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IoT Assistant-Based Secured System for Alzheimer's Disease

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Abstract: *In many countries, the rise in the count of Alzheimer's disease (AD) is an indication that concerns. In order to prevent, detect and help people with AD, new techniques are required. These changes result in a decline in thinking ability, a type of intellectual capacity that is severe enough to interfere with daily life and independence. Relationships, emotions, and conduct are all impacted. When they lose track of familiar individuals or their connections to them, those with Alzheimer's disease are put in an awkward predicament. They tend to remain silent and avoid interacting with others on days when they are always uncomfortable, which is bad for their mental health. That makes it difficult for the patient and the guardians to stay in touch with one another. In order to protect the AD patient, the goal of this work is to build a working model for a system that provides psychological technical assistance and ensures secure transfer of data which may be inspected by a family member. The created transportable prototype can divide the identified images into two groups, including family and non-family persons, by using a Convolutional Neural Network (CNN). This framework combines the use of hardware with headphone-based IoT communication..*

Keywords: Alzheimer's disease, Convolutional Neural Network, IoT communication, intellectual capacity

I. INTRODUCTION

Alzheimer's disease is just one of the many distinct medical diseases that fall under the umbrella term of dementia. Abnormal brain alterations are the root cause of the disorders referred to as "dementia" in general. These alterations cause a loss in intellectual capacity known as reasoning ability is severe enough to affect daily functioning and independence [6]. They also have an impact on relationships, feelings, and behavior. Alzheimer's disease is a rare symptom of ageing. The main risk factor for dementia in older persons is age, and those over 65 make up the bulk of cases [7]. Younger-onset Alzheimer's is the term used to describe Alzheimer's disease that worsens in those under the age of 65. Because dementia is a chronic condition, the symptoms progressively worsen over a period of several years. As Alzheimer's disease is in its later stages, people lose their ability to speak and respond to their environment. Alzheimer's disease initially causes very little memory loss [8]. Yet, a person with the condition often lives for up to eight years after being diagnosed.

The Internet of Things refers to the network of physical items, or "things," which are fitted with sensors, algorithms, as well as other capabilities for both the purpose of linking and exchange information with other equipment and systems over the internet (IoT). These technologies range from basic household appliances to sophisticated machinery. IoT is now recognised as one of the most important 21st century technologies. In today's networked environment, digital logic can record, monitor, and alter every contact between connected entities. Physical and digital items become popular, yet they collaborate

II. BACKGROUND OF THE STUDY

The convergence of two topics that are both fast expanding—quantum computing and machine learning—has given rise to the field of quantum computing in machine learning. The application of quantum mechanics to computation is the subject of the study area known as quantum computing. Quantum computers use quantum bits (qubits), which can exist in several states simultaneously, instead of the binary digits (bits) used by classical computers to encode information.

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This enables quantum computers to carry out some computations far more quickly and effectively than traditional computers. A subfield of artificial intelligence known as "machine learning" employs statistical models and algorithms to let computers learn from data and make predictions or judgments without having to be explicitly programmed. Due to its capacity to find patterns in huge, complicated datasets and generate predictions, machine learning has gained popularity in recent years. The convergence of these two disciplines has given rise to quantum machine learning, which investigates the application of quantum computing to enhance the efficiency and precision of machine learning algorithms. Quantum machine learning has the potential to revolutionize a variety of industries, including banking, healthcare, and transportation, by making it possible to analyze massive and complicated datasets more quickly and accurately. The field of quantum computing in machine learning is still in its infancy, and much of the research has been devoted to creating novel methods and algorithms that are tailored for quantum computers. Although the difficulties still present, quantum machine learning has enormous potential, and numerous researchers and businesses are making investments in this field to investigate novel approaches to the solution of challenging issues and the discovery of novel insights from data..

III. LITERATURE REVIEW

[1] Author: Zaven S. Khachaturian. The development of research activities is significantly impacted by the early and precise recognition of Alzheimer's disease (AD). An education programme for starting research to address the challenges of order to diagnose AD in its early stages was co-sponsored by the National Institute for Mental Health. The goal of the conference was to emphasise the most pertinent areas for scientific enquiry in addition to the underlying practical and clinical challenges that affect how rapidly AD diagnoses are made.

[2] Author: Shervin Emami One of the greatest and most efficient uses of image processing and algorithm- based understanding, face identification and recognition has evolved from an unknown to a well-liked field of computer vision research. Because it is widely believed that improvements to computer image processing as well as research will offer new insights into how our brains function and vice versa, computer vision is not just a computer science field of study. The author has recommended to create a program that would grant user access to a certain device based on a thorough analysis of a person's facial features out of given sample and interest in the subject. The.NET framework from Microsoft and the OpenCV computer vision open- source project from Intel will be used to create this application.

[3] Authors: SikandarKhan et. all Back propagation neural layers, faster RCNNs, single shot detection and region-based convolution systems are a few of the most well-liked object recognition algorithms. The special feature is that a camera placed in the classroom will capture pictures twice, once at the beginning and once at the end, to verify that pupils have attended the entire lesson. YOLO V3 would first count the pupils in a picture, then identify known and unknown faces, making different spreadsheets, and sending an email to students, parents, and faculty at the end of the month. The system's real-time solution for counting and identification works effectively.

[4] Authors: Max Smith-Creasey et. all Based on retrieved face traits, the system verifies a user and keeps track of the validated face but only attempts to re-authenticate when it is lost. This allows our approach to quickly identify impostor usage and close attack windows that are present in periodic authentication schemes. Additionally, a reliable existing detection element to the system that can recognize printed faces as well as face recordings is included. In order for the results to reflect genuine situations, we also generate the very first dataset comprising facial videos taken from portable devices during various real-world activities.

[5] Authors: JayanthVadlapati et. All The method is frequently employed for recognizing real-world objects, including human faces and other objects. As a conclusion, a person from a photograph can be identified using such methods. The trained model is used to distinguish people wearing masks by applying facial recognition modules from the extensive library of libraries available in Python. As 50 percent of the facial characteristics are lost when masks are used, it is essential to design a method for recognizing faces in this way. Biometric technology, video surveillance, and other fields use this particular face detection method. Thus, it is crucial to boost security and efficiency while quickening recognition.

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IV. PROBLEM STATEMENT

"Alzheimer's disease presents significant challenges for patients and caregivers, often leading to issues related to patient safety, medication management, and overall quality of life. Existing solutions for managing Alzheimer's often lack integration, real-time monitoring, and robust security measures, leaving patients vulnerable to various risks. Therefore, there is a critical need to develop an innovative IoT assistant-based system tailored specifically for Alzheimer's patients that ensures real-time monitoring, medication reminders, location tracking, and communication functionalities while prioritizing robust security measures to protect sensitive patient data and ensure system integrity. This system aims to improve patient safety, enhance caregiver support, and ultimately enhance the quality of life for individuals living with Alzheimer's disease." Existing solutions for Alzheimer's management often rely on manual methods, which are prone to errors and may not provide timely assistance or monitoring. While some technological solutions exist, such as wearable devices or mobile applications, they often lack integration, real-time monitoring capabilities, and robust security measures, leaving patients vulnerable to various risks such as wandering, medication errors, and emergencies. Furthermore, the sensitive nature of patient data necessitates stringent security measures to protect privacy and ensure compliance with healthcare regulations. Current solutions may fall short in providing adequate security, leaving patient data vulnerable to breaches or misuse.

V. PROPOSED APPROACH

Among distinct illness that fall under the general category of dementia is the Alzheimer's disease. Relationships, emotions, and conduct are all impacted. The main risk factor for Alzheimer's disease in elderly adults is aging, and those above 65 represent the majority of diagnoses. As Alzheimer's disease is in its later stages, people lose their capacity to communicate and adapt to their surroundings. Alzheimer's disease originally causes very little memory loss. Yet, a person with the condition often lives for a maximum of eight years after being diagnosed. The prevailing system according to The US National Library of Medicine states that the typical range for a human body temperature seems to be between 97F (36.1C) and 99F (37.2C) [9]. As a result, the camera can measure a material's temperature with a precision of _x0006 0.2C. But, our camera cannot detect a human personality if indeed the temperature is greater than 99F (37.2C). Currently, this method just uses software output. The proposed system makes use of mobile communication technologies and the Internet of Things (IoT) (MCT).

The internet of things, or IoT, is a network of connected computers, mechanical and digital machinery, things, or people that have been given unique identifiers (UIDs) and the capacity to transfer data across a network without necessitating human-to-human or human-to computer interactions. Numerous internet connected devices that are part of the ecosystem receive, transmit, and act on data they receive from their environment via embedded systems are present [10]. connecting to an edge device, such as an IoT gateway, that either delivers information to a cloud for analysis, IoT devices transmit the sensor data they collect. Although individuals can engage with the devices to set them up, give them instructions, or retrieve the data, the gadgets execute the remainder of the job without their assistance. Mobile communications networks as well as other related disciplines use mobile technology widely. It uses a network structure that allows numerous transmitters to send data simultaneously on a single channel [11]. Many users can use a specific frequency on this network since it reduces the possibility of enhancing between two or more sources. Tens or even hundreds of layers can indeed be incorporated in a convolutional neural network, and each layer can be trained to classify various features of an image. Each training image is processed to filters at multiple configurations, and the outcome of each preprocessed image is taken as the feed to the following layer. Beginning with relatively basic properties like brightness and borders, the filters can get more complicated until they reach characteristics that clearly identify the object. Global system for mobile communication (GSM) is a cellular modern digital standard which is widely known. The GSM certification group was founded in 1982 to develop standards for a 900 MHz pan-European cellular mobile radio system. The goal of the GSM usually consisting was to establish an integrated European mobile telephone standard. For fetching the real time datasets, the Cascade Classifiers are used. This system as depicted in Fig.1, is written in Python and Embedded C, detects the photo of a person and analyses it being a family member if loaded as a dataset. The caretaker of the Alzheimer's disease receives an alert message for the uploaded mobile number when an unknown person is detected through the webcam. Through this prototype, an accuracy of 89% was obtained in predicting the person's face from a sample dataset captured from the user

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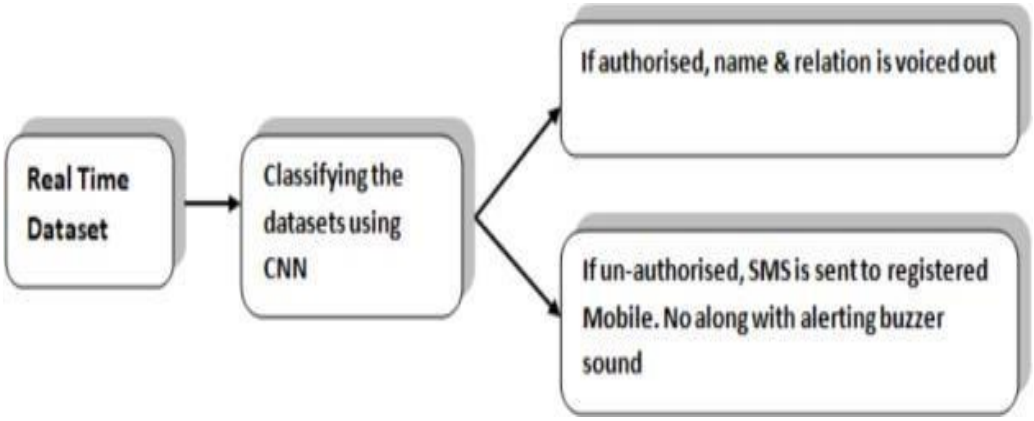

Fig.1. Working flow of the proposed system

VI. RESEARCH METHODOLOGY

Developing an IoT Assistant-Based Secured System for Alzheimer's disease involves several stages of research methodology. Below is a structured approach:

1. Literature Review: Understand existing research and technologies related to Alzheimer's disease management, IoT, and security systems. Identify gaps in current solutions and areas for improvement.
2. Problem Definition: Clearly define the challenges faced by Alzheimer's patients and their caregivers. Identify specific security concerns related to IoT devices and systems used in healthcare settings.
3. Requirement Analysis: Engage with stakeholders including patients, caregivers, healthcare professionals, and security experts to gather requirements. Define the functionalities and features needed in the IoT assistant-based secured system.
4. System Design: Design the architecture of the IoT system including hardware components, communication protocols, data flow, and software modules. Incorporate security measures such as encryption, authentication, access control, and secure data storage.
5. Prototype Development: Develop a prototype of the IoT assistant-based secured system based on the design. Implement features such as patient monitoring, location tracking, emergency alerts, medication reminders, and communication interfaces.
6. Evaluation: Conduct usability testing with Alzheimer's patients and caregivers to assess the effectiveness and ease of use of the system. Evaluate the security aspects of the system through penetration testing and vulnerability assessment. Gather feedback and iterate on the design based on the evaluation results.
7. Validation: Validate the effectiveness of the IoT assistant-based secured system in real-world scenarios. Measure the impact of the system on patient well-being, caregiver burden, and overall healthcare outcomes.
8. Ethical Considerations: Ensure that the system complies with ethical guidelines for healthcare research and data privacy regulations. Address concerns related to consent, data ownership, and confidentiality.
9. Documentation and Reporting: Document the research methodology, design decisions, implementation details, evaluation results, and validation outcomes. Prepare reports and presentations to disseminate findings to the scientific community, healthcare practitioners, and stakeholders.
10. Deployment and Deployment Strategy: Develop a deployment strategy for deploying the IoT assistant-based secured system in healthcare facilities, assisted living facilities, or patients' homes. Provide training and support for users and administrators. Monitor the system post-deployment and make necessary updates or improvements based on feedback and usage patterns.

By following this research methodology, you can systematically develop and evaluate an IoT assistant-based secured system for Alzheimer's disease management, ensuring its effectiveness

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VII. FUTURE SCOPE

The future scope of IoT face recognition assistant for Alzheimer's disease using Arduino and face recognition technology is vast. Some of the potential future developments in this field include:

1. Integration with wearable devices: Wearable devices such as smartwatches and fitness trackers can be integrated with IoT face recognition assistant for Alzheimer's disease to provide even more personalized care and monitoring.
2. Improved accuracy: Advancements in facial recognition technology can lead to even more accurate identification and tracking of Alzheimer's patients, reducing the risk of false positives or false negatives.
3. Artificial Intelligence integration: The integration of artificial intelligence can enable the system to learn and adapt to the patient's behavior, improving the accuracy of reminders and alerts.
4. Expansion to other neurodegenerative diseases: Similar technology can be developed and customized to assist patients with other neurodegenerative diseases such as Parkinson's disease and Huntington's disease.
5. Cloud integration: Integration with cloud technology can allow for remote access and monitoring of patient data, enabling doctors and caregivers to provide more effective and timely care.

Overall, the future scope of IoT face recognition assistant for Alzheimer's disease using Arduino and face recognition technology is promising, with potential for continued advancements and improvements to provide better care for patients and caregivers alike.On a future development, the unauthorized person's face would be stored in a separate file to have it as a proof of confirmation. Furthermore, the classifications of dataset could also be improved to acquire higher accuracies.

VIII. CONCLUSION

In conclusion, an IoT face recognition assistant for Alzheimer's disease using Arduino and face recognition technology can be a useful tool for improving the safety and care of Alzheimer's patients. The system can provide personalized reminders, real-time monitoring, and enhanced independence for patients. However, it is important to consider the potential privacy concerns, accuracy issues, and cost associated with implementing this technology. Overall, if implemented responsibly and with proper consideration of these factors, an IoT face recognition assistant for Alzheimer's disease using Arduino and face recognition technology can be an effective solution for providing improved care for Alzheimer's patients. The main goal of this project is to examine and predict various relations of the Alzheimer's Patient in order to help them mentally giving them a support, confidence and to see how this approach may be improved in the future to attain greater accuracy. The survey covers over the elderly stages of Alzheimer's Patient to help them hearing the name and relation with the person with a help of Arduino and GSM module setups.

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