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IoT and AI based Wearable Device for Patient with visual impairment and mild Dementia

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1. Abstract

Alzheimer's disease (AD) is a chronic, irreversible brain condition that slowly erodes one's capacity for memory and thought. One of the most prevalent causes of dementia is Alzheimer's disease. Dementia is defined as the loss of cognitive performance, including thinking, remembering, and reasoning, as well as behavioral ability to the point where it significantly impairs daily life. In the medical industry, image processing is frequently used to identify diseases and support clinicians' observation-based decision-making. The goal of the study is to identify Alzheimer's disease as early as possible so that individuals can be treated before the brain experiences irreversible alterations. To process the brain's Magnetic Resonance Imaging (MRI), we suggest the image processing method. Additionally, as a solution, we use image processing with audio-based feedback to assist them in recognizing their family members and bringing sign to spoken concepts to support their daily activities and emergency support. Additionally, we included hardware for monitoring the patient's real-time health status using IOT, and our suggested technique is also capable of texting family members in an emergency.

Keywords: MRI Images, Sign to Speech, Face Recognition, Voice Feed-back System, microcontroller.

2. Introduction

Millions of people throughout the world are afflicted by the degenerative brain ailment known as Alzheimer's disease. It impairs memory, creates disorientation, and makes doing daily tasks challenging. Alzheimer's patients frequently need round-the-clock monitoring and care, which puts a strain on family caregivers. A support system for Alzheimer's patients has been developed combining the Arduino GPS GSM with position monitoring and medication reminder, Python family member recognition, and MRI-based Alzheimer detection to address these issues.

Alzheimer's disease is one of the diseases with a higher death rate at an advanced stage in India. It is a neurological brain disorder with multiple facets that slowly destroys brain cells, which can lead to memory loss, thinking skill loss, and even the inability to remember simple tasks. Dementia is the term for this. The neurodegenerative type of dementia, which cannot be detected with this type of disease in a medical assessment and requires a patient history, MMSE, physical examination, and neurobiological examination, sees this condition becoming progressively worse. to test Different illness phases can be recognized by using the MRI table and scanning of both structural and cerebral environment, as well as hippocampus and expansion.

1.1 Background

The suggested approach intends to help Alzheimer's sufferers and lessen the workload for those who are caring for them. The system uses an Arduino board, a GPS module, and a GSM module to offer location monitoring and medication reminders. Additionally, to identify family members, the system makes use of Python. In order to detect Alzheimer's disease in its early stages and enable prompt intervention and treatment, the system also uses MRI-based Alzheimer detection.

1.2 Objectives

The suggested system's main goal is to aid Alzheimer's sufferers and lessen the load on their caretakers. The technology provides location tracking and medication reminders in an effort to do this. If a patient wanders off or gets lost, the location monitoring feature lets caretakers to find them immediately and help. To effectively manage their disease, patients must take their prescription medications as directed, and the medication reminder tool helps to ensure this. Early diagnosis of Alzheimer's disease allows for prompt intervention and therapy. This is made possible by the MRI-based Alzheimer detection feature.

3. Literature Review

3.1. Face Detection and Recognition System using Digital Image Processing

(Proceedings of the Second International Conference on Innovative Mechanisms for Industry Applications (ICIMIA 2020) IEEE Xplore Part Number: CFP20K58-ART; ISBN: 978-1-7281-4167-1)

The most crucial feature in identifying anybody is their face. Face recognition aids in the authentication of every person's identity utilizing his unique personal traits because it serves as a distinct identity for everyone. The entire process of authenticating any face data is separated into two parts. The first phase involves swiftly detecting faces, with the exception of situations when the object is positioned fairly far away. The second phase then begins, during which the faces are identified as belonging to specific people. The entire procedure is then repeated, assisting in the development of a face recognition model, one of the most carefully examined biometric technologies. Basically, the Eigenface method and the Fisher face method are the two types of face recognition approaches that are now being used. The PCA (Principal Component Analysis) is essentially used by the Eigenface approach to reduce the face dimensional space of the facial features. The focus of this research is on developing a face recognition system using digital image processing.

3.2. Research on Text Detection and Recognition Based on OCR Recognition Technology

(2020 IEEE 3rd International Conference on Information Systems and Computer Aided Education (ICISCAE))

The field of machine vision includes several key subfields, including optical character recognition (OCR). Artificial intelligence, image processing, digital signal processing, pattern recognition, and other fields are all involved. It covers everything. In high-tech domains including word information processing, office automation, machine translation, and real-time monitoring systems, it has significant practical usefulness and theoretical relevance. OCR has a new goal in the 21st century due to the ubiquity of smartphones with high-definition cameras: more and more people are using their phones to take pictures of the objects and places they encounter in order to read the text that is contained inside the images. As a result, the topic of character identification in natural landscapes has recently emerged. In the past, artificially created features and conventional image processing techniques served as the foundation for text identification and text recognition systems. These features and algorithms were complex to create and required extensive professional training and expertise, therefore their accuracy was low and they were not widely applicable. Breakthroughs have been made in the areas of computer vision such as picture classification, object recognition, and semantic segmentation in recent years due to the rapid growth of deep learning technologies. A data-driven algorithm is the deep learning algorithm. The approach based on deep learning has superior generalization than standard image processing related algorithms since it can automatically uncover and learn the hidden feature rules in a huge quantity of data through iterative training, without too much human interaction.

4. Existing System

The features of the existing system called “Alzheimer’s daily companion” are as follows:

· Free and immediate advice and tips for dealing with Alzheimer’s and dementia behaviours and situations.

· 24-hour assistance via toll free Call or email submission.

· Access to free Alzheimer’s and other dementia caregiver resources and training materials.

The Major Drawbacks of “Alzheimer’s daily companion” are as follows:

Since Alzheimer people are already being affected by memory loss it becomes very difficult for them to send or check EMail or Call Toll Free numbers for support.

5. Need for the Project

1. Safety: Alzheimer's patients often wander and may get lost, causing significant stress and anxiety for caregivers. The proposed system offers location tracking and SMS alerts to caregivers, which can improve patient safety and reduce stress levels.
2. Medication Management: Alzheimer's patients often have difficulty managing their medications, leading to missed doses and potential health risks. The proposed system offers SMS reminders to patients, helping them manage their medications more effectively and reducing the likelihood of adverse health outcomes.

3. Family Coordination: The proposed system offers a family member recognition feature, allowing the subject to recognize family members through machine learning based solution.
4. Early Detection: Alzheimer's disease can be challenging to diagnose, and early intervention is critical for effective treatment. The proposed system offers an MRI-based Alzheimer detection software that can diagnose Alzheimer's disease in its early stages, allowing for timely intervention and treatment.
5. Cost-Effective: The proposed system is cost-effective compared to other assistive technologies, making it accessible to a wider range of patients and caregivers.

6. Proposed Methodology

Our Proposed System aims to detect Alzheimer's disease at earliest so that patients can be prevented before irreversible changes occur in the brain. We propose the image processing technique to process the Magnetic Resonance Imaging (MRI) of the brain. Additionally, as a solution we also help them to recognize their family members and also bring sign to speech concepts to support with their daily activities and emergency support using image processing with audio-based feedback. And for emergency purposes we added the hardware equipment to monitor the patients real time health condition using IOT and our proposed method also capable of sending an emergency text message to relatives.

6.1 Software Requirements

Arduino IDE

Python IDLE

6.2 Programming Language

Embedded ‘C’

Python

6.3 Benefits

The proposed system has several benefits, including improved safety, improved medication management, improved communication and coordination, early diagnosis, and timely intervention and treatment. The location tracking feature enables caregivers to ensure the safety of the patient and respond quickly if the patient wanders away or gets lost.

6.4 Scope

The proposed system is intended to provide assistance to patients with Alzheimer's disease and their caregivers. The system is designed to be easy to use and accessible through a phone or other device. The system can be easily integrated into the patient's daily routine and is cost-effective.

6.5 Block Diagram software

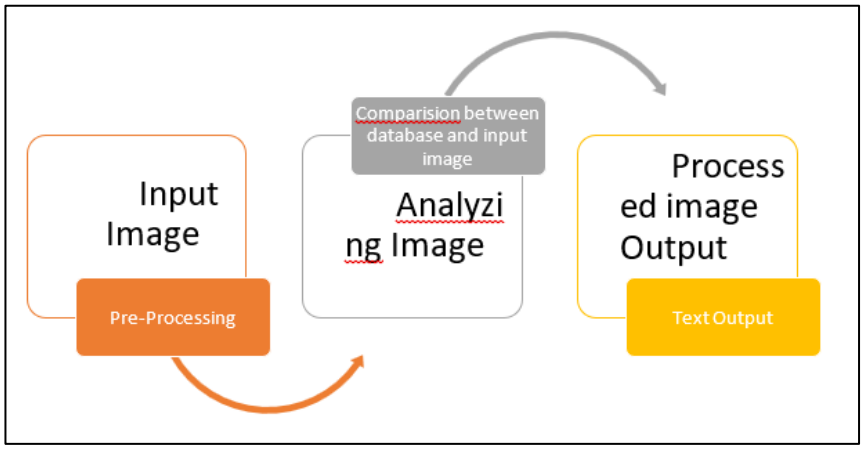

Fig: Software Block diagram

6.6 Hardware Block Diagram

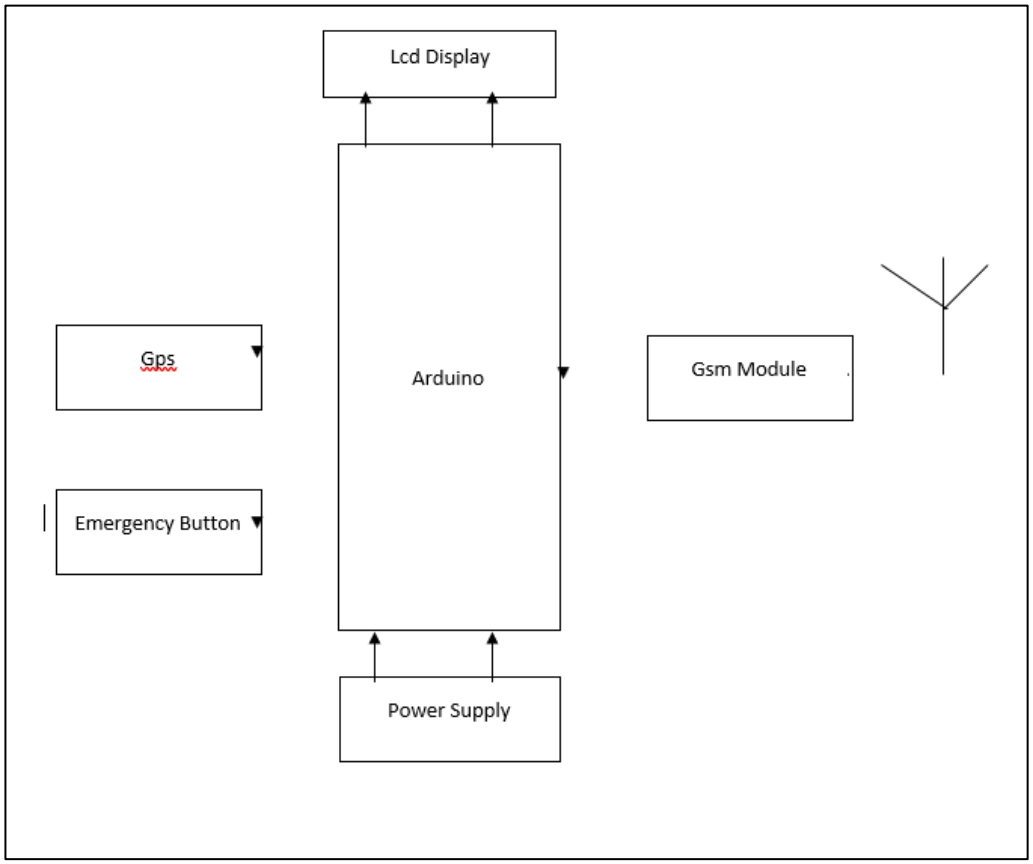

Fig: Hardware Block diagram

6.7 Hardware Requirements

S.No	Component name	Qty
1	ATmega328P Microcontroller	1
2	Node MCU	1
3	MAX30100	1
4	GSM Module	1
5	LCD Display	1
6	LCD Base	1
7	Power Supply	1
8	Emergency Button	1

7. Result & Discussion

IoT and AI-based wearable device for patients with visual impairment and mild dementia has the potential to significantly improve their safety, well-being, and independence while providing peace of mind to caregivers and loved ones. However, it's essential to design the device with privacy and security measures to ensure the user's data remains protected. Additionally, continuous user feedback and updates are crucial to refining and enhancing the device's functionality over time.

The convergence of IoT and AI technologies in wearable devices holds tremendous potential to revolutionize patient care for individuals with visual impairment and mild dementia. By providing enhanced safety, personalized assistance, and remote monitoring capabilities, these smart wearables can empower patients to lead more independent and fulfilling lives. However, addressing ethical concerns, data privacy, and ensuring accessibility for all remains critical in realizing the full potential of IoT and AI in healthcare. Collaborative efforts among healthcare professionals, technologists, policymakers, and patient communities will be pivotal in fostering innovation while upholding ethical principles and patient welfare.

8. Conclusion

In conclusion, IoT and AI-based wearable devices tailored for patients with visual impairment and mild dementia have the potential to revolutionize healthcare and significantly improve the lives of these individuals. By enhancing accessibility, providing personalized care, offering cognitive support, ensuring safety, enabling remote monitoring, and maintaining a user-friendly interface, these devices can empower patients to lead more independent and fulfilling lives while providing peace of mind to their caregivers and loved ones. Nevertheless, careful attention must be paid to ethical considerations to build trust and ensure the responsible and beneficial implementation of these technologies in healthcare settings.

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