of Raspberry Pi with piezo Buzzer and

Figure I1: Home Page of personalized Alzheimer Patient Website

The Home Page includes the Patient's photo clicked while having therapy above that are some quotes that make them feel more stronger,
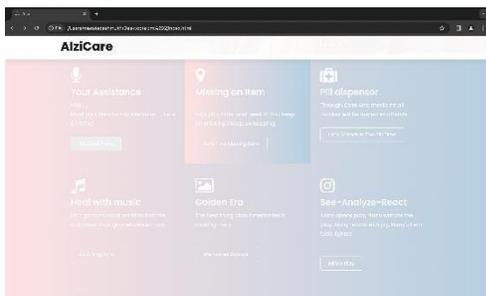

Figure 12: Features Page Of Alzheimer's personalized website

This section of webpage contains the list of all features that are present in the website. It contains all the features like Personalized Voice Assistant, Lost Item Tracker, Pill Dispensor, Music therapy, Photo gallery, Mimes, Meditation guide and some mind full games.
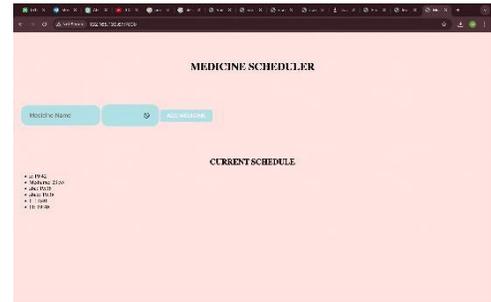

Figure 13: Medicine Dispensor Page Of Alzheimer's personalized

Here the caretaker schedule the pills for the patient so that the medicine dispenser opens at specified time so, that medicine doze is not affected
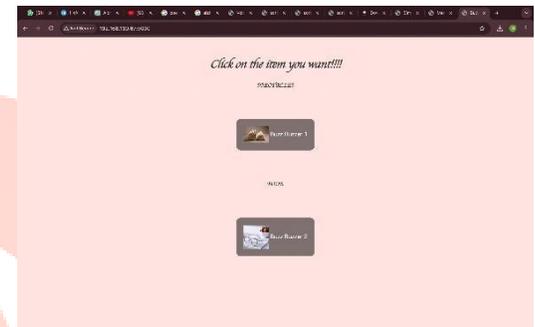
Figure 14: Lost Item Tracker Page Of Alzheimer's personalized website

The lost item tracker enables the person's reduction in anxiety and frustration related issues in lost possessions, thereby improving patient autonomy.

Figure 15: Patients talent publish Page Of Alzheimer's personalized website

Since, this is the personalized website the person's talent is showcased here so, that the person frequently see this and try countinuing passion. Here, Nancy Austen is case person. She inks best poetry.

Figure I6: Meditation Guide Page Of Alzheimer's personalized website
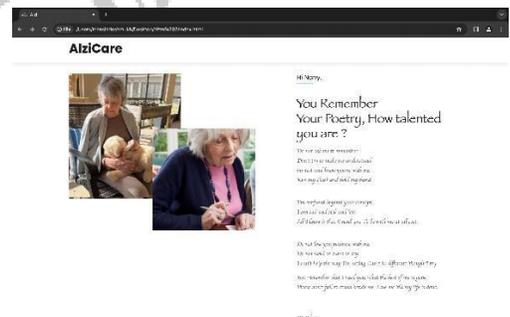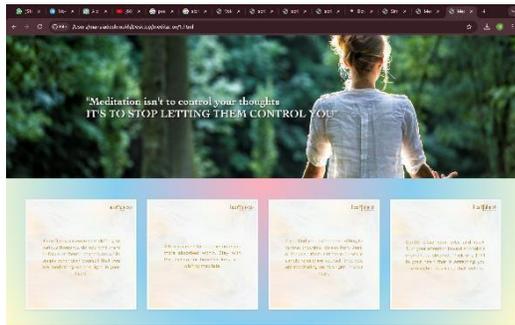The person's mind is main focus for healing. Hence, a complete guided meditation technique is included. Thus, helps in reducing stress and neurological health

VIII. LIMITATIONS

- **Dependency on Internet Connectivity**: The system's effectiveness is heavily dependent on reliable internet connectivity. Any disruption in connectivity could impair functionality, affecting the system's ability to monitor, remind, and alert.
- **Privacy Concerns**: Handling sensitive data, especially health-related information, raises privacy issues. Ensuring data protection and compliance with regulations like HIPAA is crucial.
- **Technical Complexity for Users**: While designed to be user-friendly, the initial setup and periodic maintenance of the system may require technical knowledge which could be challenging for some users or caregivers.

IX. CONCLUSION

The deployment of this integrated technological platform yielded substantial improvements:

1. **Improved Patient Engagement**: Music therapy and mime sessions significantly increased patient engagement, improving mood and cognitive responsiveness.
2. **Reduced Stress** : Meditation guides helped lower stress levels for both patients and caregivers, enhancing overall emotional wellbeing.
3. **Enhanced Memory Recall** : Interaction with the photo gallery and engaging in cognitive games facilitated memory retention and provided cognitive stimulation.
4. **Increased Independence** : The lost item tracker and voice assistant

5. **Enhanced Medication Compliance** : The automated medicine dispenser ensured timely medication intake, reducing health risks associated with improper medication management.

The integration of these technologies not only provided substantial relief to caregivers by automating routine tasks but also significantly enhanced the dignity, independence, and quality of life of Alzheimer's patients. This project demonstrated the transformative potential of tailored technological solutions in managing complex health conditions and offered promising avenues for future healthcare innovations.

X. FUTURE SCOPE

In conclusion, this IoT project has successfully integrated a Raspberry Pi with peripheral devices like a servo motor and piezo buzzer to create a versatile system aimed at improving the quality of life for Alzheimer's patients. The project demonstrates the potential of IoT solutions in healthcare by providing features such as a voice-activated personal assistant, a timely medicine dispenser, and a lost item tracker, all of which collectively enhance patient independence while reducing caregiver burden.

Looking to the future, there are several avenues for enhancing this project. One potential improvement could involve incorporating advanced AI algorithms to further personalize the interaction between the system and its users, enabling the system to adapt to changes in the patient's behavior or needs over time. Additionally, integrating more sophisticated sensors could enhance the system's ability to monitor health vitals, thus providing caregivers with critical real-time health data. Another area for development could be the implementation of a more robust network solution that ensures continuous operation even in the event of internet outages. This could involve using mesh networking to provide stronger and more reliable connectivity.

By continuing to evolve and incorporate new technologies, this project can better meet the complex needs of Alzheimer's patients and their caregivers, driving significant improvements in care and quality of life. Each enhancement will also broaden the system's applicability and effectiveness, making it a more integral part of healthcare solutions for the elder.

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