

Face Recognition-based Smart Device for Alzheimer's Patient

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Abstract— Alzheimer's disease is a sneaky neurological illness that causes symptoms to deteriorate over time. It can be extremely difficult to function on a daily basis and to retain memories. We present the "Face Recognition-Based Smart Device for Alzheimer's Patients" to empower people in the early to moderate stages of the disease. With voice-over identification and facial recognition, this all-inclusive solution goes beyond memory issues. The system tackles the various aspects of Alzheimer's disease by augmenting social connections and fostering patient autonomy. Redefining Alzheimer's care with features like monitoring features, a smart medicine box, lost item finder, and reminders stresses inclusivity and individualised support for both patients and carers. The invention has the potential to significantly improve the lives of Alzheimer's patients by encouraging independence and enhancing general wellbeing.

Index Terms— Alzheimer's disease, Medicine reminder, Health monitoring, GPS tracking, Sensors, Mobile application, Assistive tool

I. INTRODUCTION

Alzheimer's disease, a prevalent neurodegenerative disorder, manifests with memory loss, impacting individuals' ability to fulfill daily obligations and increasing the risk of disorientation, potentially leading to individuals becoming lost outside their homes. The ensuing search efforts by relatives and friends highlight the urgent need for innovative solutions to address these challenges comprehensively. In the wake of this critical necessity, bridging the gap in our understanding of Alzheimer's becomes imperative, prompting a collective effort to create impactful interventions that enhance the quality of life for both individuals grappling with the condition and their dedicated caregivers. This multifaceted approach aims not only to alleviate the immediate challenges but also to pave the way for a future where the journey of those affected by Alzheimer's is marked by dignity, support, and improved well-being.

This paper introduces an advanced system, the "Face Recognition-Based Smart Device for Alzheimer's Patients," which extends beyond facial recognition to offer a multifaceted approach. In addition to addressing memory impairment, the proposed system integrates features aimed at supporting daily tasks, enhancing social interactions, and ensuring medication adherence. The system comprises facial recognition, a dedicated smartphone application, reminders, tracking capabilities, a smart medicine box, and a lost item finder. This solution empowers individuals affected by Alzheimer's, addressing memory challenges, fostering autonomy, and recognizing diverse patient needs in neuro degenerative disorders.

The challenges faced by individuals with Alzheimer's go beyond memory loss, including difficulties in social interactions and medication adherence. Our proposed system utilizes facial recognition for voice-over identification, promoting patient recognition and self-assurance in social interactions.

In the unfortunate event of patients becoming lost, the proposed system includes a tracking feature, allowing families to determine their precise position and facilitate a swift and safe recovery. The integration of these features collectively enhances the safety and well-being of individuals affected by Alzheimer's.

Furthermore, the system introduces a smart medicine box, seamlessly integrated with the smartphone application. This feature ensures proper medication adherence, addressing a critical aspect of Alzheimer's management and significantly improving the overall quality of life for patients.

Moreover, the system integrates a comprehensive reminder feature that goes beyond the smartphone application. In addition to delivering reminders within the application, the system provides notifiable alarms, including a distinctive feature for lost item detection. This multifaceted approach not only addresses forgetfulness but also enhances organization and autonomy for individuals with Alzheimer's, ensuring a more inclusive and effective caregiving experience.

Preliminary results indicate promising outcomes, showcasing the positive impact of the proposed system on individuals with Alzheimer's symptoms. This paper provides a comprehensive exploration of the design, implementation, and evaluation of the "Face Recognition-Based Smart Device for Alzheimer's Patients," highlighting its potential to revolutionize care practices for those affected by Alzheimer's disease.

II. EXISTING SYSTEM

In the existing system, conventional healthcare monitoring systems typically function as standalone devices without comprehensive integration. This limited integration restricts the scope of data collection, analysis, and communication, hindering real-time monitoring and proactive healthcare management. As a consequence, caregivers may face challenges in accessing timely and relevant information, impacting their ability to provide optimal care to patients.

Traditional health monitoring devices operate independently, often focusing solely on individual metrics such as heart rate or blood pressure. These devices lack comprehensive integration and real-time connectivity, limiting their ability to provide holistic insights into patient well-being. As a result, caregivers may face challenges in obtaining a complete picture of the patient's health status, hindering proactive healthcare management.

Patients often find themselves needing to manage multiple devices, each serving different purposes. This situation can lead to inconvenience and potential inefficiencies in healthcare management. Juggling various devices for monitoring different health parameters can be cumbersome and may result in confusion or oversight. As a consequence, patients may struggle to maintain a cohesive approach to their healthcare, which can impact their overall well-being.

Conventional facial recognition systems, often utilized for security purposes, may raise concerns regarding privacy and data protection. The collection and storage of personal biometric information pose potential risks, as this sensitive data could be compromised or misused. Instances of unauthorized access or breaches in security protocols could lead to significant privacy violations and undermine trust in facial recognition technology.

Ref. [2] Current health monitoring devices often lack personalized communication features such as voice playback, which can hinder effective interaction and assistance for patients with diverse needs. Without this functionality, patients may encounter difficulties in receiving timely reminders, instructions, or personalized feedback, leading to potential gaps in their healthcare management. Incorporating voice playback capabilities into these devices could significantly enhance user experience and facilitate clearer communication between patients and caregivers, ultimately improving patient outcomes and satisfaction.

III. PROPOSED SYSTEM

The current system lays the groundwork with specific technologies aimed at addressing the challenges faced by individuals with Alzheimer's disease. These technologies form a foundational approach to Alzheimer's care, providing insights into the unique needs of patients. However, recognizing the limitations of the existing system in fully meeting the diverse needs of patients and caregivers, our proposed "Face Recognition-Based Smart Device for Alzheimer's Patients" project aims to enhance its capabilities. Ref. [8] By introducing an integrated IoT platform, we foster seamless connectivity between diverse components, facilitating real-time data collection and analysis within health monitoring features. This empowers caregivers with proactive insights for optimized patient care. Additionally, the incorporation of facial recognition technology, coupled with voice playback capabilities,

enables personalized interaction, instilling a sense of security and familiarity for patients. Furthermore, the key finding functionality utilizes IoT connectivity to swiftly locate misplaced items, promoting patient independence and alleviating caregiver burden. Through these advancements, our proposed system which is depicted in the Fig. 3, strives to revolutionize Alzheimer's care by providing a comprehensive and tailored solution that addresses various facets of patient needs.

Utilizing an ESP32-based IoT device, the system offers continuous real-time monitoring of vital health metrics such as temperature and pulse. This approach ensures instant and comprehensive health insights, enabling caregivers to respond promptly to any fluctuations or concerns in the patient's well-being. By leveraging advanced IoT technology, the system provides seamless connectivity, allowing caregivers to remotely access and monitor the patient's health status from anywhere. This real-time monitoring capability enhances the overall efficiency of caregiving, ensuring timely interventions and personalized care for individuals with Alzheimer's disease.

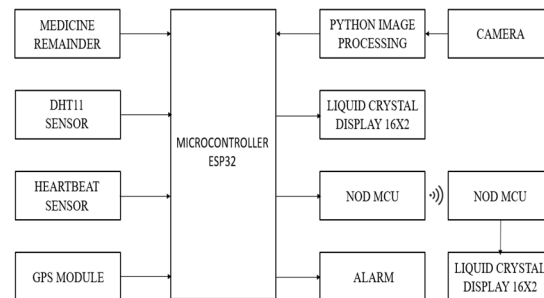


Figure 3. Block Diagram Representation of Face Recognition-Based Smart Device for Alzheimer's Patient

Facial recognition, Ref. [1] driven by Python image processing, facilitates personalized voice playback, thereby enhancing communication and interaction. This feature is particularly beneficial for individuals with specific needs or preferences, as it fosters a more engaging and supportive interaction experience. By leveraging this technology, caregivers can customize communication methods to suit the unique preferences of patients, ultimately promoting a sense of familiarity and comfort in their caregiving environment.

This project integrates a lost item finder system utilizing WiFi RSSI distance tracking, which effectively addresses the common challenge of locating personal items within a defined range. This innovative feature enhances user convenience by providing a reliable solution to the everyday task of locating essential items, such as keys, thereby streamlining daily routines and reducing unnecessary stress or frustration.

The integrated system aims to streamline healthcare management by consolidating multiple functionalities into a single platform. This user-friendly approach reduces the reliance on multiple devices, enhancing convenience and efficiency in healthcare monitoring and personal well-being. By providing a comprehensive solution within a unified interface, the system simplifies daily routines for both patients and caregivers, ultimately improving the overall quality of care and patient outcomes.

The proposed system prioritizes privacy and security by implementing facial recognition technology for user identification. This feature enhances the overall security of healthcare data and fosters a more reliable healthcare environment. With facial recognition, the system ensures that only authorized individuals can access sensitive information, thus safeguarding patient privacy and maintaining confidentiality. By integrating robust security measures, the proposed system instills trust and confidence in patients and caregivers alike, promoting a secure and efficient healthcare experience.

Simultaneously, Ref. [6] The proposed system integrates GPS tracking technology, enhancing safety by allowing caregivers to monitor the patient's real-time location. This feature prioritizes patient well-being and provides caregivers with a comprehensive toolkit for responsive and informed caregiving, emphasizing safety and peace of mind.

The proposed system introduces a comprehensive approach to Alzheimer's care by incorporating additional components such as the smart medicine box and reminder system within the smartphone application. These features are meticulously designed to address critical aspects of Alzheimer's management, focusing on medication adherence, organizational enhancement, and promoting patient autonomy. By offering personalized support tailored to the diverse needs of both patients and caregivers, the system aims to redefine the standard of care provided. Through innovative components and a holistic approach, it strives to deliver a nuanced and dynamic solution, as depicted in the informative diagrammatic representation in Fig. 3. Ultimately, the overarching goal is to enhance the quality of life for individuals affected by Alzheimer's.

IV. HARDWARE DESCRIPTION

The proposed hardware Fig.4.1. encompasses a Node MCU and ESP32 microcontroller powered by a 5V DC supply. It integrates critical components, including the DHT11 sensor for temperature monitoring, a pulse sensor for health tracking, a GPS module for real-time location monitoring, and a smart medicine reminder system for patients' medication adherence. The wireless Lost Item Finder module operates seamlessly through WiFi connectivity. This hardware setup is intricately linked to a dedicated smartphone application, offering a comprehensive interface.

The application used is the "blink" which not only facilitates the Lost Item Finder but also delivers real-time latitude and longitude notifications through the GPS module. It provides insights into the patient's health conditions and incorporates facial recognition technology. This amalgamation of hardware features ensures a robust and user-friendly system, catering to various facets of Alzheimer's care for both patients and caregivers.

The Fig.4.2. shows that the LCD display provides real time updates on the patient's pulse, temperature and medication remainder ensuring immediate attention to any health fluctuations.

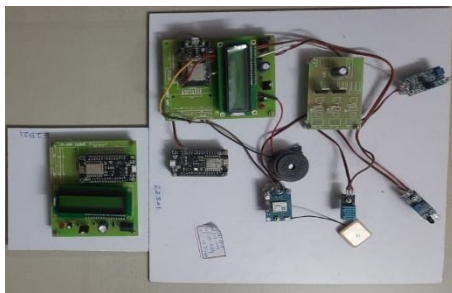


Figure 4.1. Experimental Setup of Hardware



Figure 4.2. Overview of LCD display

V. ADVANTAGES IN THE PROPOSED SYSTEM

The remarkable features embedded in the "Face Recognition-Based Smart Device for Alzheimer's Patients" play a pivotal role in enhancing its overall effectiveness. The integration of facial recognition technology, complemented by the innovative voice-over identification, establishes a seamless means of patient recognition. Beyond the practical aspects of social interactions, this feature cultivates a profound sense of familiarity, positively impacting the patient's emotional well-being.

A critical facet of the system lies in its "Lost Item Finder" functionality. Addressing the common challenge of forgetfulness in Alzheimer's patients, this feature becomes an invaluable tool. By swiftly locating misplaced items, it offers a tangible solution to a daily struggle, reducing frustration and contributing significantly to the patient's independence and overall life quality.

Expanding the scope, the device incorporates health monitoring, smart medication reminders, and tracking capabilities. This holistic approach not only ensures the well-being of the patient but also alleviates caregiving responsibilities. The health monitoring feature provides real-time data, fostering prompt responses to the patient's needs. Simultaneously, the smart medication reminders offer essential support to caregivers, enhancing their ability to organize and administer medications effectively.

In essence, the multifaceted features of this smart device not only directly benefit the patient by addressing specific challenges but also create a supportive ecosystem for caregivers. This comprehensive approach aligns with the broader goal of improving the overall quality of life for individuals affected by Alzheimer's.

VI. RESULT AND DISCUSSION

Our investigation into the "Face Recognition-Based Smart Device for Alzheimer's Patients" has yielded significant results, showcasing the successful integration of advanced technologies. The enhanced facial recognition technology, now complemented with voice-over identification, serves as a reliable mechanism for patient recognition, fostering improved social interactions and instilling self-assurance among individuals grappling with Alzheimer's.

In addition, the integration of health monitoring features, including temperature and pulse tracking displayed via LCD as depicted in Fig. 6.1, significantly contributes to patient well-being.



Fig.6.1. Operational status of the system's health monitoring



Fig.6.2. Operational status of smart medicine box

The incorporation of a medication reminder system further streamlines Alzheimer's management, ensuring consistent adherence to prescribed medication regimens. This reminder system also displays prompts on the LCD, such as "MEDICINE TAKE IT," as shown in Fig. 6.2, enhancing patient compliance and routine adherence. Moreover, the system incorporates a lost item finder technology, capable of notifying the distance of the misplaced object through the "Blink" smartphone application. This advanced feature adds another layer of convenience and assistance for both patients and caregivers, further enhancing the overall functionality of the system. Additionally, the GPS tracking functionality within the "Blink" application, as depicted in Fig. 6.3, offers real-time location updates, ensuring the safety and security of Alzheimer's patients while providing peace of mind for caregivers.

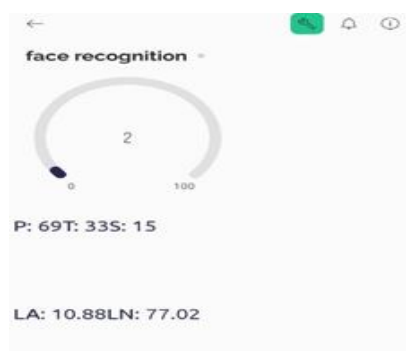


Fig.6.3. Functional overview of the smartphone application

VII. APPLICATIONS

In the reimagined application interface, the proposed system evolves into a wearable hand band, housing essential functionalities like health monitoring, GPS tracking, and facial recognition via an embedded camera with its associated functionalities. Medication reminders are seamlessly integrated into the patient's medicine box, signalling dosage times through flashing alarms. The lost item finder is reengineered into a convenient key chain holder. This hand band will feature an intuitive LCD display for real-time health updates, with medication reminders will be prominently displayed on the LCD screen, ensuring patients can easily access and adhere to their prescribed dosage schedules. All these features will be synchronized with the smartphone application, enhancing accessibility and usability for both patients and caregivers.

VIII. CONCLUSION

In conclusion, our proposed system represents a pivotal advancement in Alzheimer's care, transcending the boundaries of conventional solutions. The multifaceted approach, enriched by the inclusion of tracking and lost item finder, demonstrates a commitment to comprehensively address the challenges posed by neurodegenerative disorders. As we navigate this innovative landscape, it becomes clear that our system not only stands as a testament to technological prowess but also as a compassionate ally for patients and caregivers.

The journey forward involves a continuous commitment to refinement, guided by ongoing collaboration with healthcare professionals and stakeholders. The adaptability of our system to the evolving landscape of Alzheimer's care emphasizes its potential as a cornerstone in the holistic well-being of individuals affected by this condition. Our pursuit of excellence in technological innovation is inseparable from our dedication to enhancing the quality of life for those traversing the intricate path of Alzheimer's.

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