PROJECT DOCUMENTATION

REAL-TIME COMMUNICATION SYSTEM POWERED BY AI FOR SPECIALLY- ABLED

Team Id:-PNT2022TMID26213

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REAL-TIME COMMUNICATION SYSTEM POWERED BY AI

FOR SPECIALLY-ABLED

Table of Contents:-

REAL-TIME COMMUNICATION SYSTEM POWERED BY AI

FOR SPECIALLY-ABLED

REAL-TIME COMMUNICATION SYSTEM POWERED BY AI

FOR SPECIALLY-ABLED

1. INTRODUCTION:-

Gesture is a non-verbal means of communication. It refers to expressing an idea using position, orientation or movement of a body part. Gesture recognition is the mathematical interpretation of orientation or motion of human body by a computational system. In this project, the words expressed by hand gestures by the speech and hearing impaired are converted into verbal means of communication. The translated output is displayed on a screen and "spoken" on a speaker. Sign Language is the well-structured code, which uses hand gestures instead of sound to convey meaning, simultaneously combining hand shapes, orientations and movement of the hands. Communicative hand glove is an electronic device that can translate sign language into speech and text in order to make the communication possible between the deaf and/or mute with the general public. This technology has been used in a variety of application areas, which demands accurate interpretation of sign language. In this project, the words/letters conveyed by the disabled person are displayed on a screen and also spoken on a speaker.

Our idea is to create sign assistance, like many applications which is using voice assistance such as Siri on iOS and Cortana on windows. There is need to develop an application that will create an interactive platform where the sign language can be translated to voice output and writing, and voice and writing input can also be converted to sign language. The bigger
picture is creating an interactive model of communication for deaf and dumb people.

Dumb people are usually face some problems on normal communication with other people in society. It has been observed that they sometimes find it difficult to interact with normal people with their gestures. Because people with hearing problems or deaf people cannot speak like normal people, they have to depend on a kind of visual communication

in most cases.The primary application for addressing the sign language is the improvement of the sign language. Computer recognition of the sign language is an important research problem for communication with the hearing impaired. The system does not require that the hand is perfectly aligned to the camera.

1.1 Project Overview:-

Artificial intelligence (AI) refers to smart machines or algorithms that are capable of performing cognitive tasks usually made by humans. The sixth sense is a multi-platform app for aiding the people in need that is people who are handicapped in the form of lack of speech (dumb), lack of hearing (deaf), lack of sight (blind), lack of judicial power to differentiate between objects (visual agnosia) and people suffering from autism (characterized by great difficulty in communicating and forming relationships with other people and in using language and abstract concepts). Our current implementation of the product is on two platforms, namely, mobile and a web app. The mobile app even works for object detection cases in offline mode. What we want to achieve using this is to make a better world for the people suffering from disabilities as well as an educational end for people with cognitive disabilities using our app. The current implementation deals with object recognition and text to speech and a speech to text converter. The speech to text converter and text to speech converter utilized the Web Speech API (Application Program Interface) for the website and text to speech and speech to text library for the mobile platform. The object recognition wouldn't fetch enough use out of a website. Hence, it has been implemented on the mobile app utilizing the Firebase ML toolkit and different pre-trained models, which are both available offline as well as online.

1.2 Purpose:-

We are making use of a convolution neural network to create a model that is trained on different hand gestures. An app is built which uses this model. This app enables deaf and dumb people to convey their information using signs which get converted to human-understandable language and speech is given as output. In our society, we have people with disabilities. The technology is developing day by day but no significant developments are undertaken for the betterment of these people. Communications between deaf-mute and a normal person has always been a challenging task. It is very difficult for mute people to convey their message to normal people. Since normal people are not trained on hand sign language. In emergency times conveying their message is very difficult. The human hand has remained a popular choice to convey information in situations where other forms like speech cannot be used. Voice Conversion System with Hand Gesture Recognition and translation will be very useful to have a proper conversation between a normal person and an impaired person in any language. The project aims to develop a system that converts the sign language into a human hearing voice in the desired language to convey a message to normal people, as well as convert speech into understandable sign language for the deaf and dumb. We are making use of a convolution neural network to create a model that is trained on different hand gestures. An app is built which uses this model. This app enables deaf and dumb people to convey their information using signs which get converted to human-understandable language and speech is given as output.

2. LITERATURE SURVEY:-

ABSTRACT

EXISITING PROBLEM:-

One of the most precious gifts of nature to the human race is the ability to express itself by responding to the events that occur in its environment. Every normal person sees, hears, and then reacts to the situations by expressing himself. But there are some less lucky ones who are deprived of this precious gift. Such people, especially deaf and mute, rely on some sort of gesture language to communicate their feelings to others. The deaf, dumb and the blind follow similar problems when it comes to the use of computers. In the era of advanced technologies, where computers, laptops and other processor-based devices are an integral part of everyday life, efforts must be made to make the disabilities in life more independent.

Our goal is to design a human computer interface system that can accurately identify the language of the deaf and dumb. With the use of image processing and artificial intelligence, many techniques and algorithms have been developed in this area. Each character speech recognition system is trained to recognize the characters and convert them into the required pattern. The proposed system aims to give speech speechless, a real-time character language is captured as a series of images, and it is processed and then converted into speech and text.

REFERENCES:-

Survey 1 :

AUTHORS: Bayan Mohammed Saleh, Reem Ibrahim Al-Beshr

TITLE: Sign language recognition systemfor people with disability using machine learning and image processing.

DESCRIPTION :

Communication plays a significant role in making the world a better place. Communication creates bonding and relations among the people, whether person a, social, or political views.Most people communicate efficiently without any issues, but many cannot due to disability. They cannot hear or speak,which makes Earth a problematic place to live for them. Even simple basic tasks become difficult for them.

Survey 2 :

AUTHORS: Aditya Sharma , Aditya Vats , Shiv Shankar Dash and Surinder Kaur

TITLE: Artificial Intelligence enabled virtual sixth sense application for the disabled.

METHODS:

The sixth sense is a multi-platform app for aiding the people in need that is people who are handicapped in the form of lack of speech (dumb), lack of hearing (deaf), lack of sight (blind), lack of judicial power to differentiate between objects (visual agnosia) and people suffering from autism (characterized by great difficulty in communicating and forming relationships with other people and in using language and abstract concepts).

Survey 3 :

AUTHOR: Shrikant Temburwar, Payal Jaiswal, Shital Mande, Souparnika Patil

TITLE: Design of a Communication System using Sign Language aid for Differently Abled Peoples

DESCRIPTION:

One of the most precious gifts of nature to the human race is the ability to express itself by responding to the events that occur in its environment. Every normal person sees, hears, and then reacts to the situations by expressing himself. But there are some less lucky ones who are deprived of this precious gift. Such people, especially deaf and mute, rely on some sort of gesture language to communicate their feelings to others. The deaf, dumb and the blind follow similar problems when it comes to the use of computers.

Survey 4 :

AUTHORS: Kedar Potdar , Gauri Nagavkar

TITLE: Real-time Communication System for the Deaf and Dumb

DESCRIPTION:

This project aims to aid the deaf-mute by creation of a new system that helps convert sign language to text and speech for easier communication with audience. The system consists of a gesture recognizer hand-glove which converts gestures into electrical signals using flex sensors. These electrical signals are then processed using an Arduino

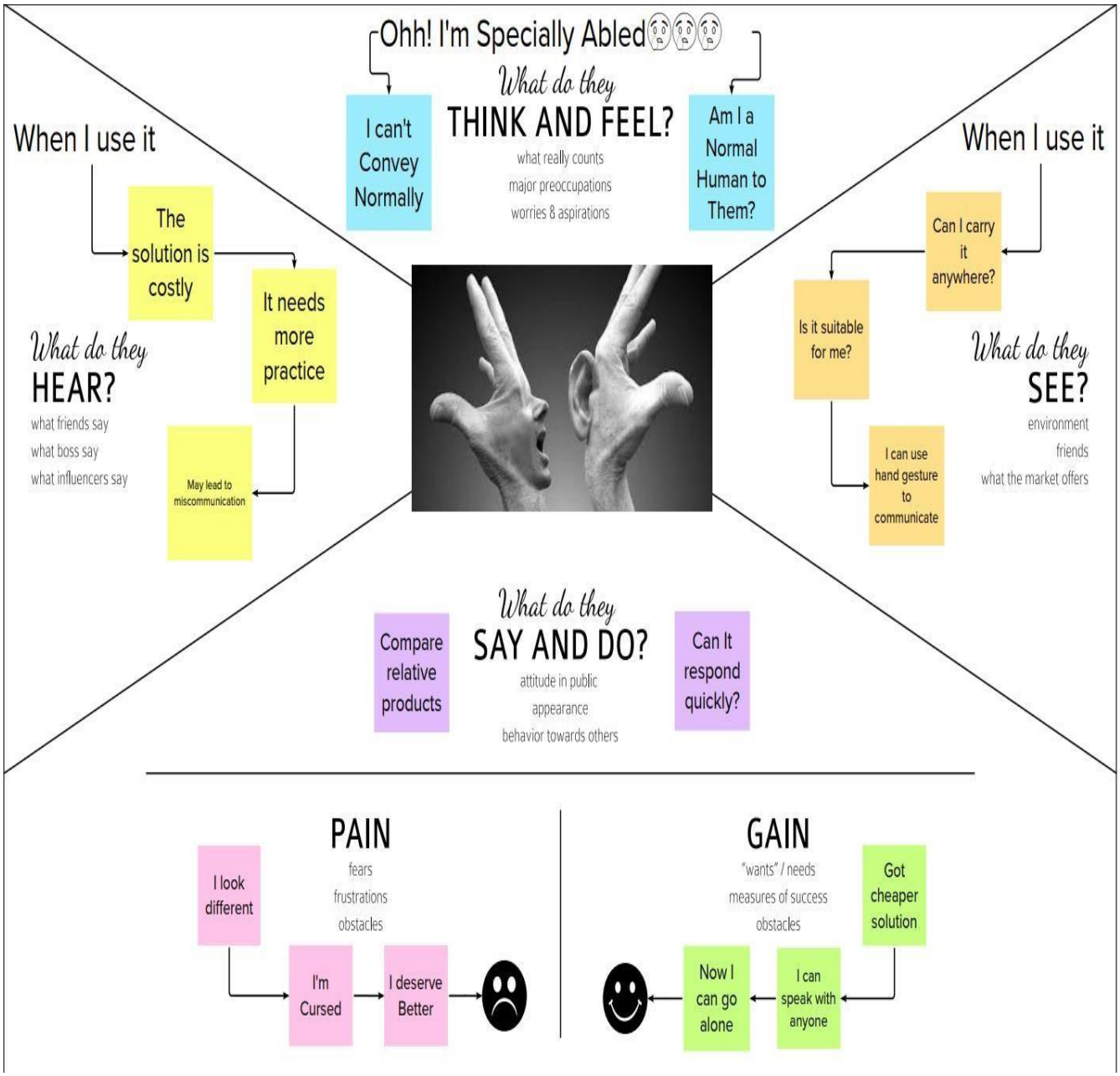
microcontroller and a Python-based backend for textto-speech conversion. The glove includes two modes of operation – phrase fetch mode and letter fetch mode.

2.3.PROBLEM STATEMENT:

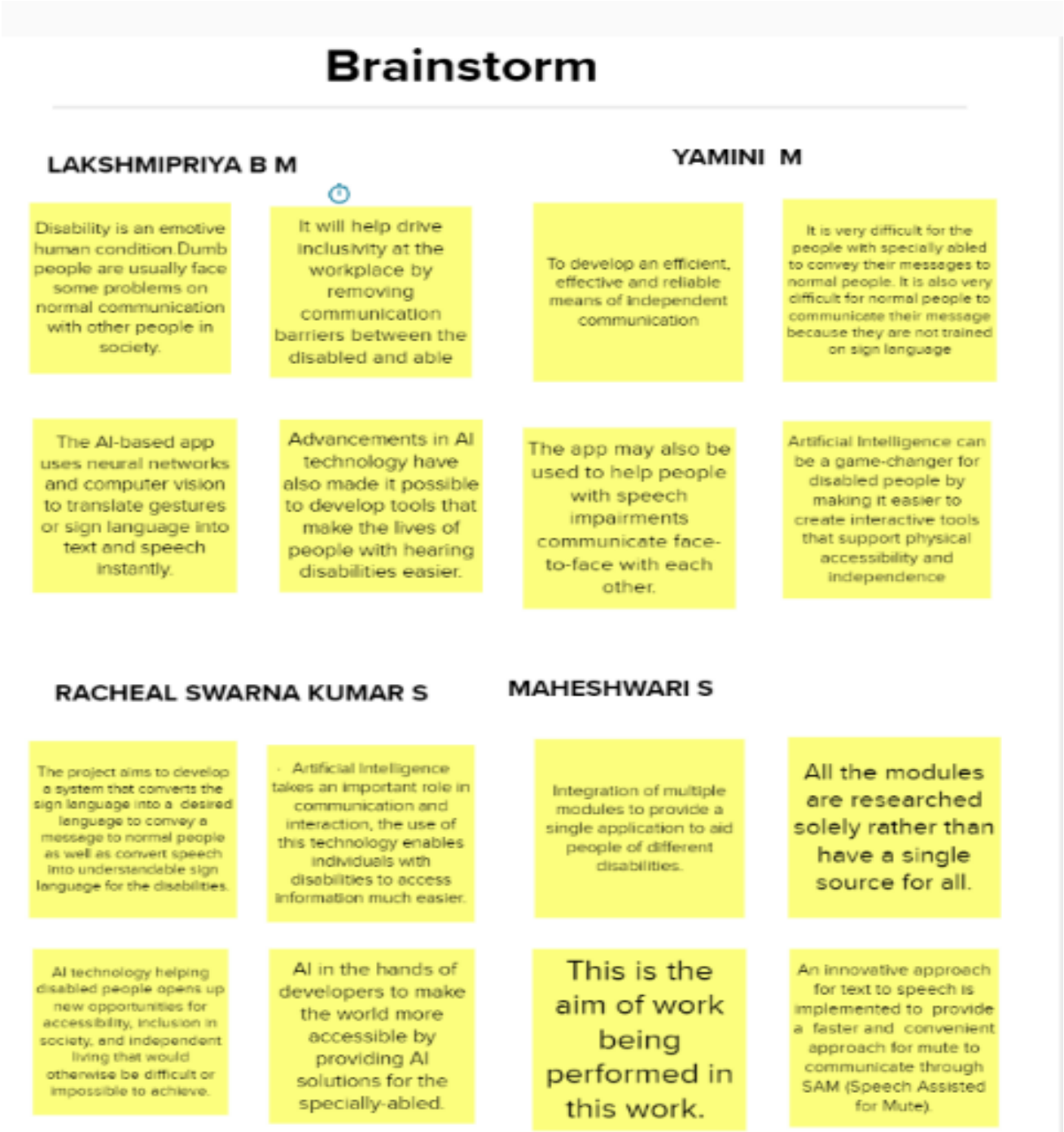
Communication should be universal without any barriers or limitations. Communication between a deaf-mute and a normal person has always been a challenging task. It is very difficult for mute people to convey their message to normal people. Since normal people are not trained on hand sign language. In emergency times conveying their message is very difficult. The human hand has remained a popular choice to convey information in situations where other forms like speech cannot be used. To facilitate easier communication for specially-abled (Deaf and Dumb) people with normal people by developing a model that incorporates necessary features including sign language interpretation and classification. The project aims to develop a system that converts sign language into a human-hearing voice in the desired language as well as to convert speech into understandable sign language for the deaf and dumb. A convolution neural network is used to create a model that will be trained on different hand gestures. A web application to use the model will be built. This application will enable the deaf and dumb people to convey their information using signs which get converted to human-understandable language and speech is given as output.

3.IDEATION PHASE & PROPOSED SOLUTION :

3.1 Empathy Map Canvas:



3.2 IDEATION AND BRAINSTORMING:-



3.3 PROPOSED SOLUTION:-

S.No	Parameter	Description
1.	**Problem Statement (Problem to be solved)**	Statement-Communication between deafmute and a normal person has always been a challenging task. Description :It is very difficult for mute people to convey their message to normal people in emergency times as well as in normal times.
2.	**Idea / Solution description**	1.The ideas consisted of designing and implement a system using artificial intelligence, image processing and data mining concepts to take input as hand gestures. 2. It generates recognizable outputs in the form of text and voice with 91% accuracy.
3.	**Novelty / Uniqueness**	1.Artificial Intelligence developed the app called GnoSys uses neural networks and computer. 2.It recognizes the video of sign language speaker,and then smart algorithms translate it into speech.
4.	**Social Impact / Customer Satisfaction**	1.About two thirds of People with a mobility and dexterity disability are most likely to experience a great deal of difficulty with everyday activities.

		2.The main purpose of this application is to make deaf-mute people feel independent and more confident.
5.	**Business Model (Revenue Model)**	1.AI can generate revenue through direct customers and collobrate with health care sector and generate revenue from their customers. 2.B2B setting uses to employ deaf and mute employees can use to convey messages according to the company.
6.	**Scalability of the Solution**	1.AI technology helping disabled people opens up new opportunities for accessibility inclusion in societyand independent living. 2.It could unlock more advanced and innovative solutions for addressing the most complex challenges faced by disbled peoples.

REAL-TIME COMMUNICATION SYSTEM POWERED BY AI

FOR SPECIALLY-ABLED

3.4 PROPOSED SOLUTION FIT

<table>
<tr>
<td>1.CUSTOMER SEGMENT(S)

Specially abled persons</td>
<td>6.CUSTOMER CONSTRAINTS

A cochlear implant is an implanted electronic medical device that can produce useful hearing sensation by electrically stimulating nerves inside the inner ear.</td>
<td>5.AVAILABLE SOLUTIONS

AI-voice-assisted technologies, like Echo, Google Home, Alexa, have created new means of accessibility for disabled people. As Artificial Intelligence takes an important role in communication and interaction, the use of this technology enables individuals with disabilities to access information much easier, all just by speaking to their devices.</td>
</tr>
<tr>
<td>2.JOBS-TO-BE-DONE / PROBLEMS

Any denial of opportunity is not simply a result of bodily limitations. It is also down to the attitudinal, social, and environmental barriers facing disabled people.</td>
<td>9.PROBLEM ROOT CAUSE

Disabilities affect the entire family. Meeting the complex needs of a person with a disability can put families under a great deal of stress — emotional, financial, and sometimes even physical. However, finding resources, knowing what to expect, and planning for the future can greatly improve overall quality of life.</td>
<td>7.BEHAVIOUR

Directly related : D-Talk, sign language, message convertion, hand gesture, mental damage, difficulty to communicate.

Indirectly associated : Empowered technology, completely paralyzed, noble cause, using sensors in day to day life, environmental threats affect their life difficulty in society.</td>
</tr>
<tr>
<td>3.TRIGGERS
Persons using sensors, vibrators, neural networks are the things used for developing their communication, for the accessible language and to avoid long words that might be hard to understand.

4.EMOTIONS: BEFORE /AFTER
They loss their confidence and they feel unlike whose have the inferiority complex to own</td>
<td>10. YOUR SOLUTION

AI powered solution stand to make a real difference for people with disabilities, supporting them in activities of daily living and enabling them to gain new skills. AI technology helping disabled people opens up new opportunities for accessibility, inclusion in society, and independent living that would otherwise be difficult or impossible to achieve.</td>
<td>8.CHANNELS of BEHAVIOURS
8.1 ONLINE
Providing special Equipment to augment Educational services for them to improve their mind and mental health. They affected by social medias by using their part of things mostly.

8.2 OFFLINE
They mostly affected by going into our direct society i.e schools, colleges and workplace such things affect their life directly.</td>
</tr>
</table>

4.REQUIREMENT ANALYSIS:-

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	LOW VISION: As a user who has trouble reading due to low vision, I want to be able to make the text larger on the screen so that I can read it. Registration through Gmail.
FR-2	User medical details	IMPAIRED USER: As a user who is hearing - impaired, I want a turn on video captions so that I can understand what is being said in videos. Confirmation via Email.
FR-3	User personal details	COLOR BLINDNESS: As a user who is color blind, I want to links to be distinguishable on the page so that I can find the links and navigate the site. Registration through Gmail.

Non-functional Requirements:

Following are the non-functional requirements of the proposed solution.

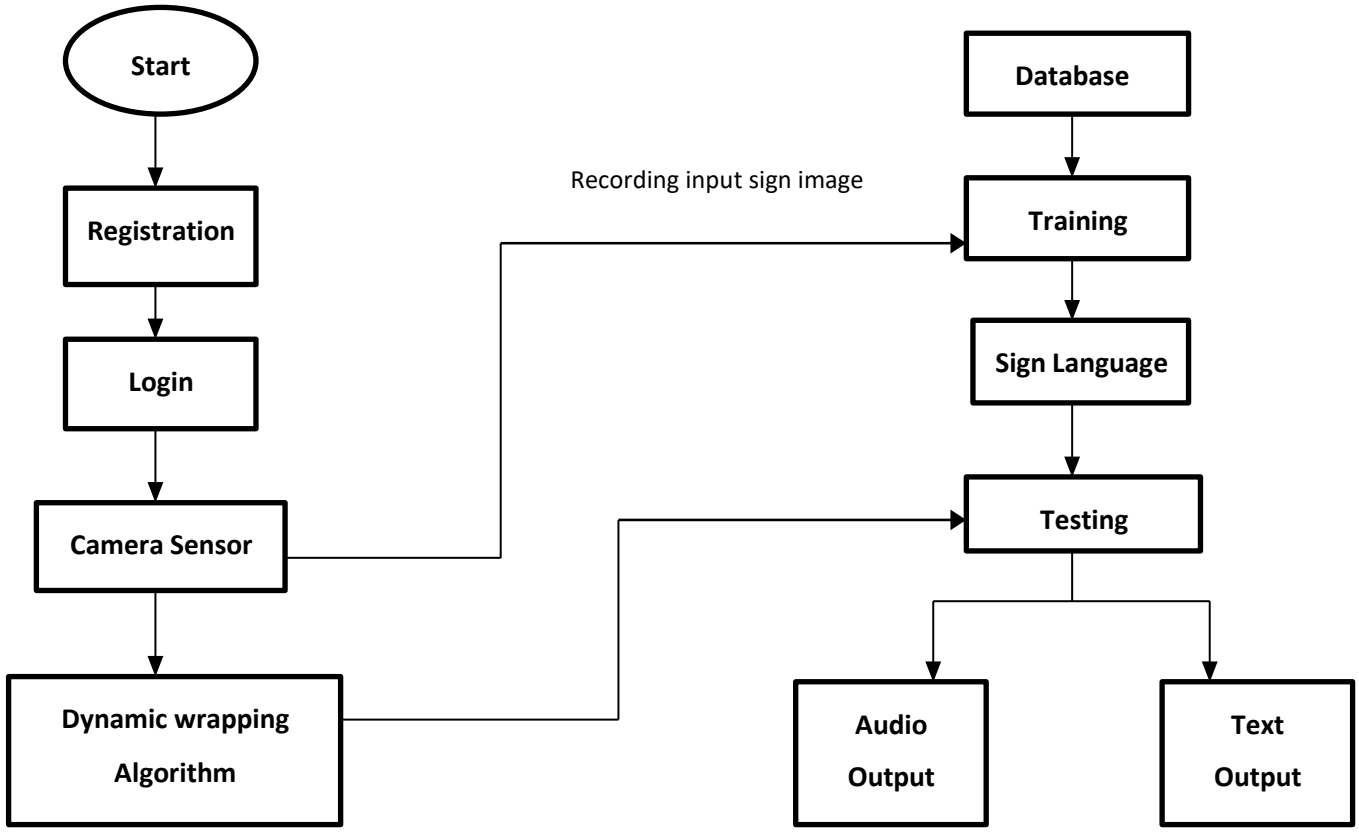
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	• Visual and Audio Help • Text size scaling • Reverse contrast
NFR-2	**Security**	Important information: • Walking in single file or in narrow space . • Steps, Stairs and Slope. • Kerbs and Roads.
NFR-3	**Reliability**	To determine reliability measures are: • Test-Retest Repeatability • Individual Repeatability
NFR-4	**Performance**	To determine predictors of success in reading with low vision aids, in terms of reading acuity, optimum acuity reserve, and maximum reading speed, for observers with low vision for various causes.
NFR-5	**Availability**	Lack of adequate low vision services and barriers to their provision and uptake impact negatively on efforts to prevent visual impairment and blindness.
NFR-6	**Scalability**	There is a large selection of device to help people with low vision. Some are “Optical”, glass lenses such as magnifying glasses and telescopes

5.PROJECT DESIGN:-

5.1 DATA FLOW DIAGRAM:-

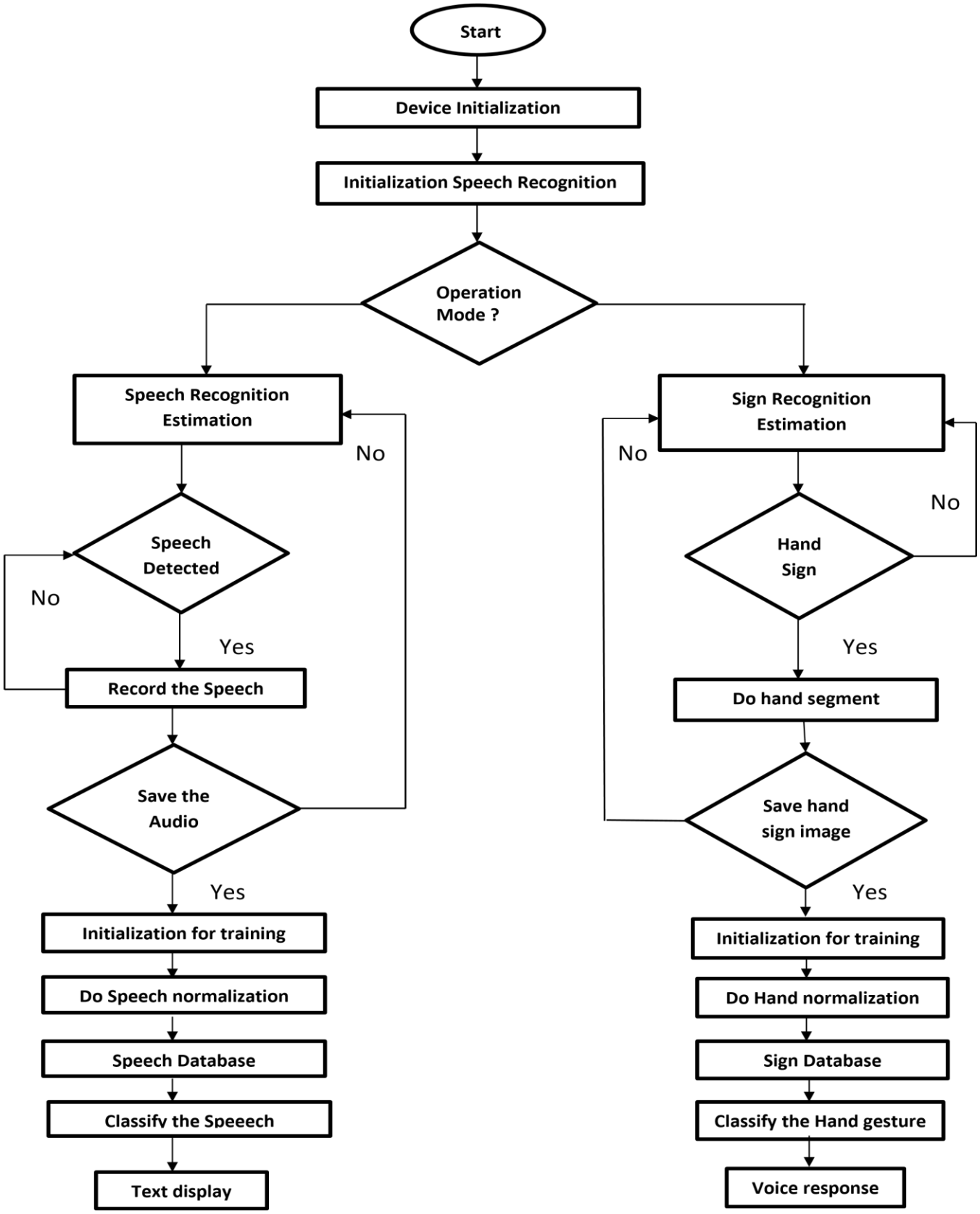
Data Flow Diagrams:

A data flow diagram (DFD) is a graphical or visual representation using a standardized set of symbols and notations to describe a business's operations through data movement.



REAL-TIME COMMUNICATION SYSTEM POWERED BY AI

FOR SPECIALLY-ABLED



5.2 TECHNOLOGY ARCHITECTURE:-

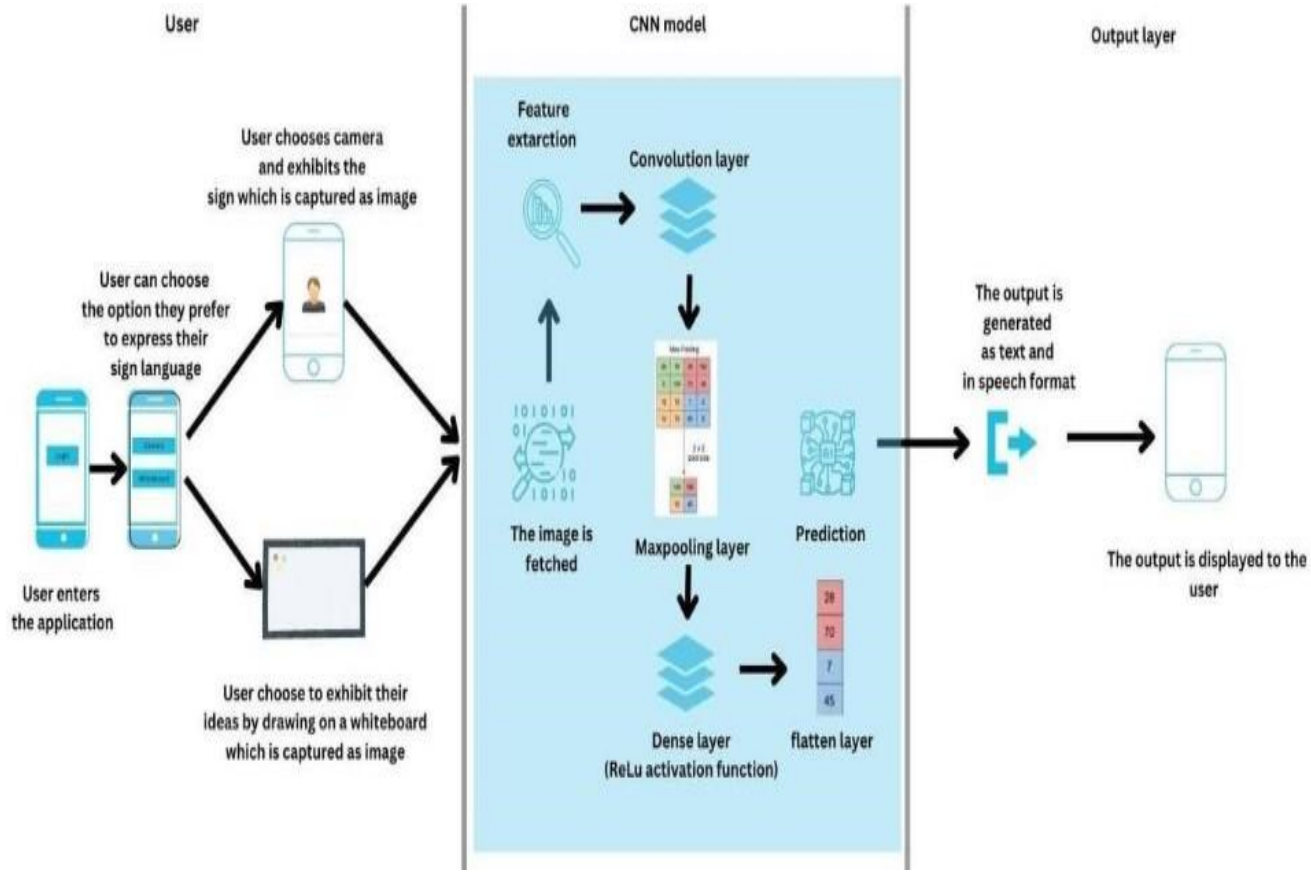


Table-1:Components& Technologies:

1.	User Interface	UserInterface provides options fortheuser toeitheruploada photo orturnon live camerafor thepredictionof signlanguage	HTML, CSS, JavaScript, Python

2.	Image Preprocessing	Gesture can be completely observable and viewing a gesture from another perspective makes the prediction.	ANN,CNN
3.	Speech	Speechtranslatesthevoice into image andsensitive neural play.	AI and machinelearning methods likedeep learning andneural networks.
4.	Database	The userlogindetails and credentials arestored and processedusing MySQLdatabase.	MySQL.
5.	Cloud Database	We use IBM cloud data storage to store and manage userdata.	IBMDB2, IBMCloudant etc.
6.	Models	SupportVecto rMachine (SVM) is subsequently appliedto classify our gestureimage dataset.	MachineLearning
7.	Testing	Thetrainedmodel is thenrunon an additional untested 10-15 signlanguage imagesandthe performance parametersare evaluated andrecorded	Scikit-learn, NLP

Table-2:Application characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Flaskwebapplication, Google colab	● HTML ● CSS ● Javascript ● Flask Google colab
2.	Security Implementations	Usersareauthenticated based ontheirusername/password pairand/orOTP sent to their givenmobile numbers	SHA-1, Encryptions, IAM Controls
3.	Scalable Architecture	Theimprovement in thespecially abledpersonsinteractionwith theenvironments.	Artificial Intelligence
4.	Availability	Thisis an open source application andit is available to all usersand it manage all thecustomers without any networkglitch	Technology used Flaskweb application

5.	Performance	Theapplicationperforms efficiently undera heavy load of translationrequestswithout any significant reduction inthe conversion accuracy	Numberof requests per minute,accuracy of translation (sign-language to speech &text tosignlanguage.

5.3 USER STORIES:-

USER TYPE	FUNCTIONAL REQUIREMENT	USER STORY NUMBER	USER STORY / TASK	ACCEPTANCE CRITERIA	PRIOROTY	RELEASE
Customer (Desktop user)	Registration	UNS-1	As a user, I can register for the application by entering my email ID, password and confirming my password.	I can access my account.	High	Sprint - 1
	Authentication	USN-2	As a user, I receive a confirmation email. Once I have registered for the application.	I can receive confirmation email and click confirm.	Low	Sprint - 1

REAL-TIME COMMUNICATION SYSTEM POWERED BY AI

FOR SPECIALLY-ABLED

	Login	USN-3	As a user, I can log into the application by entering email and password.	I am able to get into the Dashboard.	High	Sprint - 2
	Dashboard	USN-4	One place to explore all available features.	I can access my Dashboard	High	Sprit - 2
	Main Page	USN-5	As a user, I can enter the web page once clicked.	I can enter the web page for usage.	Medium	Sprit - 2
	Guidelines	USN-6	As a user, I can read through the guidelines to	I can read through the guidelines.	Medium	Sprint - 2
			understand the functioning of the web.			
	Provide the necessary functionalities required to use the web.	USN-7	I can provide the necessary specification and other details to as an executive to make sure the web run smoothly.	I can provide the necessary specification.	High	Sprint - 3

	Camera. (Hand Movement Detection)	USN-8	I can point my hand signs at camera as a user and the camera will translate them into text & voice.	I can show my hand sign towards the camera accurately for translation.	High	Sprint - 3
	Convert Sign	USN-9	As a user, I can click the button convert sign.	I can click the button convert sign and it direct me to the next site.	Medium	Sprint - 3
	Voice Mode	USN-10	Once the text has been received as a user, I can select the voice option to hear the text.	I can click on the voice mode which read the provided text.	High	Sprint - 3
Administrator	Manage	USN-11	Do-It-Yourself service for delivering everything.	Set a predefined requirements that makes a user story complete.	High	Sprint - 4

6.PROJECT PLANNING AND SCHEDULING:-

6.1 SPRINT PLANNING AND ESTIMATION:-

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data Collection	USN-1	Collect Dataset	9	High	LAKSHMIPRIYA B M, RACHEAL SWARNA KUMAR S, YAMINI M, MAHESWARI S
Sprint-1		USN-2	Image preprocessing	8	Medium	LAKSHMIPRIYA B M, RACHEAL SWARNA KUMAR S, YAMINI M, MAHESWARI S
Sprint-2	Model Building	USN-3	Import the required libraries, add the necessary layers and compile the model	10	High	LAKSHMIPRIYA B M, RACHEAL SWARNA KUMAR S, YAMINI M, MAHESWARI S
Sprint-2		USN-4	Training the image classification model using CNN	7	Medium	LAKSHMIPRIYA B M, RACHEAL SWARNA KUMAR S, YAMINI M, MAHESWARI S
Sprint-3	Training and Testing	USN-5	Training the model and testing the model's performance	9	High	LAKSHMIPRIYA B M, RACHEAL SWARNA KUMAR S, YAMINI M, MAHESWARI S

REAL-TIME COMMUNICATION SYSTEM POWERED BY AI

FOR SPECIALLY-ABLED

Sprint-4	Implementation of the application	USN-6	Converting the input sign language images into English alphabets	8	Medium	LAKSHMIPRIYA B M, RACHEAL SWARNA KUMAR S, YAMINI M, MAHESWARI S

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	10	6 Days	24 Oct 2022	29 Oct 2022	8	29 Oct 2022
Sprint-2	10	6 Days	31 Oct 2022	04 Nov 2022	5	04 Nov 2022
Sprint-3	10	6 Days	07 Nov 2022	11 Nov 2022	7	11 Nov 2022
Sprint-4	10	6 Days	14 Nov 2022	18 Nov 2022	5	18 Nov 2022

Velocity:

Average Velocity = Velocity / Sprint Duration

- Average Velocity → AV
- Velocity → Points per sprint
- Sprint Duration → Number of days per sprint

1. Sprint – 1: AV = 8 / 6 = 1.33
2. Sprint – 2: AV = 5 / 6 = 0.83
3. Sprint – 3: AV = 7 / 6 = 1.167
4. Sprint – 4: AV = 5 / 6 = 0.83

7.CODING AND SOLUTIONING:-

Feature 1:-

Facial recognition technology is quickly becoming a part of everyday life. It's used to improve public security, the accuracy of photo tagging and even make grocery shopping easier.Today, facial recognition software is being used for blind children to read books aloud and as an accessible way for deaf people to communicate with others via video chat.

Feature 2:-

Predictive text is a feature on most modern cell phones that quickly allows you to choose one of several words displayed after typing only a few letters. This can be helpful for people with disabilities because it will allow them to press fewer buttons while texting or writing messages.As technology progresses, new ways to adapt cell phones to work with disabilities will become available.

8.TESTING:-

8.1 USER ACCEPTANCE TESTING:-

1.Purpose of Document:-

The purpose of this document is to briefly explain the test coverage and open issues of project-Real Time Communication System Powered By AI For Specially Abled at the time of the release to User Acceptance Testing (UAT).

2. Defect Analysis:-

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved.

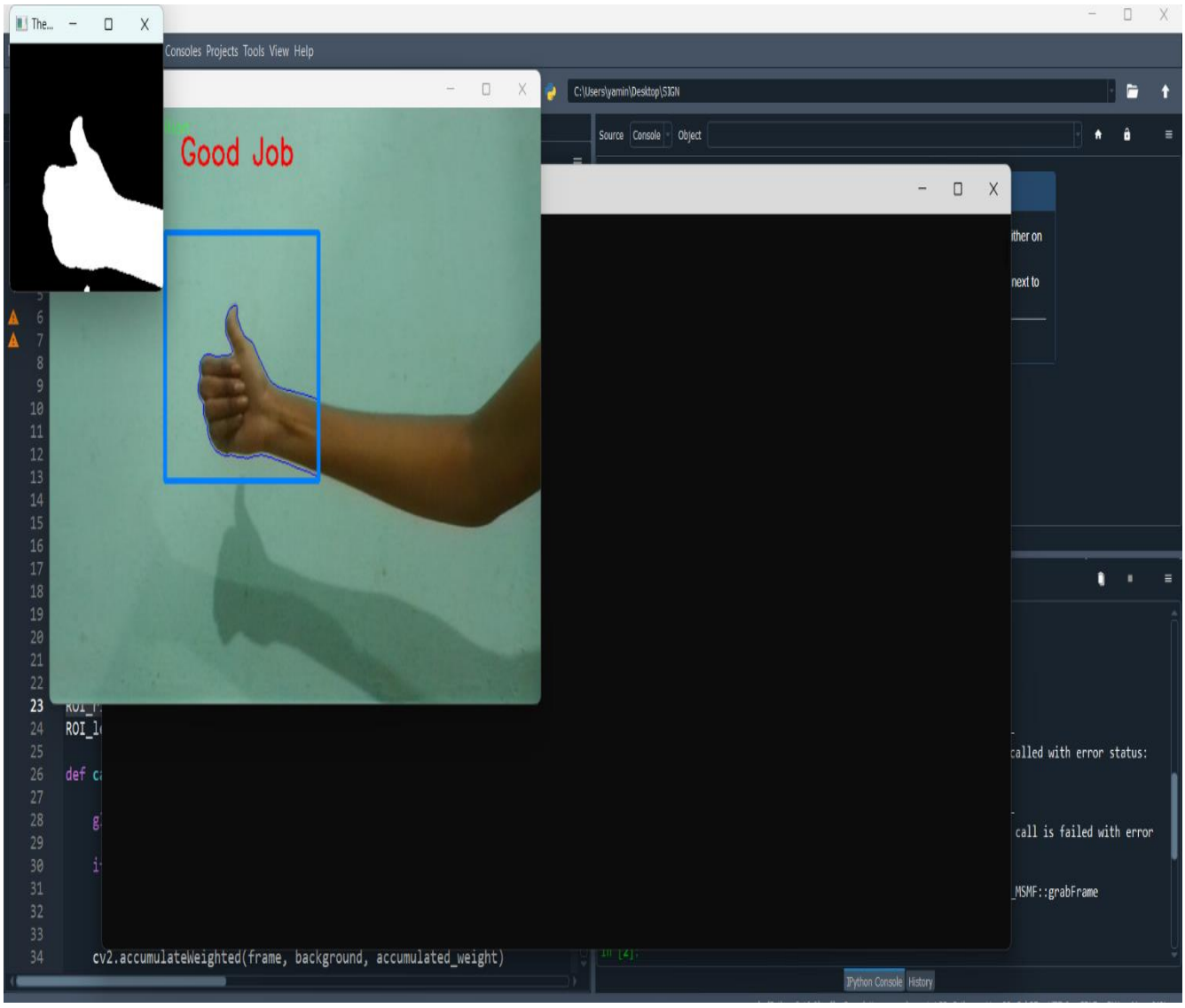
Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	0	0	0	0	2
Sign Detection	0	0	0	0	1
Threshold and Image	0	0	0	1	1
Fixed	0	1	3	1	2
External	0	1	1	0	1
Image sensing	0	0	1	0	0
Model comparison	0	1	0	0	1
Totals	0	2	5	2	8

3.Test-CaseAnalysis

This report shows the number of test cases that have passed, failed, and untested.

Section	Total Cases	Not Tested	Fail	Pass
View Home Page	7	0	1	6
Click Reference	15	0	3	12
Image displayed	12	0	0	12
Camera access	11	0	2	9
Sign recognisation	8	0	0	8
ClientApplication	49	0	0	49
Security	4	0	0	4
OutsourceShipping	4	0	0	4
ExceptionReporting	11	0	0	11
FinalReportOutput	2	0	0	2
VersionControl	1	0	0	1
Predict Sign	4	0	0	4
ExceptionReporting	11	0	0	11
FinalReportOutput	2	0	0	2
VersionControl	1	0	0	1

9.RESULTS:


Good Job
Consoles Projects Tools View Help
C:\Users\yamin\Desktop\SIGN
Source
Console
Object
cv2.accumulateWeighted(frame, background, accumulated_weight)
IPython Console
History

10.ADVANTAGES AND DISADVANTAGES:-

10.1 ADVANTAGES:-

- The limitation of the system is that employs it a logical mechanism for classification of letters based on sensor values.
- Implementation of a Machine Learning algorithm like Artificial Neural Networks for classification of letters can help clear the boundaries between similar gestures.
- Another limitation is the lack of portability as a Windows-based computer is needed for the backend.

10.2DISADVANTAGES:-

- Accuracy of system may vary depending upon light intensity changes.
- Also accuracy depends upon distance between camera and object.

11.CONCLUSION:-

The main objective of this research has been achieved successfully. Gesture interpretation works best in case users who understand sign language may interact with people who are unfamiliar with sign language. Speech interpretation is helpful for sign language non-speakers who want the accompanying hand sign to be understood. Room conditions such as lighting can play a role in predicting the outcome of poor lighting. The light that is either too bright or too dim will result in inaccurate hand segmentation, resulting in inaccurate gesture prediction. The type of inaccuracy can emerge from the user's peripherals, such as poor web camera development of technology is essential, and its deployment in sign language is highly critical. It will serve to bring efficiency in communication, not only to the deaf and dumb but those with the ability to hear and speak as well. In addition to creating opportunities for their career growth, it will enhance their social life through effective communication.Making an impact and changing the lives of the deaf and dump through technology will be an innovation of the year worth the time and resources.At the beginning of the D-Talk idea, the developersthink to have more than one task for this application, but inthe end, they narrow the task to have only one.

12.FUTURE SCOPE:-

- The system forms the base infrastructure for a complete communicational aid system for the deaf and mute.

- To expand its capabilities, more languages can be easily added by adjusting sensor values.

- Each character speech recognition system is trained to recognize the characters and convert them into the required pattern. The proposed system aims to give speech speechless, a real-time character language is captured as a series of images, and it is processed and then converted into speech and text

- Proposed systems scope is related with education of dumb peoples. Dumb people faces many problems when normal person could not understand their language. They were facing communication gap with normal peoples.

- For communication between deaf person and a second person, a mediator is required to translate sign language of deaf person. But a mediator is required to know the sign language used by deaf person. But this is not always possible since there are multiple sign language for multiple languages

13.APPENDIX:-

Index.html

```
<html>
 <head>
  <link rel="stylesheet" href={{ url_for('static', filename='css/style.css') }}>
 </head>
 <body>



  <h3 class="header">SIGN LANGUAGE TO SPEECH CONVERSION</h3>
  <div class="video">
     <img src="{{ url_for('video') }}" width="50%">
  </div>
  <div class="container">
  <form action='/predict' method='post'>
  <button type="submit" name="start" value="start" class="button1" >Start</button>
  </form>
 <form action='/stop' method='post'>

  <button type="submit" name="stop" value="stop" class="button2" >Stop</button>
 </form>
 </div>
 <div class="instruction">
```

REAL-TIME COMMUNICATION SYSTEM POWERED BY AI

FOR SPECIALLY-ABLED

 <details>
<summary>FOR EFFECTIVE USAGE FOLLOW</summary>
Once the webcam is ON Click "START" to start the predicition model.

>>Click "s" To save the text.

>>Click "a" To leave a space.

>>Click "d" To delete a character from right to left.

>>Click "w" To delete entire text.

>> The Saved text appears on the top left corner of the video screen

>> Once you are satisfied with the saved text press"STOP" to convert it into speech

>>IMPORTANT NOTE: The hand must be on the screen to display the text to save,delete or to leave a space between them.

</details>

```
</div>
<br>
<br>
<div class="team">
<center>
<details>
  <summary><b>TEAM</b></summary>
  <p><b>Ibm ID - IBM-Project-9718-1659069470</b>
  <br>
   1.YAMINI<br>
   2.LAKSHMIPRIYA<br>
   3.RACHEAL SWARNA KUMAR<br>
   4.MAHESWARI<br>


  </p>
</details>
</center>
</div>
<p>If you require any further information,let us know.</p>
<center>
<div class="alert info">
  <span class="closebtn">&times;</span>
```

```
  <strong>NOTE:</strong> A disturbance free background with good lighting(White-background) is
mostly preferred.
</div>
</center>
<script>
  var close = document.getElementsByClassName("closebtn");
  var i;

  for (i = 0; i < close.length; i++) {
    close[i].onclick = function(){
      var div = this.parentElement;
      div.style.opacity = "0";
      setTimeout(function(){ div.style.display = "none"; }, 600);
    }
  }
  </script>

  <a class="social-icon"href="https://www.linkedin.com/in/yamini-m-6a3662231?trk=profile-badge"
target="_blank">
    <ion-icon name="logo-linkedin"></ion-icon>
  </a>
  <a class="git"href="https://github.com/IBM-EPBL/IBM-Project-9718-1659069470.git"
target="_blank">
    <ion-icon name="logo-github"></ion-icon>
```

```
  </a>



  <script src="https://platform.linkedin.com/badges/js/profile.js" async defer
type="text/javascript"></script>
  <script type="module"
src="https://unpkg.com/ionicons@5.5.2/dist/ionicons/ionicons.esm.js"></script>
  <script nomodule src="https://unpkg.com/ionicons@5.5.2/dist/ionicons/ionicons.js"></script>




  </body>
</html>
```

style.css

```
body{
    background-color: #D9E2DE;
    font-family: 'Times New Roman', Times, serif;
}
button{
    border-radius: 20%;
    size: 40px;
```

```
    text-align: center;
  padding: 15px 25px;
  font-size: 15px;
  cursor: pointer;
  text-align: center;
  text-decoration: none;
  outline: none;
  color: #fff;
  background-color: #A68CEF;
  border: none;
  border-radius: 15px;
  box-shadow: 0 9px #999;
}
button:hover {background-color: #8410f9}

button:active {
  background-color: #8410f9;
  box-shadow: 0 5px #666;
  transform: translateY(4px);
}
form{
    display: inline;
    text-align: center;
}
```

```
.container{
    display: block;
    text-align: center;
    width:175px;
    margin:auto;
    padding-top:10px;
}
h2{
    color: #8410f9;
    font-size: 35px;
    text-decoration: underline;
    text-align: center;
    margin-block-start: 0em !important;
    margin-block-end: 0.5em !important;
}
img{
    display:block;
    margin-left: auto;
    margin-right: auto;
    width:40%;
    border: 10px solid #C0B5DD;
    border-radius: 10px;
    margin-bottom: 10px;
}
```

```
.result{
    text-align: center;
    font-size: 20px;
}
details > summary {
  padding: 20px;
  width: 200px;
  background: rgb(255,218,5);
  background-color: #CF9FFF;
  border: none;
  box-shadow: 1px 1px 2px #bbbbbb;
  cursor: pointer;
}

 details > p {
    background-color: white;
    width: 250px;
    padding: 2em;
    margin:0;
    box-shadow: 1px 1px 2px #bbbbbb;
    font-family:'Nunito', Arial ;
    position:relative;
  }
details>summary:hover {background-color: #8410f9}
```

```
.social-icon{
  color: rgb(76, 76, 194);
  transition: color 0.2s;
  font-size: 50px;
  text-decoration: none;
}
.social-icon:hover{
  color:blue
}
.git{
  color: rgb(87, 85, 85);
  transition: color 0.2s;
  font-size: 50px;
}
.git:hover{
  color:black;
}
body {
  background-image: url('https://www.freepik.com/free-vector/love-sign-background-hand-doodle-frame-black-white-vector_20347070.htm#query=sign%20language&position=0&from_view=search&track=sph');
  background-repeat: no-repeat;
  background-attachment: fixed;
  background-size: 100% 100%;
```

```
}
.alert {
  padding: 20px;
  background-color: #f44336;
  color: white;
  opacity: 1;
  transition: opacity 0.6s;
  margin-bottom: 15px;
  width:650px
}
.alert.info {background-color: #368faf;}
.closebtn {
  margin-left: 15px;
  color: white;
  font-weight: bold;
  float: right;
  font-size: 22px;
  line-height: 20px;
  cursor: pointer;
  transition: 0.3s;
}
.closebtn:hover {
  color: black;
}
```

REAL-TIME COMMUNICATION SYSTEM POWERED BY AI

FOR SPECIALLY-ABLED

Python Spyder screenshots:-

```
#-*- coding: utf-8 -*-
#import pyttsx3
import numpy as np
import cv2
import keras
from keras.preprocessing.image import ImageDataGenerator
import tensorflow as tf

model = keras.models.load_model(r"best_model.h5")


#word_dict = {6:"call",0:"Doctor",1:"Help",2:"Hot",3:"Lose",4:"Pain",5:"Theif"}
word_dict = {0:'Hello',1:'B',2:'Help Me',3:'D',4:'E',5:'F',6:'G',7:'H',8:'I',9:'J',10:'Thank you',11:'L',12:'M',13:'O',14:'Over there',15:'Q



background = None
accumulated_weight = 0.5

ROI_top = 100          #10
ROI_bottom = 300        #350
ROI_right = 150         #10
ROI_left = 350          #350

def cal_accum_avg(frame, accumulated_weight):

    global background

    if background is None:
        background = frame.copy().astype("float")
        return None

    cv2.accumulateWeighted(frame, background, accumulated_weight)
```

```
    cv2.accumulateWeighted(frame, background, accumulated_weight)


def segment_hand(frame, threshold=25):
    global background

    diff = cv2.absdiff(background.astype("uint8"), frame)


    _ ,thresholded = cv2.threshold(diff, threshold, 255,cv2.THRESH_BINARY)

     #Fetching contours in the frame (These contours can be of hand
#or any other object in foreground) …

    contours, hierarchy =cv2.findContours( thresholded.copy(),cv2.RETR_EXTERNAL,cv2.CHAIN_APPROX_SIMPLE)

    # If length of contours list = 0, means we didn't get any
   # contours...
    if len(contours) == 0:
        return None

    else:
        # The largest external contour should be the hand
        hand_segment_max_cont = max(contours, key=cv2.contourArea)

        # Returning the hand segment(max contour) and the
 # thresholded image of hand...
        return (thresholded, hand_segment_max_cont)

def play():
    converter.say(words)
    converter.runAndWait()
```

REAL-TIME COMMUNICATION SYSTEM POWERED BY AI

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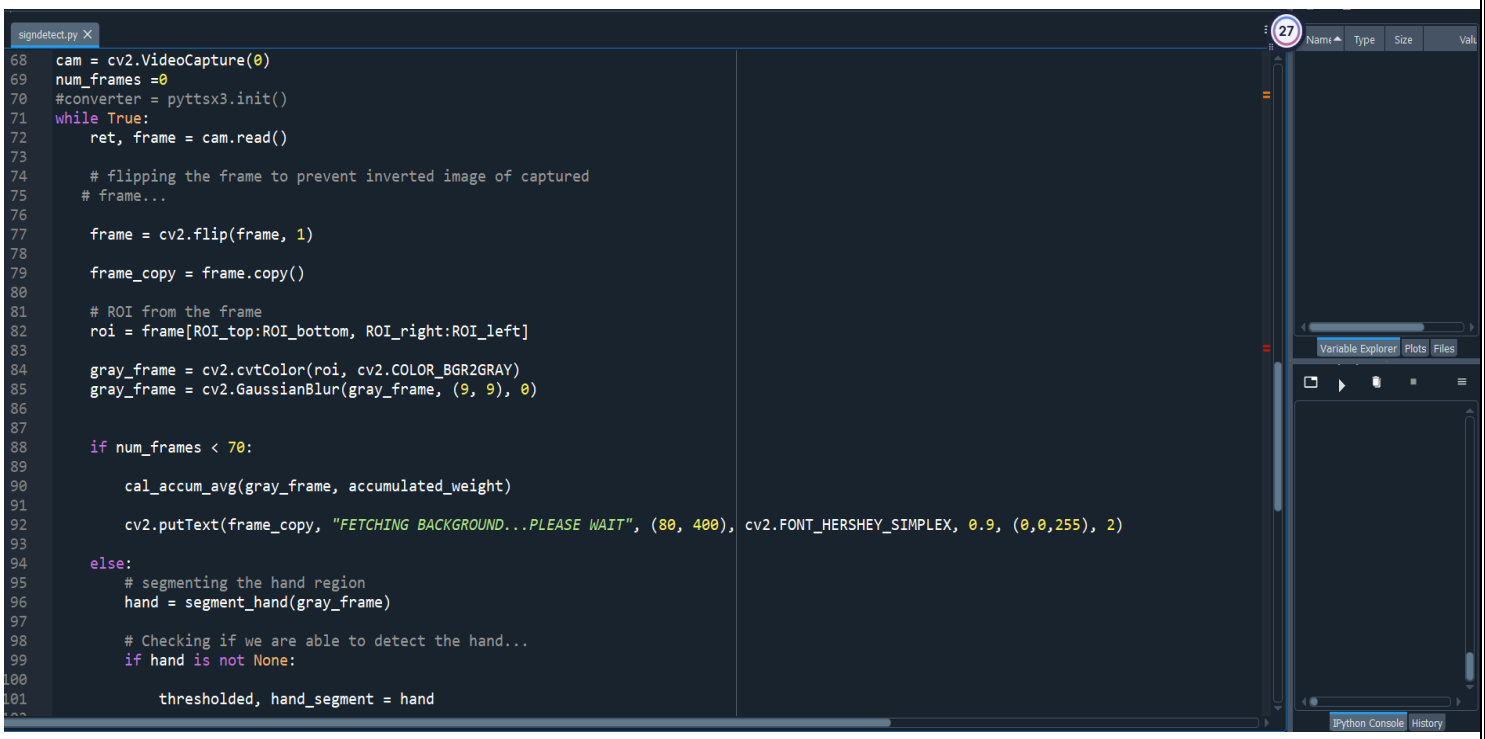

```
cam = cv2.VideoCapture(0)
num_frames =0
#converter = pyttsx3.init()
while True:
    ret, frame = cam.read()

    # flipping the frame to prevent inverted image of captured
    # frame...

    frame = cv2.flip(frame, 1)

    frame_copy = frame.copy()

    # ROI from the frame
    roi = frame[ROI_top:ROI_bottom, ROI_right:ROI_left]

    gray_frame = cv2.cvtColor(roi, cv2.COLOR_BGR2GRAY)
    gray_frame = cv2.GaussianBlur(gray_frame, (9, 9), 0)


    if num_frames < 70:

        cal_accum_avg(gray_frame, accumulated_weight)

        cv2.putText(frame_copy, "FETCHING BACKGROUND...PLEASE WAIT", (80, 400), cv2.FONT_HERSHEY_SIMPLEX, 0.9, (0,0,255), 2)

    else:
        # segmenting the hand region
        hand = segment_hand(gray_frame)

        # Checking if we are able to detect the hand...
        if hand is not None:

            thresholded, hand_segment = hand
```

```
            # Drawing contours around hand segment
            cv2.drawContours(frame_copy, [hand_segment + (ROI_right, ROI_top)], -1, (255, 0, 0),1)

            cv2.imshow("Thesholded Hand Image", thresholded)

            thresholded = cv2.resize(thresholded, (64, 64))
            thresholded = cv2.cvtColor(thresholded,cv2.COLOR_GRAY2RGB)
            thresholded = np.reshape(thresholded,(1,thresholded.shape[0],thresholded.shape[1],3))

            pred = model.predict(thresholded)
            cv2.putText(frame_copy, word_dict[np.argmax(pred)],(170, 45), cv2.FONT_HERSHEY_SIMPLEX, 1, (0,0,255), 2)
            words = ""
            words = word_dict[np.argmax(pred)]
            print(words)
            #if words:
            #    play()



    # Draw ROI on frame_copy
    cv2.rectangle(frame_copy, (ROI_left, ROI_top), (ROI_right,
    ROI_bottom), (255,128,0), 3)

    # incrementing the number of frames for tracking
    num_frames += 1

    # Display the frame with segmented hand
    cv2.putText(frame_copy, "hand sign recognition",
    (10, 20), cv2.FONT_ITALIC, 0.5, (51,255,51), 1)
    cv2.imshow("Sign Detection", frame_copy)
    print()
```

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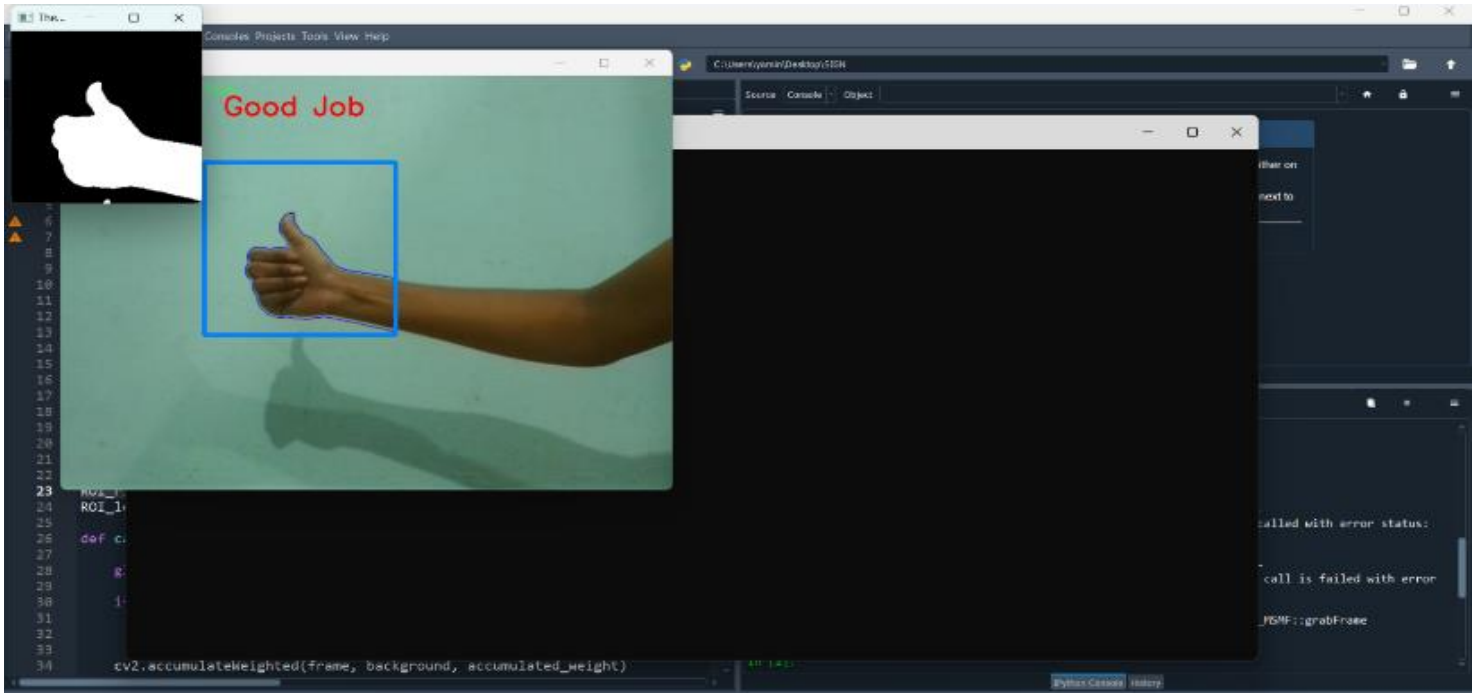
```
            pred = model.predict(thresholded)
            cv2.putText(frame_copy, word_dict[np.argmax(pred)],(170, 45), cv2.FONT_HERSHEY_SIMPLEX, 1, (0,0,255), 2)
            words = ""
            words = word_dict[np.argmax(pred)]
            print(words)
            #if words:
            #    play()



    # Draw ROI on frame_copy
    cv2.rectangle(frame_copy, (ROI_left, ROI_top), (ROI_right,
    ROI_bottom), (255,128,0), 3)

    # incrementing the number of frames for tracking
    num_frames += 1

    # Display the frame with segmented hand
    cv2.putText(frame_copy, "hand sign recognition",
    (10, 20), cv2.FONT_ITALIC, 0.5, (51,255,51), 1)
    cv2.imshow("Sign Detection", frame_copy)
    print()

    # Close windows with Esc
    k = cv2.waitKey(1) & 0xFF

    if k == 27:
        break

# Release the camera and destroy all the windows
cam.release()
cv2.destroyAllWindows()
```

OUTPUT:



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GITHUB LINK:- https://github.com/IBM-EPBL/IBM-Project-9718-1659069470.git

DEMO LINK https://drive.google.com/file/d/1iYtoXtdFAkoK424BL58RIaAnbk0k2O5/view?usp=drivesdk

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