SECURE IOT ASSISTANT-BASED SYSTEM FOR ALZHEIMER'S DISEASE

A PROJECT WORK REPORT

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TABLE OF CONTENTS

ABSTRACT

In many countries, the rise in the prevalence 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. The purpose of this work is to create a prototype for a system that offers psychological technical support and guarantees secure transmission of data that can be inspected by a member of the family to safeguard the AD sufferer. Relying on a Convolutional Neural Network (CNN), the developed portable prototype can classify the detected photographs into two categories, including family and non-family members. This framework incorporates utilizing hardware with IoT communication through headphones.

பல நாடுகளில், அல்சைமர் நோயின் (AD) பரவல் அதிகரிப்பது கவலைக்குரிய அறிகுறியாகும். AD உள்ளவர்களைத் தடுக்க, கண்டறிய மற்றும் உதவ, புதிய நுட்பங்கள் தேவை. இந்த மாற்றங்கள் சிந்தனைத் திறனில் சரிவை ஏற்படுத்துகின்றன, இது ஒரு வகையான அறிவுசார் திறன் தினசரி வாழ்க்கை மற்றும் சுதந்திரத்தில் தலையிடும் அளவுக்கு கடுமையானது. உறவுகள், உணர்ச்சிகள் மற்றும் நடத்தை அனைத்தும் பாதிக்கப்படுகின்றன. பழக்கமான நபர்கள் அல்லது அவர்களுடனான தொடர்புகளை அவர்கள் இழக்கும்போது, அல்சைமர் நோயால் பாதிக்கப்பட்டவர்கள் ஒரு மோசமான இக்கட்டான நிலைக்குத் தள்ளப்படுகிறார்கள். அவர்கள் அமைதியாக இருக்க முனைகிறார்கள் மற்றும் அவர்கள் எப்போதும் சங்கடமாக இருக்கும் நாட்களில் மற்றவர்களுடன் தொடர்புகொள்வதைத் தவிர்க்கிறார்கள், இது அவர்களின் மன ஆரோக்கியத்திற்கு மோசமானது. இது நோயாளியும் பாதுகாவலர்களும் ஒருவரையொருவர் தொடர்பில் வைத்திருப்பதை கடினமாக்குகிறது. இந்த வேலையின் நோக்கம் உளவியல் தொழில்நுட்ப ஆதரவை வழங்கும் மற்றும் AD பாதிக்கப்பட்டவரைப் பாதுகாப்பதற்காக குடும்ப உறுப்பினர்களால் பரிசோதிக்கப்படும் தரவுகளின் பாதுகாப்பான பரிமாற்றத்திற்கு உத்தரவாதம் அளிக்கும் ஒரு அமைப்புக்கான முன்மாதிரியை உருவாக்குவதாகும். Convolutional Neural Network (CNN) ஐ நம்பி, உருவாக்கப்பட்ட கையடக்க முன்மாதிரியானது கண்டறியப்பட்ட புகைப்படங்களை குடும்பம் மற்றும் குடும்பம் அல்லாதவர்கள் உட்பட இரண்டு வகைகளாக வகைப்படுத்தலாம். இந்த கட்டமைப்பானது ஹெட்ஃபோன்கள் மூலம் IoT தகவல்தொடர்புடன் வன்பொருளைப் பயன்படுத்துவதை ஒருங்கிணைக்கிறது

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

AD	-	Alzheimer's Disease
AT	-	Attention
AC	-	Alternating Current
DC	-	Direct Current
IoT	-	Internet of Things

CHAPTER 1
INTRODUCTION

1.1 OVERVIEW

Alzheimer's disease is a progressive neurological disorder that affects the brain's ability to think, remember, and reason. It is the most common cause of dementia among older adults. Alzheimer's disease begins slowly and gradually worsens over time, leading to difficulty in performing daily tasks and ultimately to a loss of independence. Alzheimer's disease typically progresses through three stages: early, middle, and late. In the early stage, individuals may experience memory loss, confusion, and difficulty with familiar tasks. In the middle stage, individuals may experience personality changes, difficulty with language, and wandering. In the late stage, individuals may be unable to communicate or care for themselves.

Face recognition is a technology that uses algorithms to identify and verify a person's identity based on their facial features. It has become increasingly popular in recent years and is now used in a variety of applications, including security systems, social media, and mobile devices. There are two main types of face recognition technologies: 2D and 3D. 2D face recognition uses a two-dimensional image of a face, such as a photograph, to identify and verify an individual. 3D face recognition, on the other hand, uses a three-dimensional model of a face, often generated by scanning the face with specialized cameras, to create a more accurate representation of a person's facial features.

Face recognition technology uses a process called "face matching" to compare the features of a person's face to a database of known faces. This involves capturing an image or video of the person's face and analyzing it to extract features such as the

distance between the eyes, the shape of the nose, and the curvature of the lips. These features are then compared to a database of faces to determine the person's identity.

The web of physical "things," that are embedded with sensors, software and other technologies for the purpose of communicating and exchanging data with other devices and systems through the internet is often known as the Internet of Things (IoT). These technologies include anything from common domestic devices to high-tech industrial gear. IoT has recently come into its own to be among the most significant 21st-century technologies. Low-cost computers, the cloud, big data, analytics, and mobile technologies enable the sharing as well as processing of information by material things with a minimum of human intervention. Digital systems can record, monitor and modify every interaction between connected entities in today's interconnected environment. The physical and digital things get hot, but they function together.

1.2 PROBLEM STATEMENT

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. They also have an impact on relationships, feelings, and behavior.

The patients suffering from Alzheimer’s disease face an uncomfortable situation when they forget the faces of the known persons or their relationship with them. On continuous days of discomfort they tend to stay silent and un-interactive with the surroundings which affect their mental health. It creates a struggle for the patient as well as the care takers to communicate and interact with each other.

CHAPTER 2
LITERATURE REVIEW

[1] Zaven S. Khachaturian (1985) has proposed the development of research activities is significantly impacted by the early and precise recognition of Alzheimer's disease (AD). The objective was to highlight the most relevant scientific research opportunities as well as the underlying clinical and technical obstacles that have a bearing on how quickly AD diagnosis is carried out. Alzheimer's disease (AD) is a major public health problem in the United States and throughout the world. Early and accurate diagnosis is critical for the effective management of AD, as well as for the development and testing of new therapeutic agents. The current diagnostic criteria for AD, including clinical, neuropsychological, and neuro imaging criteria is reviewed.

LIMITATIONS:

- Lack of a definitive diagnostic test: Currently, there is no single definitive test for AD. The diagnosis of AD is usually based on clinical examination, neuropsychological testing, and imaging studies. These tests are useful but are not foolproof.
- Overlapping symptoms with other dementias: The symptoms of AD often overlap with other types of dementia, such as vascular dementia, Lewy body dementia, and fronto-temporal dementia. This can make it difficult to accurately diagnose AD and distinguish it from other forms of dementia.
- Lack of biomarkers: Although there are several biomarkers that can be used to diagnose AD, they are not always reliable.
- Cost and availability of diagnostic tests: Some diagnostic tests for AD can be expensive and not readily available. This can limit access to diagnosis for some individuals.

[2] Shervin Emami (2012) 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. The key feature is to provide an overview of current and emerging Information and Communication Technology (ICT) solutions and their potential impact on various industries and sectors. The rapid advancements in ICT, including big data, artificial intelligence, machine learning, cloud computing, blockchain, and the Internet of Things (IoT), among others is discussed. The challenges and potential risks associated with these technologies, such as data privacy, security, and ethical considerations are also concluded.

LIMITATIONS:

- Limited accessibility: While many ICT solutions can enhance accessibility, not all individuals have access to the technology needed to use these solutions. This creates a digital divide and can exclude certain individuals from the benefits of these solutions.
- Technical limitations: Some ICT solutions may require specialized technical expertise, which may not be available in all areas. Technical limitations can hinder the development and implementation of certain ICT solutions, particularly in less developed regions.
- Cost: Many ICT solutions can be expensive to develop and implement. The high cost can limit accessibility to these solutions and may prevent smaller organizations or individuals from utilizing them.

[3] SikandarKhan et.al (2020) proposed a technique which relies on 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 is propsed. The combined framework is built on Microsoft Azure's face API and the YOLO V3 (You Only Look Once) technique for facial recognition (face database). 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. The system operates by capturing images of individuals in real-time, processing them with OpenCV to extract facial features, and then matching these features with those in a pre-existing database using the Face API.

LIMITATIONS:

- Accuracy: The accuracy of the system depends on the quality of the images captured by the camera. If the lighting is poor, or if the images are blurred, the system may not be able to accurately recognize faces.
- Security: The system can be easily fooled by people wearing masks or other facial accessories that alter their appearance. This could potentially lead to attendance fraud.
- Maintenance: The system requires regular maintenance, including calibration of the cameras and software updates, to ensure that it continues to function properly.
- Privacy: There are concerns about the privacy implications of using facial recognition technology for attendance tracking.

[4] Max Smith-Creasey et.al (2018) explains 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 the 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 very first dataset comprising facial videos taken from portable devices during various real-world activities and generated. The system includes a tracking algorithm that enables the camera to adjust its position and orientation as the user moves, ensuring continuous authentication. Additionally, the system incorporates liveness detection to prevent unauthorized access by detecting spoofing attempts or presentation attacks. The detailed description of the system design and implementation, as well as an evaluation of its performance in terms of accuracy, speed, and robustness is provided.

LIMITATIONS:

- Dependence on camera quality: The accuracy of the system depends on the quality of the camera in the mobile device. If the camera is of low quality, the system may not be able to accurately detect the user's face.
- Sensitivity to lighting conditions: The system is sensitive to lighting conditions, which can affect the accuracy of face detection and liveness detection.
- Processing power: The continuous face authentication scheme requires significant processing power, which could drain the battery life of the mobile device and slow down other applications running on the device.

[5] JayanthVadlapati et.al (2021) proposed the method which 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. The proposed method involves the use of a combination of Haar cascades and convolutional neural networks (CNNs) for feature extraction and classification, respectively. We evaluate the performance of the method on a dataset of images of individuals wearing face masks and compare it to traditional facial recognition methods. The experimental results demonstrate that the proposed method achieves high accuracy in recognizing individuals even when they are wearing face masks. We also show that the method is robust to variations in lighting conditions and facial expressions.

LIMITATIONS:

- Decreased accuracy: The system's accuracy can be impacted by the use of face masks, as they cover a significant portion of the faces which leads to false negatives or false positives in identification.
- Varied quality of images: The images captured for the system can vary in quality due to factors such as lighting conditions, angles, and distances.
- Limited training data: The system's accuracy can be limited by the amount and quality of training data available.
- Dependence on facial features: The system depends on the facial features that are visible in the images captured, which can be impacted by the use of face masks. This can lead to false identification or non-identification.

CHAPTER 3
MODULES DESCRIPTION

INTRODUCTION

An IoT face recognition assistant for Alzheimer's disease is a system that combines the technologies of the Internet of Things (IoT) and face recognition to assist patients suffering from Alzheimer's disease. The system utilizes a camera and facial recognition software to identify individuals and retrieve their personal information, such as their name, address, and emergency contact information. This information is then displayed on a monitor or sent to the caregiver's smartphone, allowing them to keep track of the patient's movements and activities.

The system can be set up to detect and alert the caregiver if the patient goes into an area they are not supposed to or if they leave a designated area. This feature helps ensure the patient's safety and can also help prevent wandering, which is a common occurrence in Alzheimer's patients.

Additionally, the system can be programmed to remind the patient of important tasks, such as taking medication or attending appointments, through an audio message or visual prompt displayed on a screen. This feature can help maintain the patient's independence and promote their ability to perform everyday tasks.

Overall, an IoT face recognition assistant for Alzheimer's disease has the potential to greatly benefit both patients and caregivers by increasing safety, promoting independence, and providing a means for continuous monitoring and assistance.

The proposed system is divided into three modules:

3.1.1 Arduino Uno and it’s setup

3.1.2 GSM Module and it’s Configurations

3.1.3 Software Implementation on testing the real time dataset

3.1.1 Arduino Uno and its setup:

The board for the Arduino Uno shown in Fig.3.1.1, combines a microcontroller with all the essentials to help developing and debugging applications simple. A microcontroller board termed the Uno is built on the ATmega328P. It has a 16 MHz quartz crystal, 6 analogue inputs, 14 digital input/output pins, a USB port, a power jack, an ICSP header, and a reset button. It includes with everything needed to operate the microcontroller; to get started, just use a USB cable for connecting it to a computer, or an AC-to-DC adapter to power it. A 2.1mm core plug is capable of helping connect the adapter by inserting it into the circuit board's power supply. Battery cables may be placed into the POWER connector's GND and Vin pin headers. The board runs off of a 6 to 20 volt external source. The 5V pin, however, may supply less than five volts if supplied with less than 7V, and the circuit may become unbalanced. The voltage regulator would overheat and injure the board if more than 12V is used. The suggested range is between 7 and 12 volts.

PARTS OF ARDUINO WITBH ITS SPECIFICATION:

Part	Specification
Arduino Uno	Microcontroller: ATmega328P, Operating voltage: 5V
Breadboard	Number of rows: 2, Number of columns: 30
Jumper wires	Gauge: 22 AWG, Length: 3 to 6 inches
LED	Voltage: 2V to 3.3V, Current: 10mA to 20mA
Resistor	Resistance: 220Ω to 10kΩ
Capacitor	Capacitance: 1µF to 100µF
Push button	Contact resistance: <50mΩ, Operating force: 100g to 300g
Potentiometer	Resistance: 10kΩ to 100kΩ, Tolerance: ±10%
Servo motor	Voltage: 4.8V to 6V, Torque: 1.5kg/cm to 15kg/cm
Stepper motor	Voltage: 5V to 12V, Steps per revolution: 200
DC motor	Voltage: 3V to 12V, Current: 100mA to 300mA
Motor driver module	Maximum current: 2A to 10A, Maximum voltage: 12V to 24V

Table 3.1.1: Parts of Arduino And Its Specification

USAGE SPECIFICATION OF ARDUINO:

1. Microcontroller: The heart of the Arduino board, responsible for executing program instructions and controlling input/output operations.

2. Breadboard: A reusable platform used to build electronic circuits without the need for soldering. It allows components to be easily connected and disconnected for prototyping purposes.

3. Jumper wires: Used to connect components on a breadboard or between the Arduino board and other components. They come in various lengths and colors.

4. LED (Light Emitting Diode): A common output component that emits light when current flows through it. LEDs are often used to indicate the status of a system or to provide visual feedback.

5. Resistor: A passive component that limits the flow of current in a circuit. They are used to protect components, set the operating point of circuits, and provide voltage dividers.

6. Capacitor: A passive component that stores electrical charge and releases it over time. They are used to filter signals, store energy, and stabilize power supplies.

7. Push button: A switch used to control the flow of current in a circuit. They are often used to input commands to the system or to trigger events.

8. Potentiometer: A variable resistor that can be used to control the voltage or current in a circuit. They are often used to control the speed or position of motors, or to adjust the brightness of LEDs.

9. Servo motor: A motor that can rotate to a specific position and hold it. They are often used in robotics and other applications where precise control of

movement is required.

10. Stepper motor: A motor that rotates in precise increments, allowing for accurate control of position and speed. They are often used in applications that require precise control of motion, such as 3D printing or CNC machines.

11. DC motor: A motor that rotates continuously when power is applied. They are often used in robotics and other applications that require continuous rotation.

12. Motor driver module: A circuit board that provides power and control signals to motors. They are often used to drive motors that require higher voltage or current than the Arduino board can provide.

ARDUINO IDE:

The Arduino Software allows the programming of the Uno (IDE). From the Tools > Board menu, choose "Arduino/Genuino Uno". The Uno's ATmega328 is preconfigured with a boot loader which enables to update its firmware without a third-party hardware programmer. It employs the initial STK500 protocol for communication (C header files). There is a command (-i800) that allows the boot loader to delay the booting by 10 minutes while boot loading an Atmega8 chip with Arduino 0010. Thereby, using the command line rather than the IDE eliminates the "-i800" instruction and substituting it with the "-F" command, or use the Arduino 0007 IDE. The Arduino 0010 works well for uploading sketches. Overriding the boot loader, the microcontroller is instead programmed using Arduino ISP header. The Arduino repository contains the firmware source code for the ATmega16U2 (or 8U2 in the rev1 and rev2 boards). The ATmega328 has 32 KB (with 0.5 KB occupied by the boot loader). It also has 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).

Fig 3.1.1 Arduino Board

B. GSM Module and its setup:

GSM offers suggestions rather than demands. The GSM specifications have to get into great detail that defines the functionalities and interface specifications, but they skip off hardware. The goal is to place as little constraints on the designers as feasible while yet enabling the users to buy materials from various sources. The switching system (SS), base station system (BSS) and operation and support system (OSS) are the three main systems that make up the GSM network. The basic GSM network elements are shown in below fig 3.2.1.

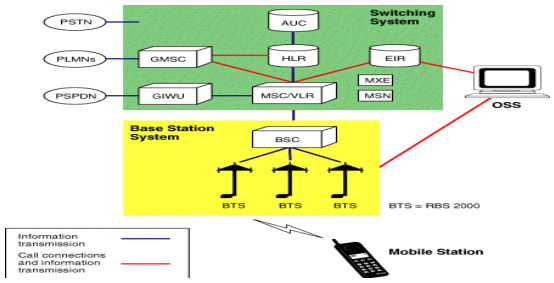

Fig 3.2.1 GSM Network Elements

Part	Specification
GSM Module	Frequency bands: 850/900/1800/1900 MHz, SIM card slot, serial communication
Antenna	Frequency range: 824-960 MHz, 1710-1990 MHz, 50 Ohm impedance, SMA connector
SIM Card	Type: Mini SIM or Micro SIM, Storage capacity: 64KB to 256KB
Power Supply	Input voltage: 100-240V AC, Output voltage: 5V DC, Output current: 1A to 2A
Voltage Regulator	Input voltage range: 4.5V to 40V, Output voltage: 1.2V to 37V, Output current: 1A to 5A
Level Converter	Input voltage: 1.8V to 5V, Output voltage: 3.3V or 5V
Resistors	Resistance: 220 ohms to 10k ohms
Capacitors	Capacitance: 1µF to 100µF
Diodes	Types: 1N4007, 1N4148, or equivalent, Maximum reverse voltage: 50V to 1000V
Transistors	Types: NPN or PNP, Maximum voltage: 30V to 60V, Maximum current: 500mA to 1A

Table 3.2.1: GSM Module Parts and Specification

USES AND ITS SPECIFICATION:

1. GSM Module: The main component of a GSM system, responsible for communication with the network and sending/receiving data. It typically includes a SIM card slot, serial communication interface, and support for various frequency bands.

2. Antenna: Used to transmit and receive radio signals between the GSM module and the network. It is typically designed to operate in the frequency range used by the GSM system and has a specific impedance and connector type.

3. SIM Card: A small chip that stores subscriber information and authentication data. It is inserted into the GSM module and provides access to the network.

4. Power Supply: Provides the necessary power to operate the GSM module and other components. It typically converts AC power to DC power and regulates the voltage and current to the required levels.

5. Voltage Regulator: Used to regulate the voltage and current supplied to the GSM module and other components. It ensures that the voltage remains within a specified range, even if the input voltage varies.

6. Level Converter: Converts signals between different voltage levels, such as from 5V to 3.3V. It is often used to interface between the GSM module and other components that operate at different voltage levels.

7. Resistors: Used to limit current or voltage in a circuit. They are often used in combination with other components to set the operating point of a circuit or to provide voltage dividers.

8. Capacitors: Used to store and release electrical charge. They are often used to filter signals, provide power supply decoupling, or stabilize oscillators.

9. Diodes: Used to control the flow of current in a circuit. They are often used to protect components from voltage spikes or to rectify AC signals.

10. Transistors: Used to amplify or switch electrical signals. They are often used to drive relays or motors, or to amplify signals from sensors.

A wireless modem that runs with a GSM wireless network is known as a GSM modem. Similar like a dial-up modem, a wireless modem operates. Generally, a serial or USB cable is used to connect an external GSM modem to a computer. A laptop may utilize a GSM modem that is in the format of a PC Card or PCMCIA Card. It must be installed into a particular laptop's PC Card or PCMCIA Card slots. Like a GSM cellular telephone, a GSM modem demands a SIM card from a cellular carrier in for operation. Attention (AT) commands are executed by software to regulate modems. A similar set of basic standard AT commands is accepted by dial-up and GSM modems equally. A GSM modem works similar to a dial-up modem. GSM modems provide an enhanced level of AT commands instead of the standard AT commands. The GSM specifications define these enhanced AT instructions. The enhanced AT commands are used to read, write, and delete SMS messages. It also keeps track of signal strength, the battery's power level and charging status. Approximately six to ten SMS messages may be transmitted by a GSM modem every minute, meaning a relatively low rate.

C. Software Implementation on Real Time Dataset:

REAL TIME DATASET TO STORE IN LOCAL STORAGE:

1. Identify the type of sensor or device that is generating the real-time dataset. For example, if you are working with temperature or humidity data, you may be using a DHT11 or DHT22 sensor. If you are working with GPS data, you may be using a GPS module.
2. Choose an appropriate communication protocol to transfer the real-time data from the sensor to the device where you will store the data. Common protocols include USB, Wi-Fi, or Bluetooth. Ensure that the communication protocol is compatible with both the sensor and the device.
3. Write a program or script to collect the real-time data from the sensor and

save it to a file on the device's local storage. Depending on the application, this program may need to perform data preprocessing or filtering.

4. Choose an appropriate file format to store the data. Common file formats include CSV, JSON, or binary files. Ensure that the file format is compatible with the analysis tools you plan to use.

5. Implement the necessary hardware connections between the sensor and the device, and run the program or script to collect and store the real-time data.

6. Once the data has been stored, you can analyze it using various tools such as Excel, MATLAB, or Python. You may need to write additional code to parse and process the data depending on the file format you choose.

The default frontal face detections are loaded in a .xml file which could be easy for a edge to edge facial scan. The dataset folder and its sub folders are created and called which includes setting of path for the dataset and its sub data. The real photos are taken n loops making the webcam read the faces by VideoCapture() and webcam.read() functions respectively. VideoCapture is a function in the OpenCV library that allows you to capture video frames from a camera or a video file. Cascade filters, on the other hand, are a type of object detection algorithm that uses Haar cascades to detect objects of interest in an image or video frame.To use cascade filters with VideoCapture, Initialize the VideoCapture object to capture frames from a video source. Load the cascade filter file using the cv2.CascadeClassifier() function. Loop through each frame captured by the VideoCapture object. Convert each frame to grayscale using cv2.cvtColor(). Use the detectMultiScale() method of the cascade filter object to detect objects in the grayscale frame. Draw rectangles around the detected objects using cv2.rectangle().Display the resulting frame with the detected objects.

To run and voice out the relations, Tkinter is a Python GUI (Graphical User

Interface) library that provides a set of tools to create and manipulate windows, buttons, labels, textboxes, and other graphical elements in a graphical application.The ttk module in tkinter provides additional widgets and functions that are not available in the standard tkinter library, such as themed widgets, which can be customized to match the look and feel of your operating system. By using "from tkinter import ttk", you can access all the widgets and functions provided by the ttk module, such as ttk.Button, ttk.Entry, ttk.Treeview, and ttk.Notebook, among others. It's likely that part of a larger program that uses various libraries to interact with hardware and provide user feedback. The if statement is likely used to check if the person trying to access a system is authorized and then perform certain actions based on the result.

To run voices and get them as speech using Tkinter, you can use a Text-to-Speech (TTS) library that has a Python interface, such as pyttsx3. Here are the general steps to follow:

1. Install pyttsx3 using pip: pip install pyttsx3.
2. Import pyttsx3 and Tkinter: import pyttsx3 and import tkinter.
3. Create a Tkinter window with a text box and a button to trigger the TTS conversion.
4. Define a function that will convert the text in the text box to speech using pyttsx3.
5. Call the speak_text() function when the button is clicked to convert the text in the text box to speech.
6. Test the system to ensure that the voices are being properly converted to speech when the button is clicked.

DATA FLOW DIAGRAM

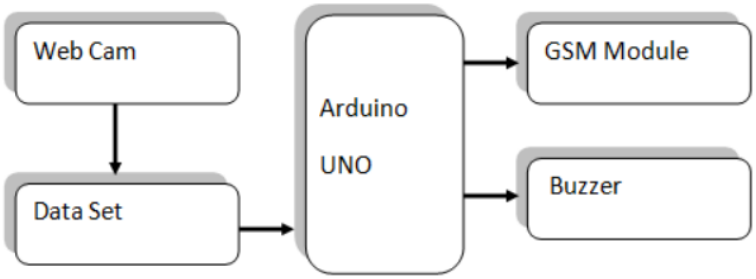

Fig 3.4 Data Flow Diagram of Hardware

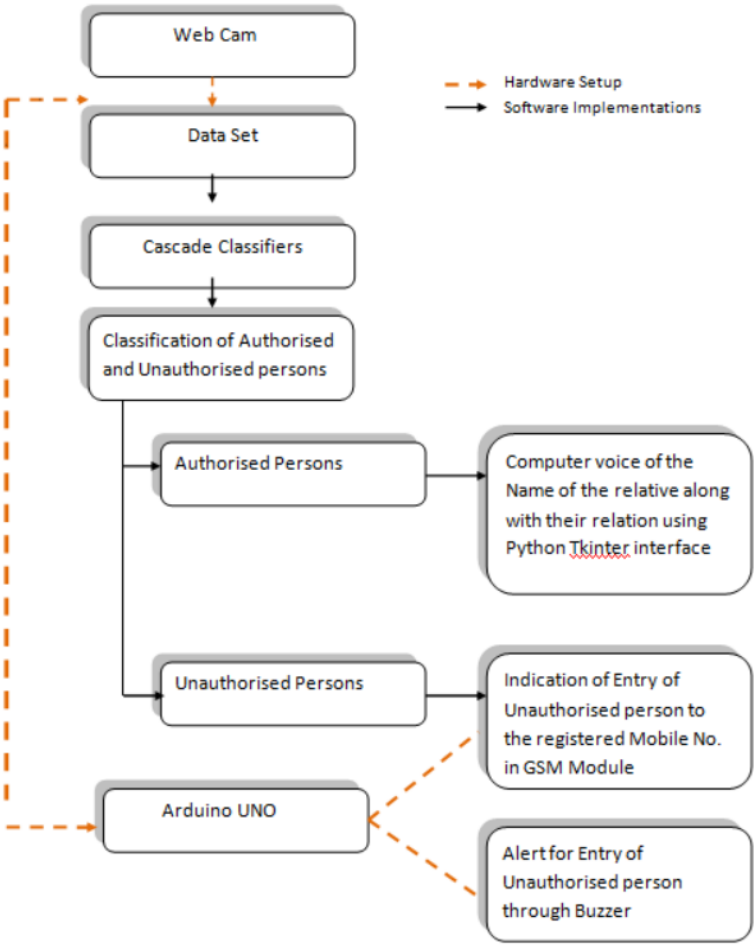

Fig 3.5 Implementation Work Flow Diagram

A Webcam is used to capture the real time dataset. The captured dataset is fed into Arduino UNO which in turn is connected with a GSM Module and a Buzzer. The Arduino is designed in such a way that is to alert the surrounding using the buzzer and intimate the entry of unknown person through the registered phone number. It also voices over the name of the person with their relation to the Alzheimer patient when the dataset matches with real faces.

1. The system captures an image of the person's face using the camera module connected to Arduino.
2. The image is processed by the face recognition algorithm installed in the system.
3. The algorithm compares the captured image with the database of authorized persons' images stored in the system.
4. If the captured image matches with an authorized person's image, the system sends a confirmation message to the authorized person's mobile number using the GSM module.
5. If the captured image does not match with any authorized person's image, the system sends an alert message to the caregiver's mobile number using the GSM module.
6. The caregiver can then check the alert message and take necessary action to ensure the patient's safety.

The flow diagram starts with the capture of an image of the person's face using the camera module connected to Arduino. This image is then processed by the face recognition algorithm installed in the system. The algorithm compares the captured image with the database of authorized persons' images stored in the system.If the captured image matches with an authorized person's image, the system sends a confirmation message to the authorized person's mobile number using the GSM module. This allows authorized persons such as family members and caregivers to gain access to the patient and provide care as needed.

On the other hand, if the captured image does not match with any authorized person's image, the system sends an alert message to the caregiver's mobile number using the GSM module. This enables the caregiver to take immediate action to ensure the patient's safety and well-being. It is important to note that false positives can occur, where the system incorrectly identifies a person as unauthorized. Therefore, the system must be tested and calibrated to ensure accuracy and avoid unnecessary alerts. Overall, this flow diagram provides a detailed overview of the process of using IoT face recognition assistant for Alzheimer's disease using Arduino and GSM module to differentiate between authorized and unauthorized persons.

MERITS AND DEMERITS:

IoT (Internet of Things) face recognition assistant for Alzheimer's disease is a technology that uses facial recognition technology to detect and identify individuals with Alzheimer's disease. This technology has both merits and demerits.

Merits:

1. Improved safety: One of the biggest benefits of IoT face recognition assistant for Alzheimer's disease is improved safety. With the help of this technology, caregivers and family members can easily track the whereabouts of Alzheimer's patients, reducing the risk of them wandering away or getting lost.
2. Personalized care: IoT face recognition assistant for Alzheimer's disease can be customized to the needs of the patient. The technology can be programmed to remind patients of their medication schedule, appointments, and other important tasks.
3. Enhanced independence: IoT face recognition assistant for Alzheimer's disease can help patients maintain their independence by reminding them of tasks and helping them complete tasks independently.
4. Real-time monitoring: This technology can monitor the daily activities of Alzheimer's patients and send alerts to caregivers and family members in case of any unusual activity.

Demerits:

1. Privacy concerns: IoT face recognition assistant for Alzheimer's disease raises privacy concerns, as the technology collects and stores data about the patient's movements and activities.
2. Cost: IoT face recognition assistant for Alzheimer's disease can be expensive, and not everyone may be able to afford it.
3. Accuracy issues: The accuracy of the facial recognition technology used in IoT face recognition assistant for Alzheimer's disease can be impacted by various factors, such as lighting and facial expressions, which may result in false positives or false negatives.
4. Dependence on technology: IoT face recognition assistant for Alzheimer's disease may make patients overly dependent on technology, which may impact their ability to perform tasks independently.

In conclusion, IoT face recognition assistant for Alzheimer's disease has both advantages and disadvantages. While it can improve safety and provide personalized care for patients with Alzheimer's disease, it raises privacy concerns, may be expensive, and can lead to dependence on technology.

CHAPTER 4

RESULTS

COMPARISON OF AUTHORIZED AND UNAUTHORIZED PERSONS

IoT face recognition assistant for Alzheimer's disease using Arduino and GSM module can be used to compare authorized and unauthorized persons. The system can be programmed to recognize the faces of authorized persons such as family members and caregivers and send an alert if an unauthorized person is detected.

Authorized Persons:

1. Access to patient information: Authorized persons can be granted access to patient information, medication schedules, and other important details.
2. Ease of communication: Family members and caregivers can be easily contacted in case of emergency or any changes in the patient's condition.
3. Enhanced safety: The system can detect and alert authorized persons if the patient wanders away or experiences any unusual activity, improving safety.

Unauthorized Persons:

1. Potential privacy concerns: The system may raise privacy concerns if it records and stores data about unauthorized persons without their consent.
2. False positives: The system may falsely identify some people as unauthorized, leading to unnecessary alerts and inconvenience.
3. Safety concerns: If an unauthorized person gains access to the patient, it can lead to safety concerns for the patient.

Overall, using IoT face recognition assistant for Alzheimer's disease using Arduino and GSM module to compare authorized and unauthorized persons can provide enhanced safety and care for Alzheimer's patients, while also raising potential privacy and accuracy concerns. It is important to consider the potential drawbacks and limitations of the technology when implementing it.

EXPERIMENTAL RESULTS:

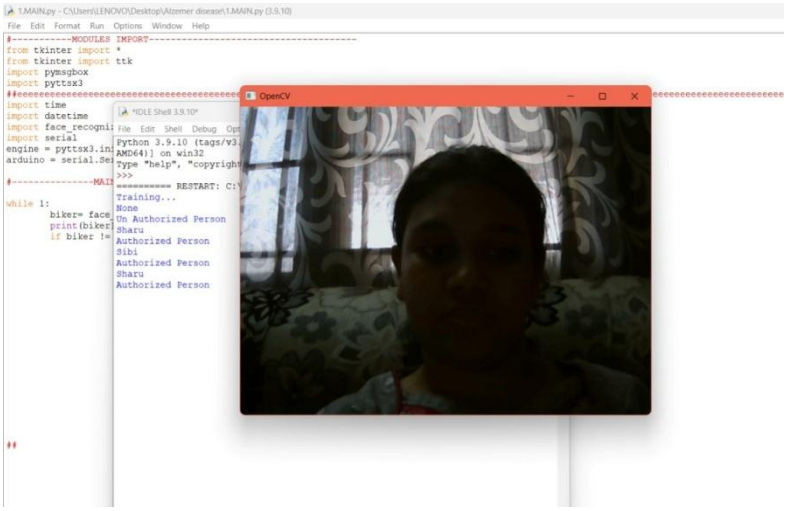

Fig 4.1 Identifying the authorized person along with their relation

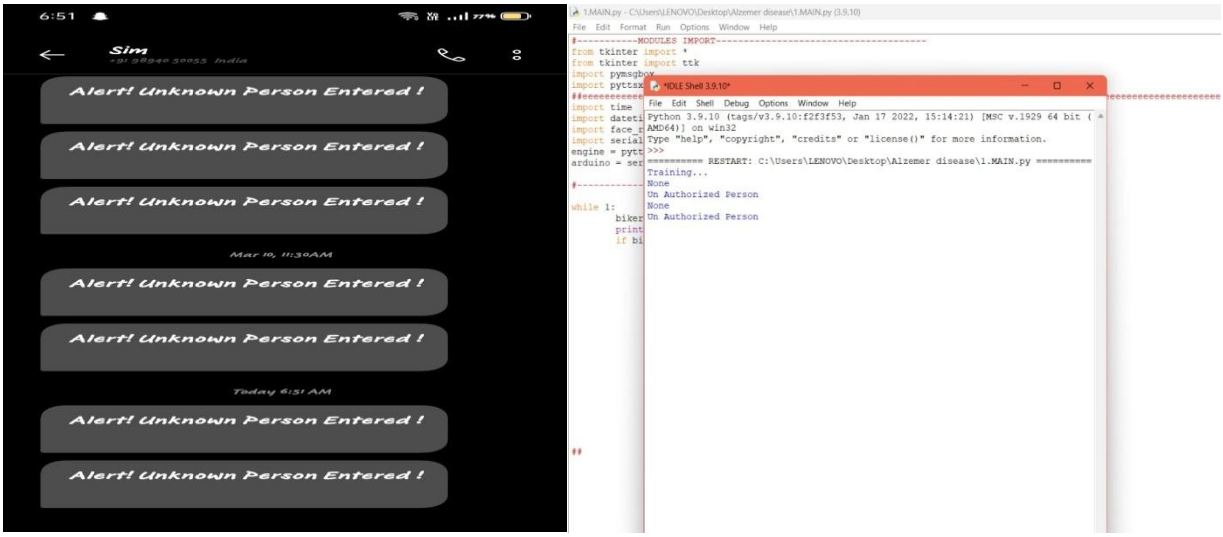

Fig 4.2 Alerting with the buzzer sound for the unknown person entered

The Fig.4.1 shows the message as “Thank you” and “Success” along with person name and their relation. The name of the person and their relation is also converted from text to speech. As shown is Fig.4.2 the “Unknown person entered” message was sent to the registered phone number and buzzer sound was high to alert the surroundings. When the loop level reached 40 the accuracy of predicting the face the accuracy graduated up to the level of 86%. When the loop level reached 90 the accuracy of predicting the face the accuracy graduated up to the level of 89%. The accuracy mainly depends on the light facilitation and brightness.

CHAPTER 5
CONCLUSION AND FUTURE SCOPE

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.

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.

APPENDIX

SAMPLE CODE

```
int led=4;
int buzzer = 5;
void setup()
{
  Serial.begin(9600);
  pinMode(led, OUTPUT);
  pinMode(buzzer, OUTPUT);
}

void loop()
{
    if (Serial.available())
      {
        String
data=Serial.readString();
        data.trim();
        Serial.println(data);
          if(data=="a")
            {
              digitalWrite(led, HIGH);
              delay(5000);
              digitalWrite(led, LOW);
              Serial.println("Authorized
person");
            }
```

```
        if(data=="b")
          {

Serial.println("AT+CMGF=1");
            delay(1000);

Serial.println("AT+CMGS=\"+9197
91700883\"\r");
            delay(1000);
            Serial.println("Unknown
Person Entered !");
            delay(100);
            Serial.println((char)26);
            delay(1000);
            digitalWrite(buzzer,
HIGH);
            delay(2000);
            digitalWrite(buzzer,
LOW);
          }

    }
}
```

CREATE.PY:

```
#creating database
import cv2, sys, numpy, os
```

```
haar_file = 'haarcascade_frontalface_default.xml'
datasets = 'datasets'  #All the faces data will be present this folder
sub_data = 'Sharu'     #These are sub data sets of folder

path = os.path.join(datasets, sub_data)
if not os.path.isdir(path):
    os.mkdir(path)
(width, height) = (130, 100)    # defining the size of images
face_cascade = cv2.CascadeClassifier (haar_file)
webcam = cv2.VideoCapture(0) #'0' is use for my webcam, if you've any other
camera attached use '1' like this

# The program loops until it has n images of the face.
count = 1
while count < 41:
    (_, im) = webcam.read()
    gray = cv2.cvtColor(im, cv2.COLOR_BGR2GRAY)
    faces = face_cascade.detectMultiScale(gray, 1.3, 4)
    for (x,y,w,h) in faces:
        cv2.rectangle(im,(x,y),(x+w,y+h),(255,0,0),2)
        face = gray[y:y + h, x:x + w]
        face_resize = cv2.resize(face, (width, height))
        cv2.imwrite('%s/%s.png' % (path,count), face_resize)
        count += 1

    cv2.imshow('OpenCV', im)
    key = cv2.waitKey(10)
    if key == 27:
```

```
    break
```

MAIN.PY:

```
#-----------MODULES IMPORT-------------------------------------
from tkinter import *
from tkinter import ttk
import pymsgbox
import pyttsx3
import time
import datetime
import face_recognize
import serial
engine = pyttsx3.init()
arduino = serial.Serial('COM5', 9600, timeout=3)

#---------------MAIN LOOP-------------------------

while 1:
      biker= face_recognize.recognition()
      print(biker)
      if biker != "":
            if ((biker =='Sharu')):
               pymsgbox.alert(timeout=1000,text="Thank You",
 title="Sucess!!")
               arduino.write(str.encode('a'))
               print ("Authorized Person")
               engine.say("Sharmili Daughter")
               engine.runAndWait()
```

```
                time.sleep(2)

            elif ((biker =='Sibi')):
                pymsgbox.alert(timeout=1000,text="Thank You",
  title="Sucess!!")
                arduino.write(str.encode('a'))
                print ("Authorized Person")
                engine.say("Sibi Friend")
                engine.runAndWait()
                time.sleep(2)
            else:
                print ("Un Authorized Person")
                arduino.write(str.encode('b'))
##                  arduino.write(str.encode('c'))
                engine.say("Un Authorized Person")
                engine.runAndWait()
                time.sleep(2)
```

REFERENCES

[1] Zaven S. Khachaturian." *Diagnosis of Alzheimer's Disease*". Arch Neurol. 1985; 42(11):1097-1105.

[2] Shervin Emami." *Insights on Current and Future ICT Solutions*". Mobile Computer Vision. 2012; Vol. 4 No.1.

[3] SikandarKhan, AdeelAkram & NighatUsman." *Real Time Automatic Attendance System for Face Recognition Using Face API and OpenCV*". Wireless Personal Communications.2020: Vol.113.

[4] Max Smith-Creasey, FatemaA. Albalooshi , Muttukrishnan Rajarajan." *Continuous face authentication scheme for mobile devices with tracking and liveness detection*". Microprocessors and Microsystems.2018; Vol.63, 147-15

[5] JayanthVadlapati, S SenthilVelan, EwinVarghese." *Facial Recognition using the OpenCV Libraries of Python for the Pictures of Human Faces Wearing Face Masks during the COVID-19 Pandemic*". Computing Communication and Networking. 2021.

[6] J. Mitchell and S. Shiri-Feshki, "*Rate of progression of mild cognitive impairment to dementia--meta-analysis of 41 robust inception cohort studies*", Acta Psychiatrica Scandinavica, vol. 119, no. 4, pp. 252-265, 2009.

[7] R. Jack Jr et al., "*NIA-AA research framework: toward a biological definition of Alzheimer's disease* ", Alzheimer's & Dementia, vol. 14, no. 4, pp. 535-562, 2018.

[8] S. S. Salloway et al., "*Two phase 3 trials of bapineuzumab in mild-to-moderate Alzheimer's disease*", The New England Journal of Medicine, vol. 370, no. 4, pp. 322-333, 2014.

[9] Y. Taigman et al., "*DeepFace: Closing the Gap to Human-Level Performance in Face Verification*", in Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition, 2014, pp. 1701-1708.

[10] S. Zafeiriou et al., "*A survey on face detection in the wild: Past, present and future*", Computer Vision and Image Understanding, vol. 138, pp. 1-24, 2015.

[11] W. Zhao et al., "*Face recognition: A literature survey*", ACM Computing Surveys, vol. 50, no. 6, pp. 1-34, 2017.

[12] M. Banzi, "*Arduino: A low-cost open-source hardware for artists, designers, hackers, and hobbyists*", IEEE Pervasive Computing, vol. 7, no. 3, pp. 8-13, 2008.

[13] M. K. Rasheed et al., "*Design and implementation of remote sensing system based on Arduino*", in Proceedings of the International Conference on Communication and Signal Processing, 2015, pp. 1465-1469.

[14] M. Usman and S. Kim, "*Design and development of solar charge controller using Arduino*", in Proceedings of the International Conference on Computer, Control, Informatics and Its Applications, 2015, pp. 86-90.

[15] E. Pereira and L. A. Fernandes, "*Comparison of GSM and GPRS traffic measurements in indoor environments*", in Proceedings of the International Symposium on Broadband Communications, 2004, pp. 1-6.

[16] H. K. Kim, J. T. Kim, and S. M. Chung, "*Design and implementation of low power consumption GPS/GSM tracking system*", in Proceedings of the International Conference on Control, Automation and Systems, 2010, pp. 230-234.

[17] R. G. Abbasi et al., "*Internet of things-based environmental monitoring system using GSM communication*", IEEE Access, vol. 5, pp. 18996-19007, 2017.