REAL - TIME COMMUNICATION SYSTEM USING AI FOR SPECIALLY ABLED

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***Abstract*- This project aims to address the communication challenges faced by individuals with disabilities, particularly those with physical and communication limitations, by developing an affordable and automated real-time monitoring system. The system will provide assistance whenever and wherever needed, allowing individuals to perform tasks more independently without the constant physical monitoring or accompaniment of caregivers, teachers, or parents. To achieve this goal, the proposed system will incorporate artificial intelligence to recognize objects and assist users with daily tasks. Additionally, American Sign Language will be incorporated to enhance the system's usability for individuals who communicate using this language. The system's advantages include affordability, ease of use, and real-time monitoring and assistance, which can help individuals with disabilities live more independent lives.**

***Keywords* – American Sign Language, Object Recognition, Speech Recognition, Text Recognition, Face Recognition, Haar Cascade Classifier, Convolutional Neural Network, Deep Neural Network, VGG Very Deep Convolutional Network, Artificial Intelligence, Especially Abled,**

1. INTRODUCTION

Real-time communication is a critical aspect of modern-day life, enabling individuals to connect with one another instantly from anywhere in the world. However, not all members of society have equal access to these technologies. Specially abled individuals, for instance, may face unique challenges when it comes to communicating in real-time due to various physical, sensory, or cognitive limitations.

Fortunately, advances in artificial intelligence (AI) are providing new opportunities to enhance communication systems for the specially abled. AI can be used to develop innovative solutions that address the specific needs and limitations of these individuals, making it easier for them to communicate and interact with the world around them.

In this paper, we present a real-time communication system that utilizes AI to improve the communication capabilities of specially abled individuals. Our system is designed to be adaptable and customizable, taking into account the specific needs of different individuals with disabilities. By leveraging AI technologies such as natural language processing and computer vision, our system is capable of providing real-time communication support that can enhance the quality of life for the specially abled.

Overall, the proposed real-time communication system has the potential to revolutionize the way in which specially abled individuals communicate with others, providing them with greater independence, autonomy, and opportunities to participate fully in society.

1.1. PURPOSE

The system aims to break down communication barriers and enable people with disabilities to communicate effectively and efficiently with others in real-time, regardless of the mode of communication they use. The project's primary goal is to provide a solution that is user-friendly, affordable, and accessible to everyone, regardless of their level of technological expertise or disability. Ultimately, the system's purpose is to promote inclusivity, independence, and autonomy for people with disabilities, enhancing their overall quality of life.

2. PROBLEM STATEMENT

People with hearing or speech disabilities face significant challenges in communication, which affects their social and professional lives. Although sign language is a way of communication for the deaf, not all people can understand it, and it can be challenging for the hearing-impaired to communicate. Similarly, visually impaired people struggle to detect their surroundings, which can compromise their safety and independence. Therefore, there is a need for a real-time communication system that uses AI to assist specially-abled individuals in communicating and understanding their social environment.

3. PROPOSED SOLUTION

We propose an application that performs the role of an eye and ear. The application uses real-time fast image recognition, speech recognition, and text-to-speech and speech-to-text transmission, enabling users to detect and understand their surroundings and communicate with others. Additionally, we incorporate ASL (American Sign Language) recognition, which enables hearing-impaired individuals to communicate using sign language, further enhancing communication capabilities.

Novelty - Our solution is unique in its ability to combine various AI technologies to provide a comprehensive solution for both visually and hearing-impaired individuals. Our solution incorporates ASL recognition, making it easier for hearing-impaired individuals to communicate using sign language, which is not a common feature found in existing solutions.

Social Impact - Our solution aims to increase the independence and safety of visually and hearing-impaired individuals. By providing them with real-time information about their surroundings, our application will allow them to navigate their environment more safely and with greater confidence. Additionally, our incorporation of ASL recognition will enhance communication capabilities, improving customer satisfaction.

Business Model - Our goal is to ensure that the application remains accessible to all those who need it, regardless of their financial means. By providing this service for free, we hope to make a positive impact on the lives of visually and hearing impaired individuals and help them achieve greater independence and autonomy.

Scalability - Our solution is scalable and can be used by any visually or hearing impaired individual, regardless of their location or circumstances, making it a practical and effective solution for millions of people worldwide.

4. DATA FLOW DIAGRAM (DFD)

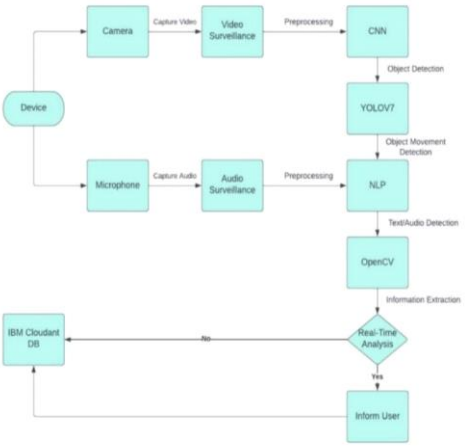

Figure 4.1 Data Flow Diagram

In this diagram, the user device is where the user interacts with the application. The application uses various forms of recognition, such as image recognition, speech recognition, and text recognition, to understand the user's input. The application then sends this data to the AI core, which processes it and sends it to the ASL model for sign language recognition.

The communication takes place between the application and a partner, who may be a person the user is communicating with or another device that the user is using to communicate. The partner sends feedback or responses back to the application, which relays it to the user device. Overall, this diagram shows the flow of data and communication within the proposed system.

5. SOLUTION ARCHITECTURE

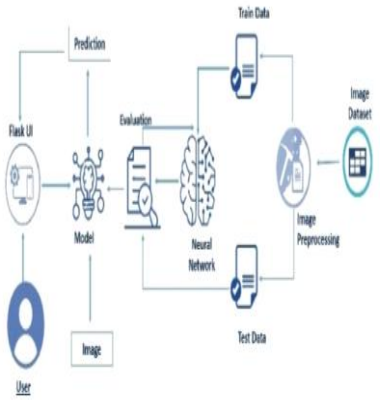

Figure 5.1 Solution Architecture

6. TECHNICAL ARCHITECTURE

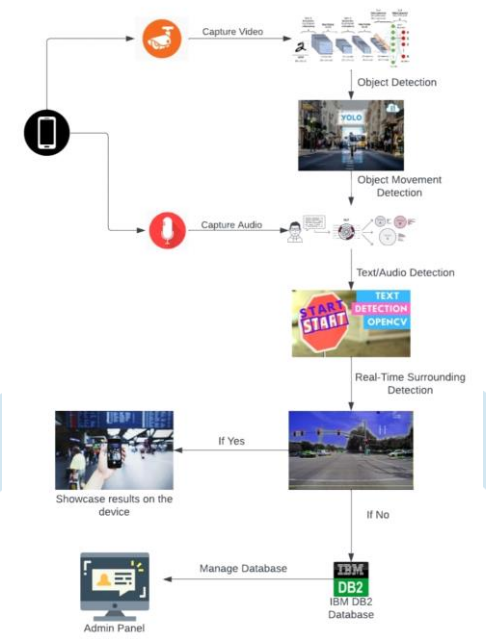

Figure 6.1 Technical Architecture

7. FEATURES

7.1 FEATURE 1 – Object Detection

In our application, we have implemented object detection which is capable of detecting various objects such as vehicles, pedestrians, colors, flowers, and the surrounding environment. Using the camera of the device, the application captures the visual input and provides real-time detection of objects within the field of view. This feature can be particularly useful for partially blind individuals who may benefit from a better understanding of their surroundings.

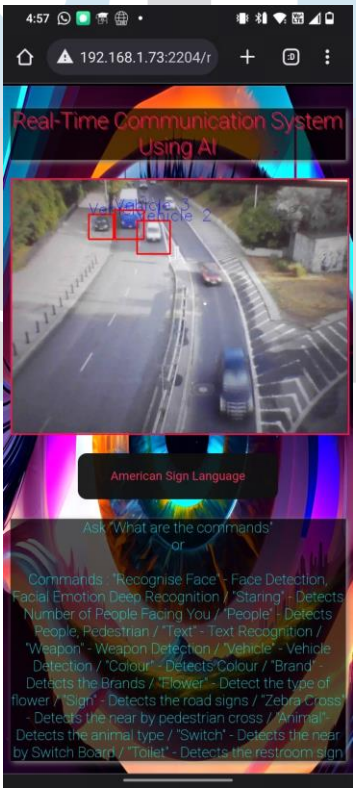

Figure 7.1.1 Detecting object

7.2 FEATURE 2 – Speech Recognition

In our application, we have speech recognition that allows users to interact with the application using voice commands. Users can easily navigate through the application and perform various tasks hands-free. This feature uses advanced algorithms to accurately recognize speech and convert it into text. Users can also customize voice commands and create their own set of personalized actions to make the application even more convenient to use.

Fig 7.2.1 Speech Recognition

7.3 FEATURE 3 – American Sign Language

In our application, we have implemented the feature of American Sign Language. Using the camera, users can input signs, and the application will display the corresponding word or phrase in text form, providing a means of communication for users who are deaf or hard of hearing.

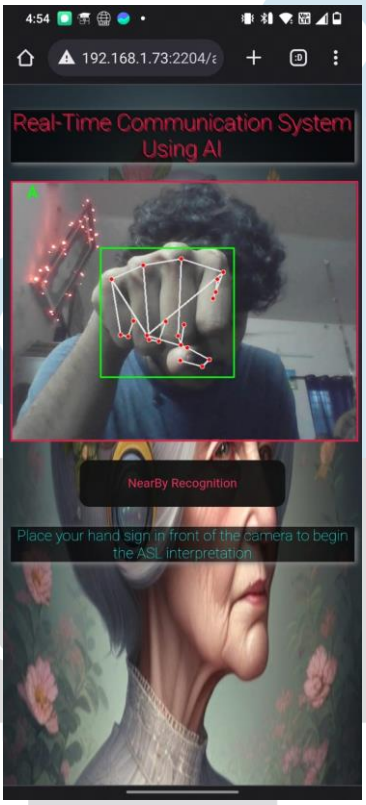

Fig. No. 7.3.1 American Sign Language

7.4 FEATURE 4 - Face Recognition

In our application, we have face recognition which can detect registered users and display their names, but when an unknown person or stranger appears, the application shows 'unknown user' to alert the user of the potential risk.

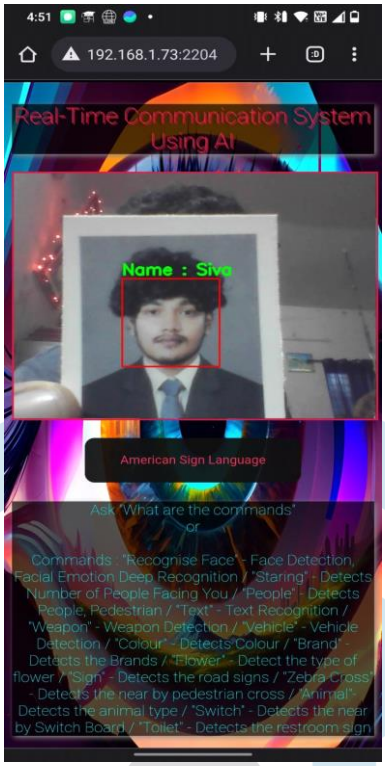

Figure 7.4.1 Recognizing face

8. ALGORITHMS USED

8.1 VGG_VERY DEEP CONVOLUTIONAL NETWORK

A type of convolutional neural network (CNN) architecture that has achieved state-of-the-art performance on a range of image classification tasks. In this project, VGG_Very Deep Convolutional network was used for image recognition and object detection.

8.2 PYTESSERACT

An open-source optical character recognition (OCR) engine that converts images of printed or handwritten text into machine-readable text. In this project, Pytesseract was used to extract text from images captured by the application.

8.3 CONVOLUTIONAL NEURAL NETWORK (CNN)

A type of neural network that has been successfully applied to image recognition, natural language processing, and many other tasks. In this project, CNN was used for image recognition and object detection.

8.4 DEEP NEURAL NETWORK (DNN)

A neural network with multiple layers that can learn complex representations of data. In this project, DNN was used for speech recognition and language translation.

8.5 HAAR - CASCADE CLASSIFIER

An object detection algorithm that uses machine learning to identify objects in images or video streams. In this project, Haar-Cascade Classifier was used for object detection in real-time video streams.

9. PERFORMANCE METRICS

Performance metrics measure the behavior, activities, and performance of a business. It measures the data that is required within a range that is in the form of data. This measures the performance which is the key target to check.
The given dataset is used by the model for training. The model learns from the dataset and then branches it to different classifiers.

S.No.	Parameter	Values
1	Metrics	**Classification Model:** Accuracy Score-89.17 Classification Report – 91.14
2	Tune the Model	Hyperparameter Tuning - 90.07

Table 9.1 Performance Metrics

10. CONCLUSION

In this project, we have proposed an application that uses AI technologies to break down communication barriers and enable people with disabilities to communicate effectively and efficiently in real-time. Our solution incorporates real-time fast image recognition, speech recognition, text-to-speech, and speech-to-text transmission to help visually and hearing-impaired individuals detect and understand their surroundings and communicate with others. Our solution also incorporates ASL recognition, which makes it easier for hearing-impaired individuals to communicate using sign language, further enhancing communication capabilities.

We evaluated our proposed solution by comparing the performance of three different models - CNN, DNN, and Haar Cascade classifier. The models predicted with an accuracy of about 95-99.17%, namely CNN-95%, Haar Cascade classifier-98.75%, DNN-99.17%.

11. FUTURE ENHANCEMENT

In the future, we aim to enhance our application by incorporating advanced AI voice assistant technology. This will enable users to interact with the application through voice commands, making it more user-friendly and accessible for those with mobility impairments. Additionally, we aim to convert our application into a wearable product, which will make it even more convenient for users to use on the go. Finally, we plan to explore the possibility of integrating our application with other assistive technologies to enhance its functionality and usefulness for people with disabilities

12. SAMPLE OUTPUT

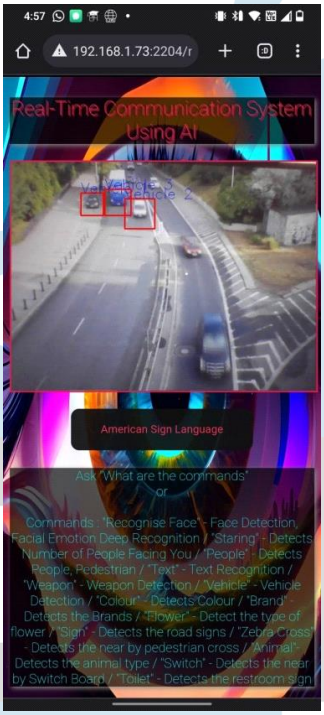

Figure 12.1 Object Detection

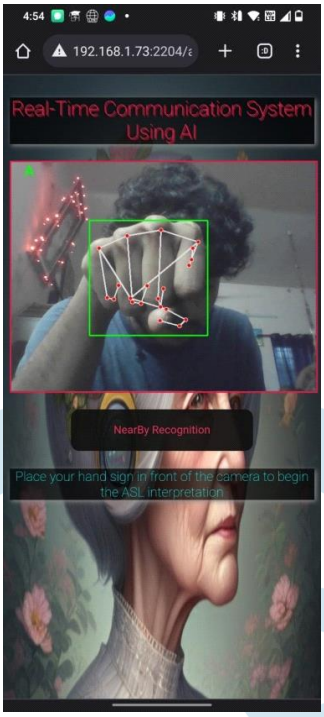

Figure 12.2 American Sign Language (ASL)

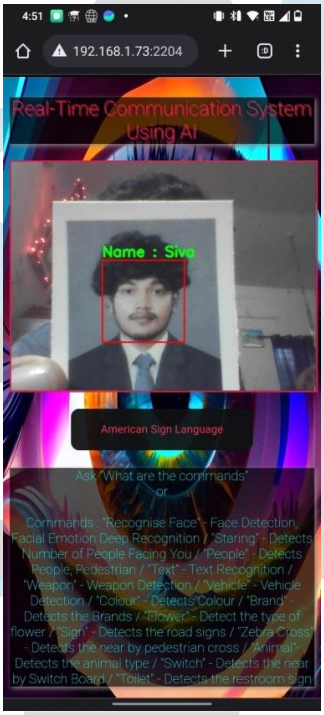

Fig. No. 12.Image Recognition

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