Project Report

REAL-TIME COMMUNICATION SYSTEM POWERED BY AI FOR SPECIALLY ABLED

Submitted by

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TABLE OF CONTENTS

SOURCE CODE

GITHUB

PROJECT DEMO

CHAPTER 1

INTRODUCTION

1.1 ProjectOverview

Real-time communications (RTC) is any mode of telecommunications in which all users can exchange information instantly or with negligible latency or transmission delays.In RTC, there is always a direct path between the sourceand the destination. Although the link might containseveral
intermediate nodes, the data goes from source to destination without being stored in between them. In contrast, asynchronous or time shifting communications, such as email and voicemail, always involve some form of data storage between the source and the destination. In these cases,there is an anticipated delay between the transmission and receipt of the information.

1.2 Purpose

Real-time communication (RTC) refers to any communication that happens betweentwo (or more) individuals in real-time – with minimal latency and without transmission delays. Some examples of real-time communication include landline phones, mobile calls, instant messaging, VoIP, and videoconferencing.

CHAPTER 2
LITERATURE SURVEY

2.1 ExistingProblem

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. Communication between deaf-mute and a normal person has always been a challenging task. It is very difficult for mute people to convey theirmessage to normal people. Since normal peopleare not trainedon handsign 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 cannotbe used. Voice Conversion System with Hand Gesture Recognition and translation will be very useful to have a proper conversation between a normalperson and an impaired person in any language.

2.2 Reference

1.**Year 1955:** An Allen Newell and Herbert A. Simon created the "first artificial intelligence program ,Which was named as **"Logic Theorist"**.

2.**Year 1956 -** John McCarthy coined the term ‘artificial intelligence’ and had the first AI conference.

3. AI was a term first coined at Dartmouth College in 1956. Cognitive scientist Marvin Minsky was optimistic about the technology's future.

4. This program had proved **38** of **52** Mathematics theorems, and find new and more elegant proofs for some theorems

5. Year 1972: The first intelligent humanoid robot was built in Japan which was named as WABOT-1.

6. Year 1997: In the year 1997, IBM Deep Blue beats world chess champion, Gary Kasparov.

7. Deep learning, big data and artificial general intelligence (**2011**-present)

8. Self-awareness AI is the future of Artificial Intelligence. These machines will be super intelligent, and will have their own consciousness, sentiments, and self-awareness.

9. Machine learning based techniques in data analysis (Lavanya Vemulapalli, Dr.P.Chandrasekhar - **2018**

10. Based Real Time Communication for Physically and Speech Disabled People (Omg Chin Ann, Marlene Valeriu Lu -**2019)**

11. Survey on Application of Artificial Intelligence in Cyber Security (Shidawa Baba Atiku, Achi Unimke Aaron, Fathima Shittu- **2020**

12. Systematic review of computer vision symantic analysis in medical (Antonio Victor Alencar Lundgren, Byron Leite Dantas Bezzerra – **2021**

13. Year 2020 - Baidu releases the Liner fold AI algorithm to medical and scientific and medical teams developing a vaccine during the early stages of the SARS-CoV-2 (COVID-19) pandemic. The algorithm can predict the RNA sequence of the virus in only 27 seconds, which is 120 times faster than other methods.

2.3 PROBLEM STATEMENT DEFINITION

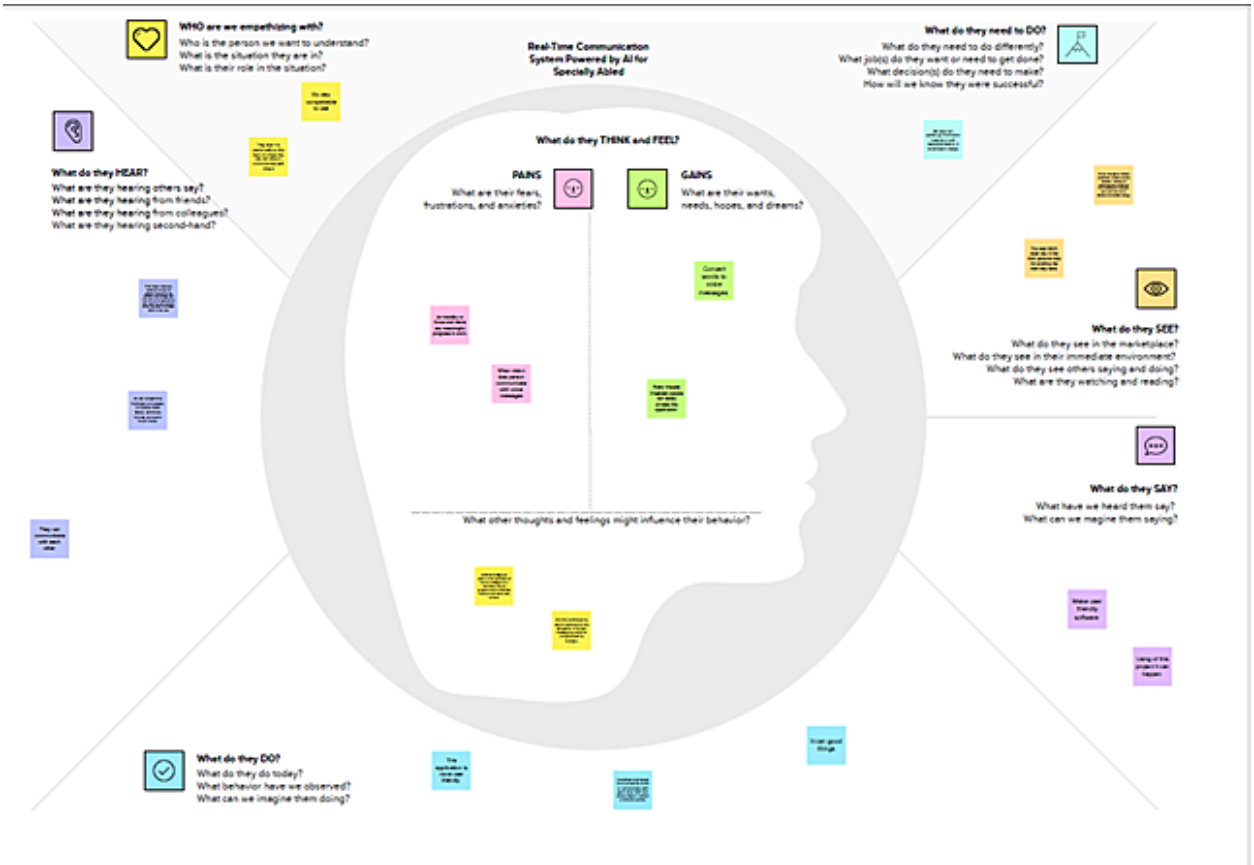
Statement – In the recent years, there has been rapid increase in the number of deaf and dumb victims due to birth defects, accidents and oral diseases. Since deaf and dumb people cannot communicate with normal person so they have to depend on some sort of visual communication. A World Health Organization report says around 63 million people in India suffer from either complete or partial deafness, and of these, at least 50 lakh are children. Communication between deaf-mute and a normal person has always been a challenging task.

Description - The Deaf/Dump people needs a way to communicate easily and quickly with the normal people, so that the Deaf/Dump people feel confident enough to express there thought, ideas, and can make conversation with the normal people.

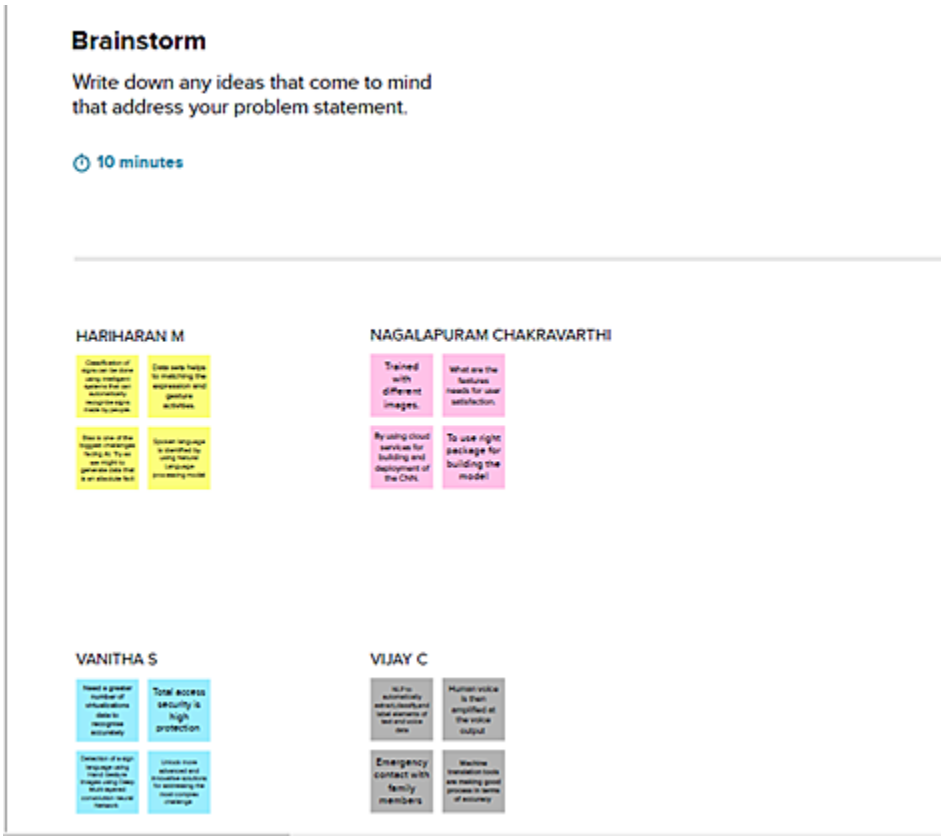
CHAPTER 3

IDEATION AND PROPOSED SOLUTION

3.1 EMPATHY MAP



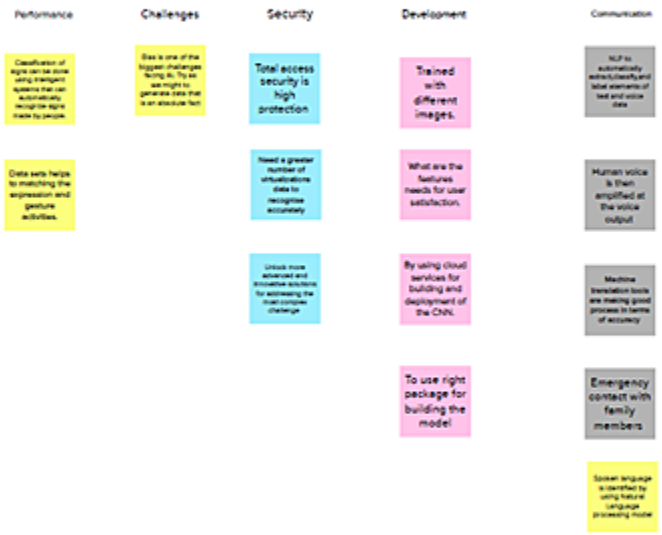
3.2 IDEATION AND BRAINSTORMING



Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

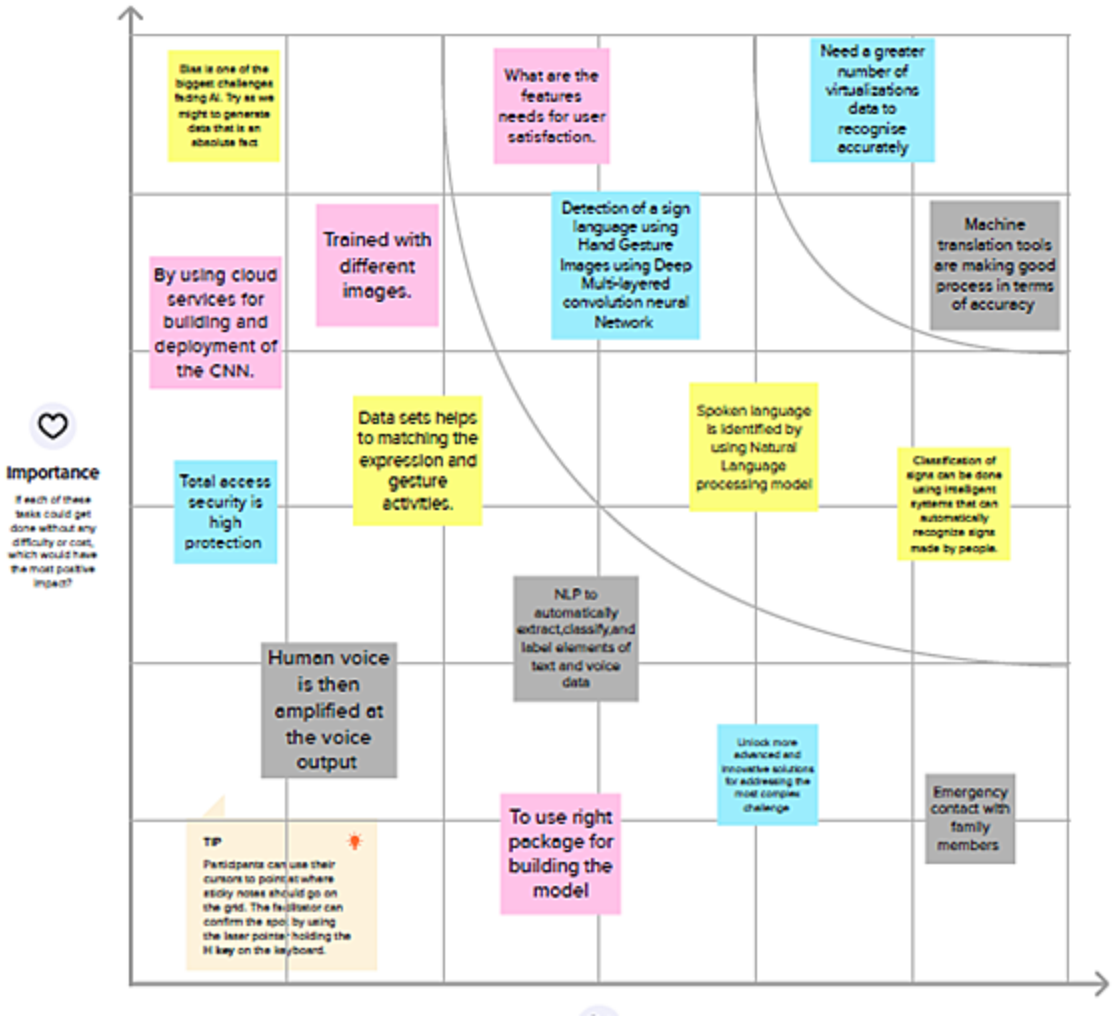
20 minutes



Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes

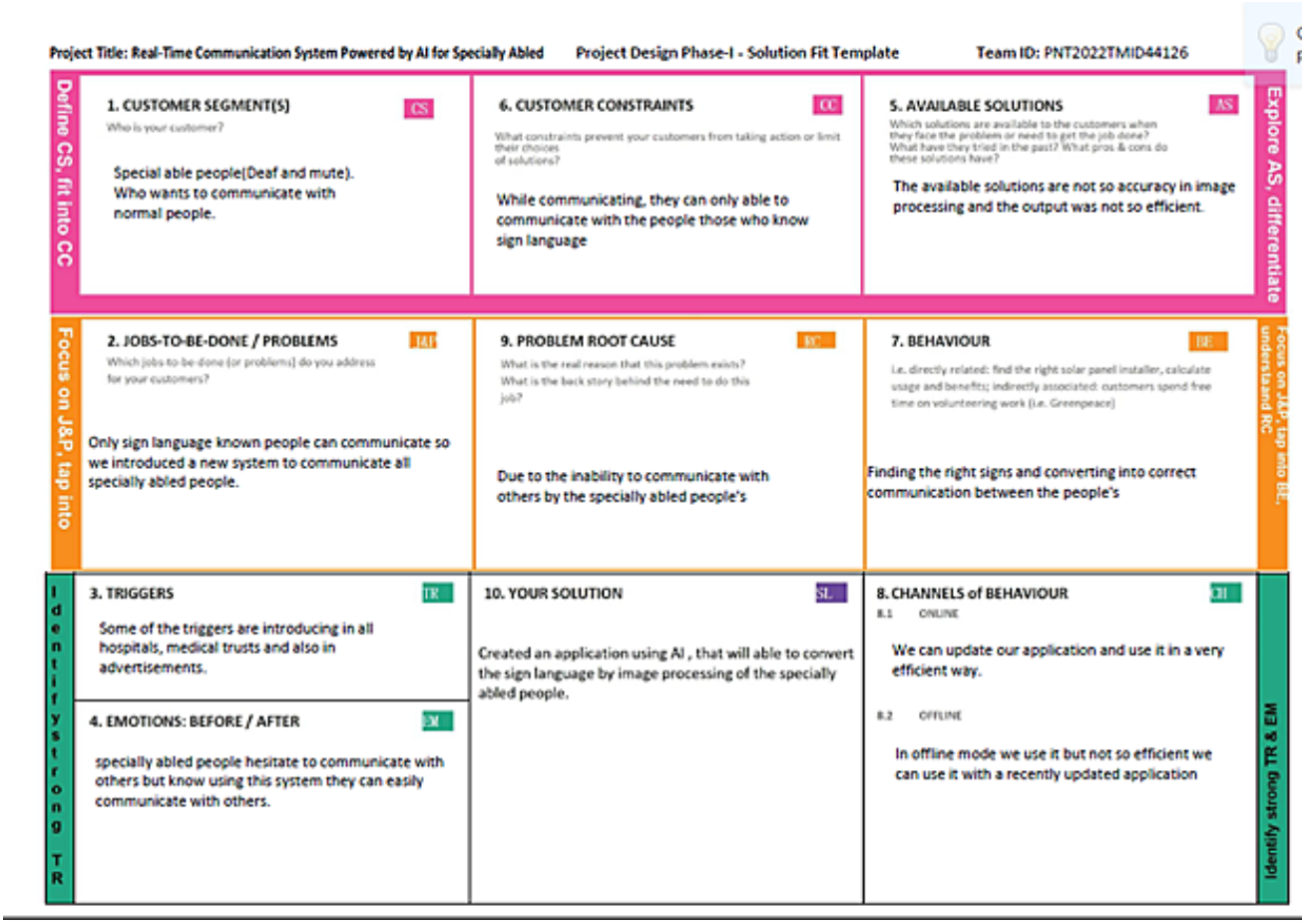


3.3 PROPOSED SOLUTION

S.No	Parameter	Description
1.	Problem Statement (Problem to be solved)	Existence of complications in understanding inputs from user.
2.	Idea / Solution description	Real-time captioning or translations for people with a hearing impairment or even people who don’t speak the language.
3.	Novelty / Uniqueness	We are making use of a convolution neural network to create a model that is trained on different hand gestures.
4.	Social Impact / Customer Satisfaction	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.
5.	Business Model (Revenue Model)	This business model truly revolutionizes accessibility and people with disabilities can drastically improve their everyday lives. The person who is incapable of speaking can easily chat with normal people and the people with hearing impairments can also understand the speech of normal person using this device.

6.	Scalability of the Solution	Accessibility for people with disabilities is high and hearing-impaired users can use text descriptions. Device is portable and power consumption is low. Battery can be charged and reused again. It is user friendly.

3.3 **PROBLEM SOLUTIONFIT**



CHAPTER 4

REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

FR No.	**Functional Requirement (Epic)**	**Sub Requirement (Story / Sub-Task)**
FR-1	User Registration	Registration through Gmail
FR-2	User Confirmation	Confirmation via Email
FR-3	User Communication	Communication can be done through pc or mobile camera.
FR-4	User requirement	Option should be shown for hand sign to text and voice conversion and vice versa.
FR-5	Communication requirement	Tutor can be made available to have one to one teaching for user.
FR-6	Regulatory requirements	App shutdown in case of cyber attack
FR-7	Reporting	If any issues found in the application, automatically it will be notified to the developer.
FR-8	Compliance to rules or law	Terms and conditions, private policy, End usersubscription agreement.

4.2 NON FUNCTIONAL REQUIREMENTS

FR No.	**Non-Functional Requirement**	**Description**
NFR-1	**Usability**	The camera captures all expressions including facial expressions and hand gestures which can be easily used by all age groups. It can be used by deaf-mute people and their care takers.
NFR-2	**Security**	The system is more secure and information of the customers is also maintained confidentially.
NFR-3	**Reliability**	The system is very liable, it can last for long amounts of time if well maintained.
NFR-4	**Performance**	The performance of the model is efficient. The cost-effective nature of the system makes it extremely liable. The latency is very less for the conversion process.
NFR-5	**Availability**	The solution is suitable for different languages and can be used in many countries. It can be trained for all the available sign languages. This model can be used at any time anywhere.

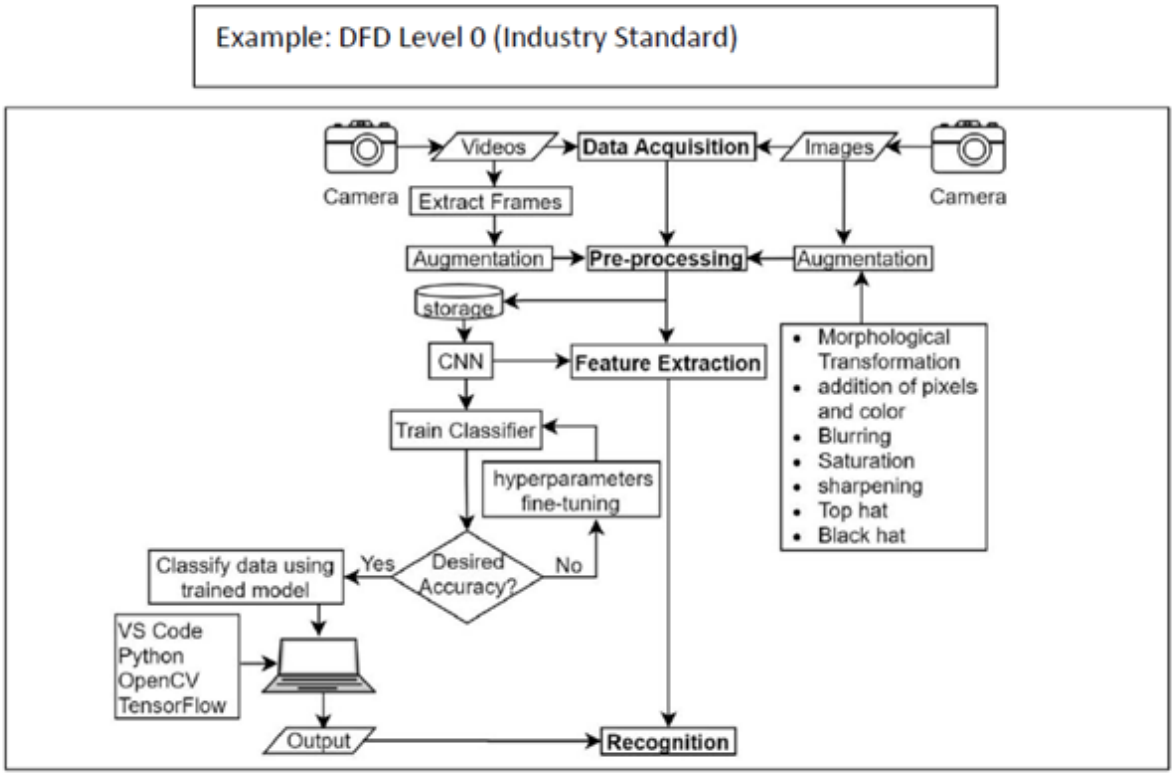
NFR-6	**Scalability**	The system gives output rapidly. It also predicts quickly when it gets so many inputs at a time. It predicts different types of sign language at a time. Up to 25000 users can be use this model at a time.

CHAPTER 5

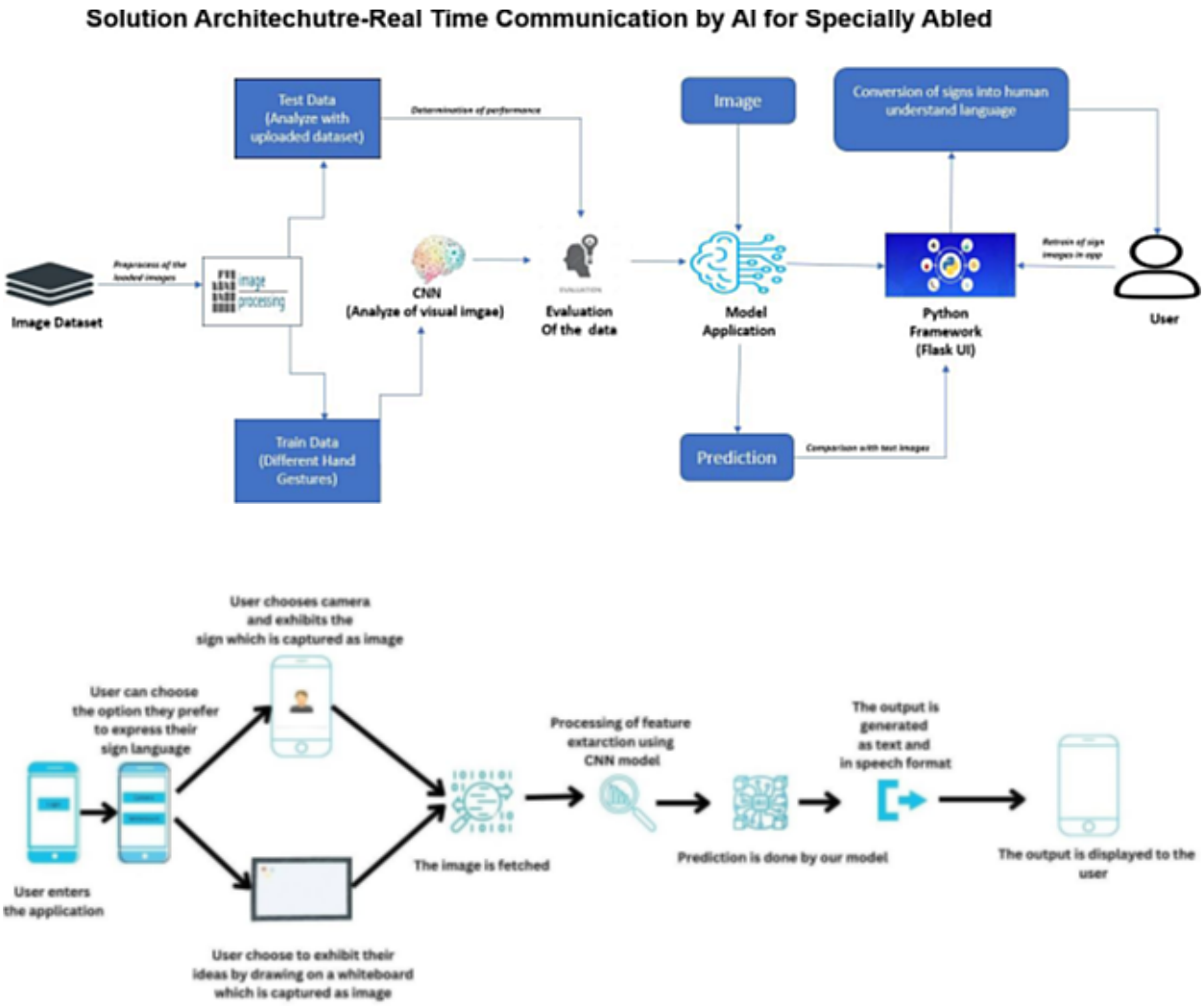
PROJECT DESIGN

5.1 DATA FLOW DIAGRAM

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



5.2 SOLUTION AND TECHNICAL ARCHITECTURE



5.3 USER STORIES

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer *(Desktop user)*	Registration	USN-1	**Not Required**	I can access my account / dashboard	High	Sprint-1
	Login	USN-2	**Not Required**		High	Sprint-1
	Dashboard	USN-3	**Not Required**			
Customer *(Desktop user)*	**Main page**	USN-4	As a User, **I can enter the web page once clicked, which provides be the Guidelines** to use the app	I can **enter the web page** once clicked	Medium	Sprint-1
Customer *(Desktop user)*	**Guidelines**	USN-5	As a User , **I can give a read through the guidelines to understand the functioning of the app.**	I can **give a read through the guidelines.**	Medium	Sprint-1
Customer *(Desktop user)*	**Convert Sign**	USN-6	As a User, **I can click the button Convert sign ,** which directs me towards the Main screen	I can **click the button Convert sign and directed me to main screen.**	Medium	Sprint-2
Customer *(Desktop user)*	**Camera(Hand movement detection)**	USN-7	As a User, **I can show my hand sign towards the camera which converts them into text manner.**	**I can show my hand sign** towards the camera accurately.	High	Sprint-2
Customer *(Desktop user)*	**Voice mode**	USN-8	Once the text is obtained, As a User **I can click on the voice mode which provides the text in the form of speech.**	**I can click on the voice mode** which provides the text in the form of speech.	High	Sprint-2

Customer Care Executive	**Provide the necessary functionalities required to use the app.**		As an Executive, I can **provide the Specifications of Camera required, and other factors** that are required for smooth functioning of the app.	**I can provide the Specifications** of Camera required, and other factors	Low	Sprint-1
Customer Care Executive	**Check the performance of the app**		As an Executive, I can **check the usage and queries obtained from the end users.**	I can **check the usage and queries** obtained from the end users.	Medium	Sprint-1
Administrator	**Receive queries based on the usage**		As an Admin, I can **take the queries from the customer care and perform the testing phase again , loading the other signs in the dataset,** in order to make the customers to use the app effectively.	I can **take the queries from the customer care and perform necessary phases again.**	High	Sprint-2

CHAPTER 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	As a user, I can collect the dataset from various resources with different data	10	Low	Nagalapuram Chakaravarthi Vanitha S
Sprint-1	Image Preprocessing	USN-2	As a user, I can import ImageDataGenerator Library and configure it, Apply ImageDataGenerator Functionality to Train and Test Dataset	10	Medium	Vanitha S Vijay C
Sprint-2	Model Building	USN-3	As a user, I will get an application with ML model which provides accurate communication and sharing data with sensor.	5	High	Hariharan M Nagalapuram Chakakravathi Vanitha S Vijay C
Sprint-2	Add CNN layers	USN-4	Creating the model and adding the input, hidden, and output layers to it.	5	High	Hariharan M Nagalapuram Chakakravathi Vanitha S Vijay C
Sprint-2	Compiling the model	USN-5	With both the training data defined and model defined, it's time to configure the learning process.	2	Medium	Hariharan M Vanitha S
Sprint-2	Fit and Save the model	USN-6	As a user, the model is saved & integrated with an android application or web application in order to predict something	6	Medium	Nagalapuram Chakaravarthi Vijay C
Sprint-2	Test the Model	USN-7	As a user, let us test our model with our image dataset.	2	Low	Hariharan M
Sprint-3	Building UI Application	USN-8	As a user, I will use technical button to operate the microphone for recognize.	10	High	Hariharan M Vijay C
Sprint-3		USN-9	As a user, I can know the details of the fundamental usage of the application.	5	Low	Vanitha S
Sprint-3		USN-10	As a user, I can see the prediction with help of technical in the application.	5	Medium	Nagalapuram Chakaravarthi
Sprint-4	Train the model on IBM	USN-11	As a user, I train the model on IBM and integrate flask/Django with scoring end point.	10	High	Hariharan M Nagalapuram Chakakravathi Vanitha S Vijay C
Sprint-4	Cloud Deployment	USN-12	As a user, I can access the web application and make the use of the product from anywhere.	10	High	Hariharan M Nagalapuram Chakakravathi Vijay C

6.2 SPRINT DELIVERY SCHEDULE

Sprint	Total Story Points	Duration	Sprint StartDate	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	5 Days	24 Oct 2022	28 Oct 2022	20	28 Oct 2022
Sprint-2	20	5 Days	30 Oct 2022	03 Nov 2022	20	03 Nov 2022
Sprint-3	20	5 Days	05 Nov 2022	09 Nov 2022	20	09 Nov 2022
Sprint-4	20	5 Days	11 Nov 2022	15 Nov 2022	20	15 Nov 2022

CHAPTER 7

CODING & SOLUTIONING

7.1 FEATURE 1

Using Live webstreaming for real time capture

```
@app.route('/')
def index():
    return render_template('index.html')
@app.route('/video')
def video():
    return Response(generate_frames(),mimetype='multipart/x-mixed-replace;
boundary=img')
if __name__=="__main__":
    app.run(debug=False)
```

7.2 FEATURE 2

```
## read the camera frame to predict the live webcam value
 success,img=camera.read()
  if not success:
            break
        else:
            imgOutput = img.copy()
            hands, img = detector.findHands(img)
            if hands:
                hand = hands[0]
                x, y, w, h = hand['bbox']
```

CHAPTER 8

TESTING

8.1 TEST CASES

Test case ID	Feature Type	Component	Test Scenario
Home Page_TC_OO1	Functional	Home Page	Verify user is able to see the Home is displayed or not
Home Page_TC_OO2	UI	Home Page	Verify the UI elements in Home page Shown
Home Page_TC_OO3	Functional	Home page	Verify user has available for live webstreaming
Home Page_TC_OO4	UI	Webstreaming	Verify the UI elements in webstreaming page Shown
Home Page_TC_OO5	Functional	Home Page	Verify user is able to show the hands

Home Page_TC_006	Functional	Home Page	Verify user is able to show the hands in clearly
Home Page_TC_007	Functional	Home page	Verify user is able to show the hands in clearly
Home Page_TC_008	UI	Webstreaming	Verify the UI elements predicted value
Home Page_TC_009	Functional	Home page	Verify user is able to show the hand signs
Home Page_TC_010	Functional	home page	Verify user is able to show the hand signs

Pre-Requisite	Steps To Execute
Internet Connection	1.Enter URL and click go
Web application need browser to run	1.Enter URL and click go 2.Verify Home page shown with below UI elements: Indrotuction of Signlanguage Detection
Open to Browser	1.Enter URL(http://127.0.0.1:5000) and click go 2.To display on Live webstreaming
Web application need browser to run	1.Enter URL(http://127.0.0.1:5000/) and click go 2.To display on Live webstreaming 3.We can checkup to correctly see the page
Internet Connection	1.Enter URL(http://127.0.0.1:5000) and click go 2.To display on Live webstreaming 3.We can checkup to correctly see the page 4.Detect the hands first 5.Match to the model

Internet Connection	1.Enter URL(http://1127.0.0.1:5000[]) and click go 2.To display on Live webstreaming
Internet Connection	1.Enter URL(http://127.0.0.1:5000[]) and click go 2.To display on Live webstreaming 3.We can checkup to correctly see the page 4.Detect the hands first 5.Match to the model
Web application need browser to run	1.Enter URL(http://127.0.0.1:5000[]) and click go 2.Click on Recognize button 3.Enter Recognize page then Enter Recognize page then click choose button 4.My Computer console open then select user data 5.Click on select button 6.click recognize button
Internet Connection	1.Click choose button 2.Show the hand signs 3.to display the predicted value
Internet Connection	1.Show to Predicted

Test Data	Expected Result	Actual Result	Status
http://127.0.0.1:5000	Home Page should display	Working as expected	Pass
http://127.0.0.1:5000	Application should show below UI elements to show the content	Working as expected	Pass
http://127.0.0.1:5000	User should redirected to Recognize as hand signs	Working as expected	Pass
http://127.0.0.1:5000	User can verify to the true webstreaming	Working as expected	Pass
http://127.0.0.1:5000	It has matching to the labels	Working as expected	Pass

http://127.0.0.1:5000/	Predict to the signs should display	Working as expected	Pass
http://127.0.0.1:5000/	If user not show any signs to not recognising	Working as expected	Pass
http://127.0.0.1:5000/	Detect to the hand sign in display for square box	Working as expected	Pass
http://127.0.0.1:5000/	Input sign will detect. After detect status no show predicted labels	Working as expected	Pass
http://127.0.0.1:5000/	If user not show any signs to not recognising	Working as expected	Pass

Commnets	TC for Automation(Y/N)	BUG ID	Executed By
Steps are clear to follow	No	No Bug	Nagalapuram chakaravarthi
Steps are clear to follow	No	No Bug	Vijay C
Steps are clear to follow	No	No Bug	Vanitha S
Steps are clear to follow	No	No Bug	Hariharan M
Steps are clear to follow	No	No Bug	Nagalapuram chakaravarthi

Steps are clear to follow	No	No Bug	Vijay C
Steps are clear to follow	No	No Bug	Vanitha S
Steps are clear to follow	No	No Bug	Hariharan M
Steps are clear to follow	No	No Bug	Nagalapuram chakaravarthi
Steps are clear to follow	No	No Bug	Hariharan M

8.2 USER ACCEPTANCE TESTING

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of theproject at the time of the release to User Acceptance Testing (UAT).

2. Defect Analysis

This reportshows the number of resolvedor closed bugs at each severitylevel, and how they were resolved.

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	9	6	2	0	17
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	6	2	4	20	32
Not Reproduced	0	0	1	0	1
Skipped	0	0	0	1	1
Won't Fix	0	0	2	1	3
Totals	18	11	12	23	64

3. Test Case Analysis

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

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	4	0	0	4
Client Application	8	0	0	8
Security	2	0	0	2
Outsource Shipping	1	0	0	1
Exception Reporting	7	0	1	6
Final Report Output	4	0	0	4
Version Control	2	0	0	2

CHAPTER 9

RESULTS

9.1 PERFORMANCE METRICS

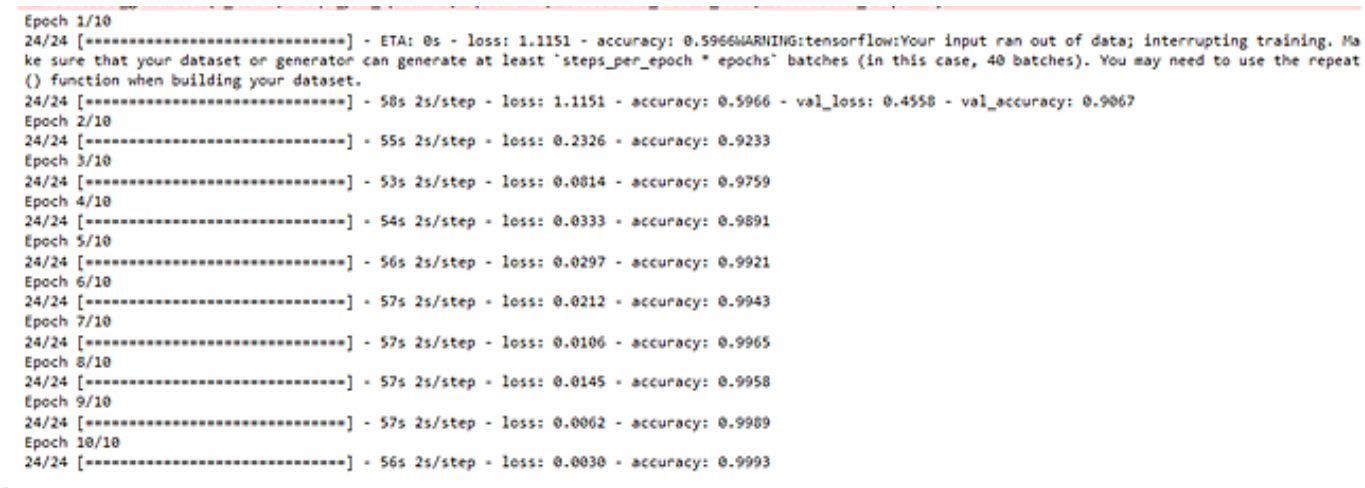
Use the test case for performance testing

S.No.	Parameter	Values	Screenshot
1.	Model Summary	Total params: 15,750,473 Trainable params: 15,750,473 Non-trainable params: 0	See image 1(Below Attached)
2.	Accuracy	Training Accuracy - 0.9993 Validation Accuracy – 0.9667	See Image 2(Below Attached)
3.	Confidence Score (OnlyYoloProjects)	Class Detected - 9 Confidence Score- 9	

Image 1 :

```
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d (Conv2D)             (None, 62, 62, 32)        320

 max_pooling2d (MaxPooling2D  (None, 31, 31, 32)       0
 )

 flatten (Flatten)           (None, 30752)             0

 dense (Dense)               (None, 512)               15745536

 dense_1 (Dense)             (None, 9)                 4617

=================================================================
Total params: 15,750,473
Trainable params: 15,750,473
Non-trainable params: 0
_________________________________________________________________
```

Image 2 :



```
Epoch 1/10
24/24 [==============================] - ETA: 0s - loss: 1.1151 - accuracy: 0.5966WARNING:tensorflow:Your input ran out of data; interrupting training. Ma
ke sure that your dataset or generator can generate at least `steps_per_epoch * epochs` batches (in this case, 40 batches). You may need to use the repeat
() function when building your dataset.
24/24 [==============================] - 58s 2s/step - loss: 1.1151 - accuracy: 0.5966 - val_loss: 0.4558 - val_accuracy: 0.9067
Epoch 2/10
24/24 [==============================] - 55s 2s/step - loss: 0.2326 - accuracy: 0.9233
Epoch 3/10
24/24 [==============================] - 53s 2s/step - loss: 0.0814 - accuracy: 0.9759
Epoch 4/10
24/24 [==============================] - 54s 2s/step - loss: 0.0333 - accuracy: 0.9891
Epoch 5/10
24/24 [==============================] - 56s 2s/step - loss: 0.0297 - accuracy: 0.9921
Epoch 6/10
24/24 [==============================] - 57s 2s/step - loss: 0.0212 - accuracy: 0.9943
Epoch 7/10
24/24 [==============================] - 57s 2s/step - loss: 0.0106 - accuracy: 0.9965
Epoch 8/10
24/24 [==============================] - 57s 2s/step - loss: 0.0145 - accuracy: 0.9958
Epoch 9/10
24/24 [==============================] - 57s 2s/step - loss: 0.0062 - accuracy: 0.9989
Epoch 10/10
24/24 [==============================] - 56s 2s/step - loss: 0.0030 - accuracy: 0.9993
```

CHAPTER 10
ADVANTAGES& DISADVANTAGES

10.1 ADVANTAGES

It enables employees from across the world to communicate with each other 24×7 and share ideas or solve problems quickly. It is a cost-effective way of getting several people from different locationsto attend meetings and conferences – without having to spend time or money on travel, and accommodation.

10.2 DISADVANTAGES

The biggest disadvantage of communication is that it takes a lot of time to listen, speak, read, orwrite to someone.While trying to do one thing you can accidentally hurt another person'sfeelingsby not listening or paying attention. This could result in damaging your relationship with them.

CHAPTER 11

CONCLUSION

11.1 CONCLUSION

Real-time communication (RTC) workloads can be deployed on AWS to attain scalability, elasticity, and high availability while meeting the key requirements. Today, several customers are using AWS,its partners, and open source solutions to run RTC workloads with reduced cost and faster agility aswell as a reduced global footprint.The reference architectures and best practices provided in this white paper can help customers successfully set up RTC workloads on AWS and optimize the solutionsto meet end user requirements while optimizing for the cloud.It is very helpful for disablity persons to find out the correct values.This project for dedicated to all disability persons and it executed successfully.

CHAPTER 12

FUTURE SCOPE

- Through image recognition technology, AI understands the context of objects in photos anddescribes photosto people.
- The speech-to-text and text-to-speech technologies helped those people who had speechimpediments
- The product in AI that narrates the entire world around them visually impaired by reading texts, describing whereabouts and the looks of the nearby peopleby identifying and recognizing faces andemotions.
- Autonomous vehicles are in trend and their success is due to AI technology. These vehicles can bebeneficial to people living with limited physical mobility
- To improve the new signs to detect with use this projects.
- to implement the some new options of tools.

CHAPTER 13
APPENDIX

13.1 SOURCE CODE

app.py :

```
        from flask import Flask,render_template,Response
import cv2
from cvzone.HandTrackingModule import HandDetector
from cvzone.ClassificationModule import Classifier
import numpy as np
import math

app=Flask(__name__)



def generate_frames():
    camera=cv2.VideoCapture(0)

    detector = HandDetector(maxHands=1)
    classifier = Classifier("Model/keras_model.h5", "Model/labels.txt")

    offset = 20
```

```
imgSize = 300

folder = "Data/C"
counter = 0
imgResize = 0
labels = ["A", "B", "C","D","E","F","G","H","I"]
while True:

    ## read the camera frame
    success,img=camera.read()
    if not success:
        break
    else:
        imgOutput = img.copy()
        hands, img = detector.findHands(img)
        if hands:
            hand = hands[0]
            x, y, w, h = hand['bbox']

            imgWhite = np.ones((imgSize, imgSize, 3), np.uint8) * 255
            imgCrop = img[y - offset:y + h + offset, x - offset:x + w + offset]

            imgCropShape = imgCrop.shape

            aspectRatio = h / w

            if aspectRatio > 1:
                k = imgSize / h
                wCal = math.ceil(k * w)
                imgResize = cv2.resize(imgCrop, (wCal, imgSize))
                imgResizeShape = imgResize.shape
                wGap = math.ceil((imgSize - wCal) / 2)
```

```
            imgWhite[:, wGap:wCal + wGap] = imgResize
            prediction, index = classifier.getPrediction(imgWhite, draw=False)
            print(prediction, index)

        else:
            try:
                k = imgSize / w
                hCal = math.ceil(k * h)
                imgResize = cv2.resize(imgCrop, (imgSize, hCal))
            except Exception as e:
                print(str(e))
            imgResizeShape = imgResize.shape
            hGap = math.ceil((imgSize - hCal) / 2)
            imgWhite[hGap:hCal + hGap, :] = imgResize
            prediction, index = classifier.getPrediction(imgWhite, draw=False)

        cv2.rectangle(imgOutput, (x - offset, y - offset-50),
                      (x - offset+90, y - offset-50+50), (255, 0, 255), cv2.FILLED)
        cv2.putText(imgOutput, labels[index], (x, y -26),
cv2.FONT_HERSHEY_COMPLEX, 1.7, (255, 255, 255), 2)
        cv2.rectangle(imgOutput, (x-offset, y-offset),
                      (x + w+offset, y + h+offset), (255, 0, 255), 4)




    ret,buffer=cv2.imencode('.jpg',imgOutput)
    imgOutput=buffer.tobytes()

    yield(b'--img\r\n'
          b'Content-Type: image/jpeg\r\n\r\n' + imgOutput + b'\r\n')
```

```
@app.route('/')
def index():
    return render_template('index.html')

@app.route('/video')
def video():
    return Response(generate_frames(),mimetype='multipart/x-mixed-replace;
boundary=img')

if __name__=="__main__":
    app.run(debug=False)
```

train.py :

```
# -*- coding: utf-8 -*-
"""
@author: welcome
"""

import cv2
from cvzone.HandTrackingModule import HandDetector
import numpy as np
import math
import time

cap = cv2.VideoCapture(0)
detector = HandDetector(maxHands=1)

offset = 20
imgSize = 300

folder = "Data/I"
```

```
counter = 0

while True:
    success, img = cap.read()
    hands, img = detector.findHands(img)
    if hands:
        hand = hands[0]
        x, y, w, h = hand['bbox']

        imgWhite = np.ones((imgSize, imgSize, 3), np.uint8) * 255
        imgCrop = img[y - offset:y + h + offset, x - offset:x + w + offset]

        imgCropShape = imgCrop.shape

        aspectRatio = h / w

        if aspectRatio > 1:
            k = imgSize / h
            wCal = math.ceil(k * w)
            imgResize = cv2.resize(imgCrop, (wCal, imgSize))
            imgResizeShape = imgResize.shape
            wGap = math.ceil((imgSize - wCal) / 2)
            imgWhite[:, wGap:wCal + wGap] = imgResize

        else:
            k = imgSize / w
            hCal = math.ceil(k * h)
            imgResize = cv2.resize(imgCrop, (imgSize, hCal))
            imgResizeShape = imgResize.shape
            hGap = math.ceil((imgSize - hCal) / 2)
            imgWhite[hGap:hCal + hGap, :] = imgResize

        cv2.imshow("ImageCrop", imgCrop)
        cv2.imshow("ImageWhite", imgWhite)
```

```
    cv2.imshow("Image", img)
    key = cv2.waitKey(1)
    if key == ord("s"):
        counter += 1
        cv2.imwrite(f'{folder}/Image_{time.time()}.jpg',imgWhite)
        print(counter)# -*- coding: utf-8 -*-
```

index.html :

```
                <html lang="en">

<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <meta http-equiv="X-UA-Compatible" content="ie=edge">
    <title>Singlanguage Classification</title>
    <link href="https://cdn.bootcss.com/bootstrap/4.0.0/css/bootstrap.min.css" rel="stylesheet">
    <script src="https://cdn.bootcss.com/popper.js/1.12.9/umd/popper.min.js"></script>
    <script src="https://cdn.bootcss.com/jquery/3.3.1/jquery.min.js"></script>
    <script src="https://cdn.bootcss.com/bootstrap/4.0.0/js/bootstrap.min.js"></script>
    <link href="{{ url_for('static', filename='css/main.css') }}" rel="stylesheet">
    <style>

    .bg-dark {
        background-color:   #4B92BB!important;
    }
    #result {
        color: #ffffff;
    }
    body
{
    background-image: url("../static/hand sign.jpg");
    background-size: 50%;
```

```
}

  </style>
</head>

<body>

  <nav class="navbar navbar-dark bg-dark">
    <div class="container">
      <a class="navbar-brand" href="#">Signlangue detection</a>
    </div>
  </nav>
  <div class="container">
    <div id="content" style="margin-top:2em">
    <div class="container">
     <div class="row">

      <div class="col-sm-6 bd">
       <h3>Singlanguage Classification: </h3>
       <br>
       <p><mark style="background-color:#a48c74;">Sign languages are languages that use the visual-manual modality to convey meaning, instead of just spoken words.It used primarily by the deaf and hard of hearing, it is also used by hearing individuals, such as those unable to physically speak, those who have trouble with oral language due to a disability or condition (augmentative and alternative communication), and those with deaf family members including children of deaf adults.</mark></p>
      </div>
      <div class="col-sm-6">
        <div>
          <h4 class="mt-5">Sign Detection</h4>
         <img src="{{ url_for('video') }}" width="100%"> </div>
      <footer>
        <script src="{{ url_for('static', filename='js/main.js') }}" type="text/javascript"></script>
      </footer>
```

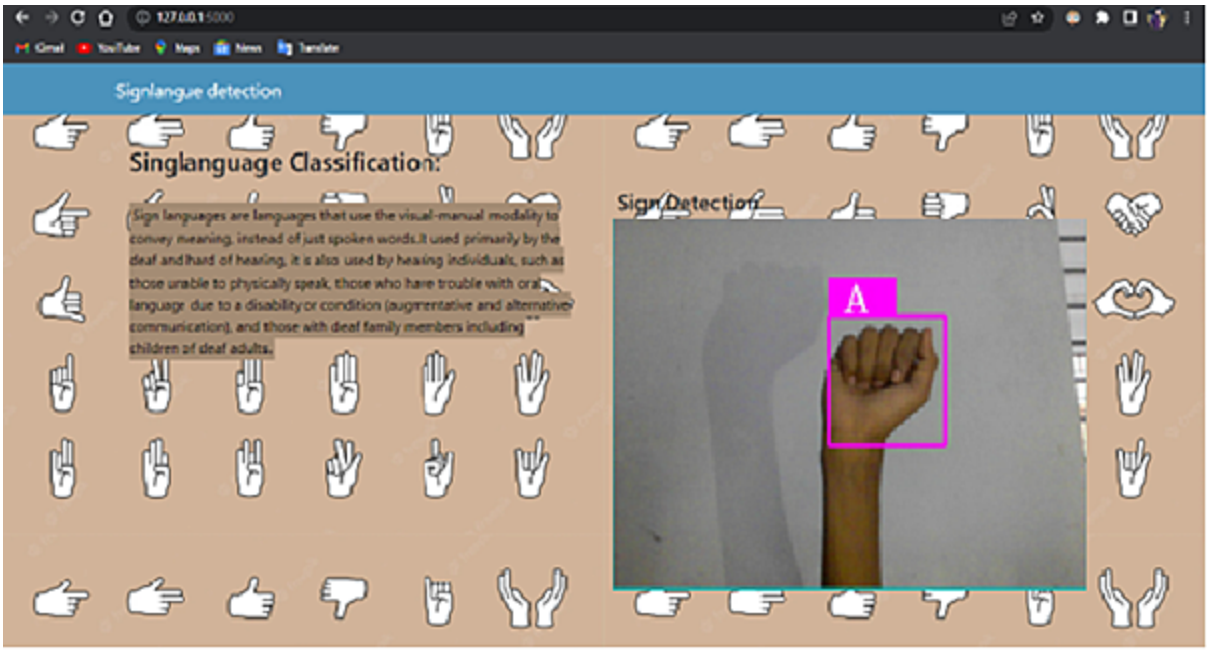
```
        </div>
      </div>
      </div>
   </div>
</body>



</html>
```

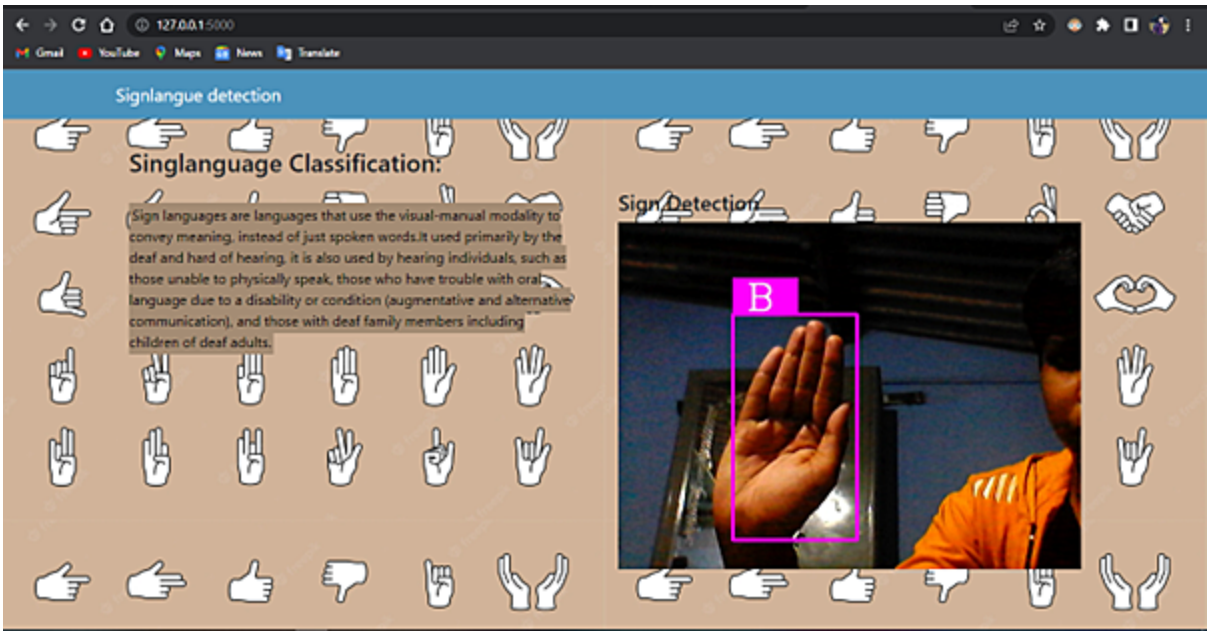
main.css :

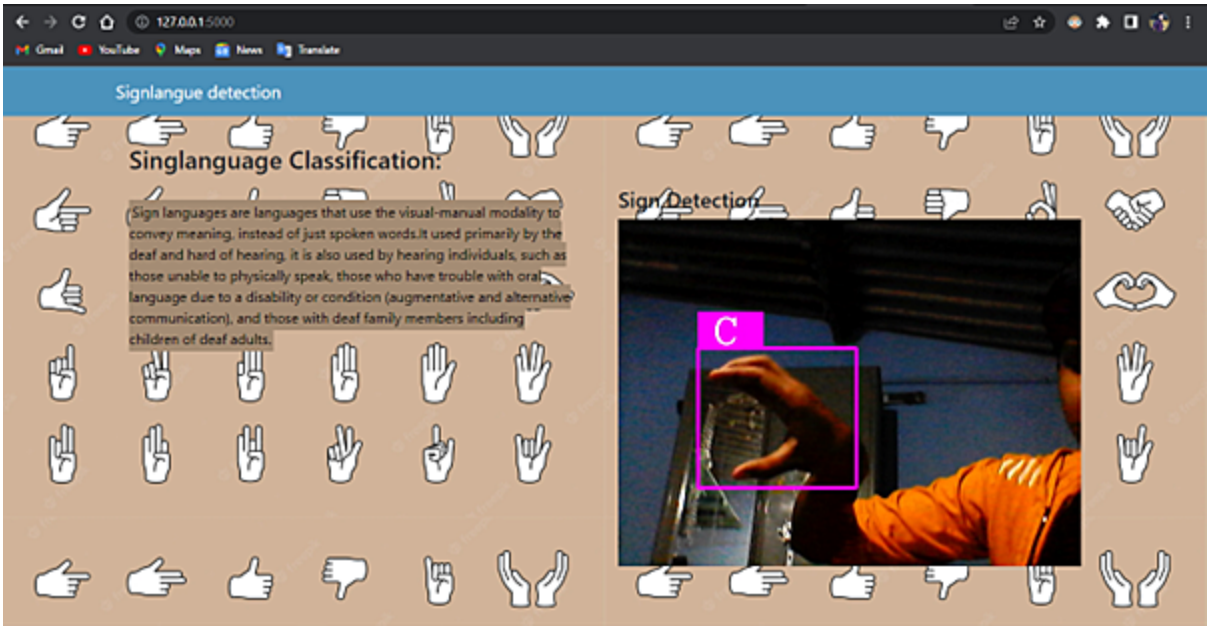
```
.img-preview {
   width: 256px;
   height: 256px;
   position: relative;
   border: 5px solid #F8F8F8;
   box-shadow: 0px 2px 4px 0px rgba(0, 0, 0, 0.1);
   margin-top: 1em;
   margin-bottom: 1em;
}

.img-preview>div {
   width: 100%;
   height: 100%;
   background-size: 256px 256px;
   background-repeat: no-repeat;
   background-position: center;
}

input[type="file"] {
   display: none;
}
```

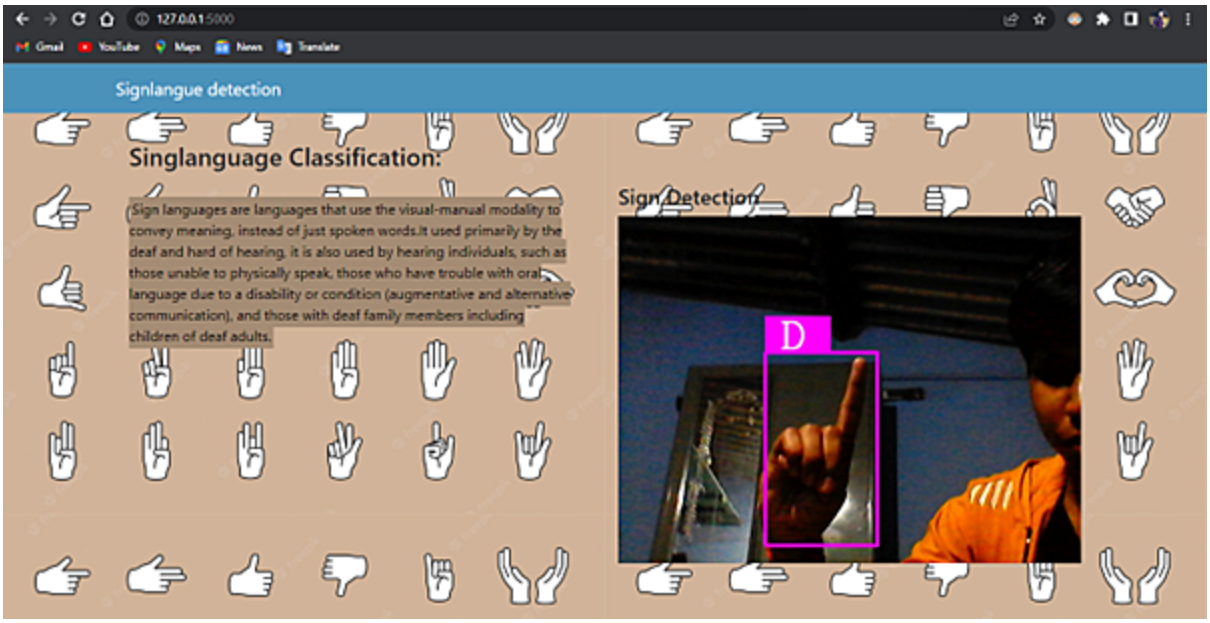
```
.upload-label{
    display: inline-block;
    padding: 12px 30px;
    background: #39D2B4;
    color: #fff;
    font-size: 1em;
    transition: all .4s;
    cursor: pointer;
}

.upload-label:hover{
    background: #34495E;
    color: #39D2B4;
}

.loader {
    border: 8px solid #f3f3f3; /* Light grey */
    border-top: 8px solid #3498db; /* Blue */
    border-radius: 50%;
    width: 50px;
    height: 50px;
    animation: spin 1s linear infinite;
}

@keyframes spin {
    0% { transform: rotate(0deg); }
    100% { transform: rotate(360deg); }
}
```

Sample Output






127.0.0.1:5000
Gmail
YouTube
Maps
News
Translate
Signlangue detection
Singlanguage Classification:
(Sign languages are languages that use the visual-manual modality to convey meaning, instead of just spoken words.It used primarily by the deaf and hard of hearing, it is also used by hearing individuals, such as those unable to physically speak, those who have trouble with oral language due to a disability or condition (augmentative and alternative communication), and those with deaf family members including children of deaf adults.
Sign Detection
C


127.0.0.1:5000
Gmail
YouTube
Maps
News
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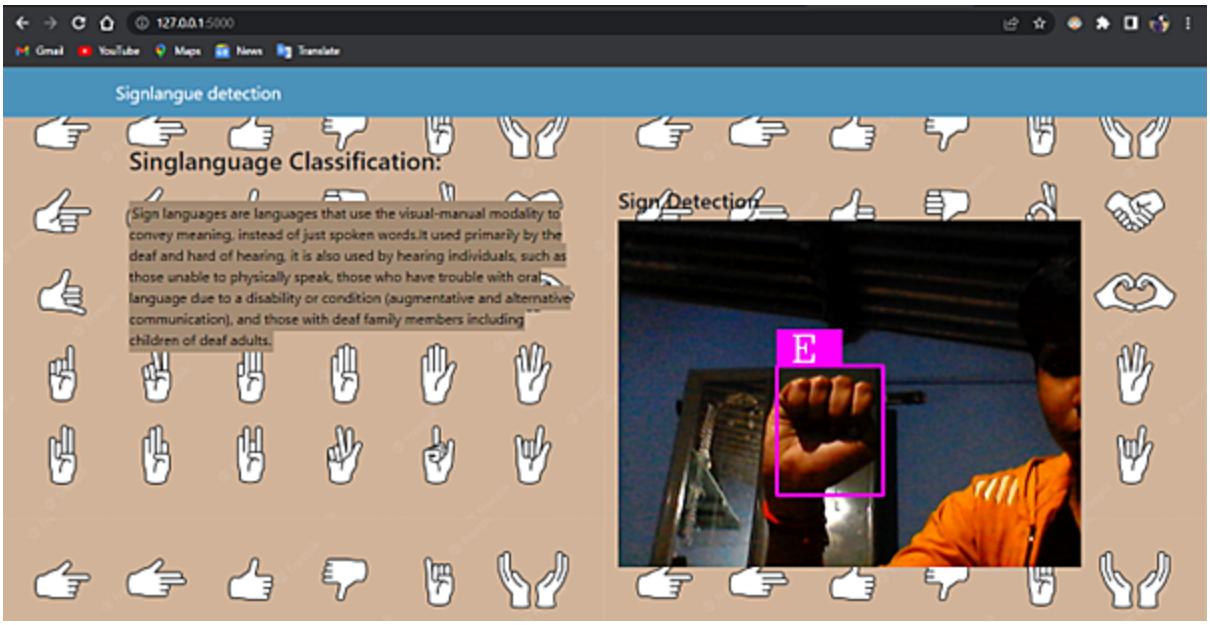
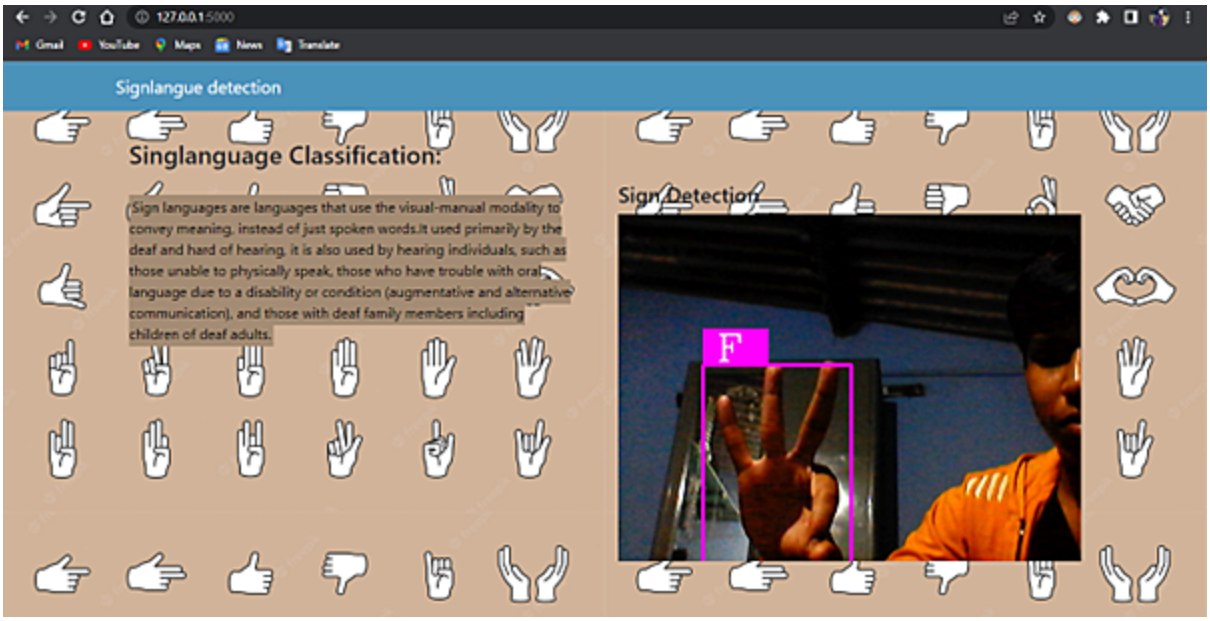
Sign Detection
D


127.0.0.1:5000
Gmail
YouTube
Maps
News
Translate
Signlangue detection
Singlanguage Classification:
(Sign languages are languages that use the visual-manual modality to convey meaning, instead of just spoken words.It used primarily by the deaf and hard of hearing, it is also used by hearing individuals, such as those unable to physically speak, those who have trouble with oral language due to a disability or condition (augmentative and alternative communication), and those with deaf family members including children of deaf adults.
Sign Detection
E


127.0.0.1:5000
Gmail
YouTube
Maps
News
Translate
Signlangue detection
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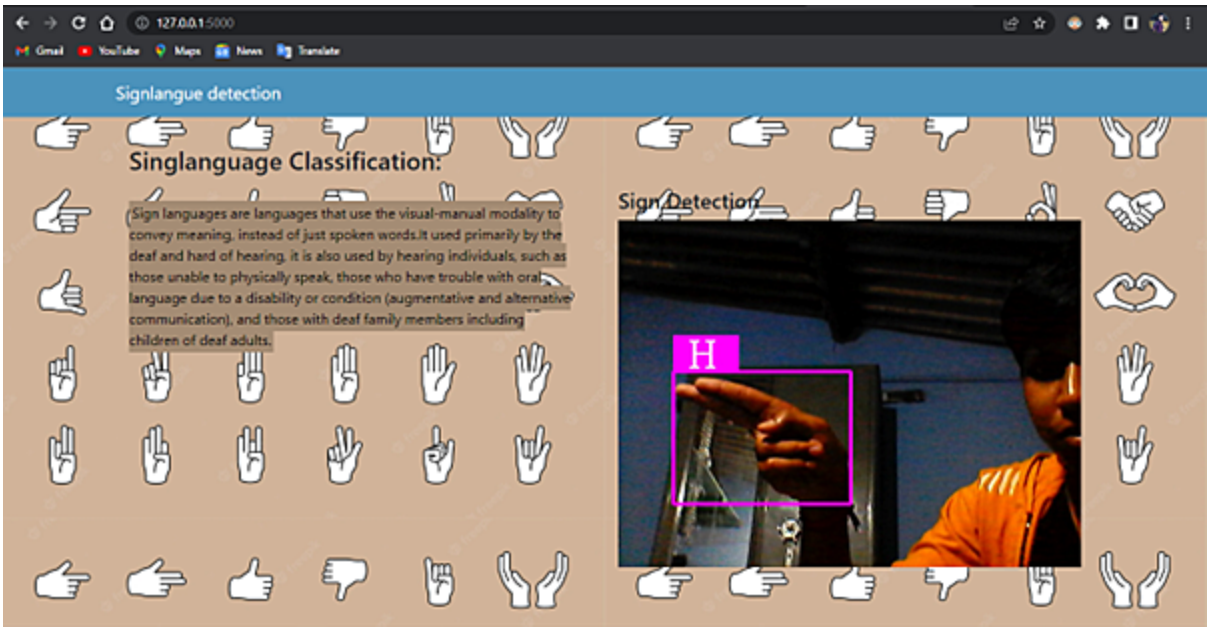
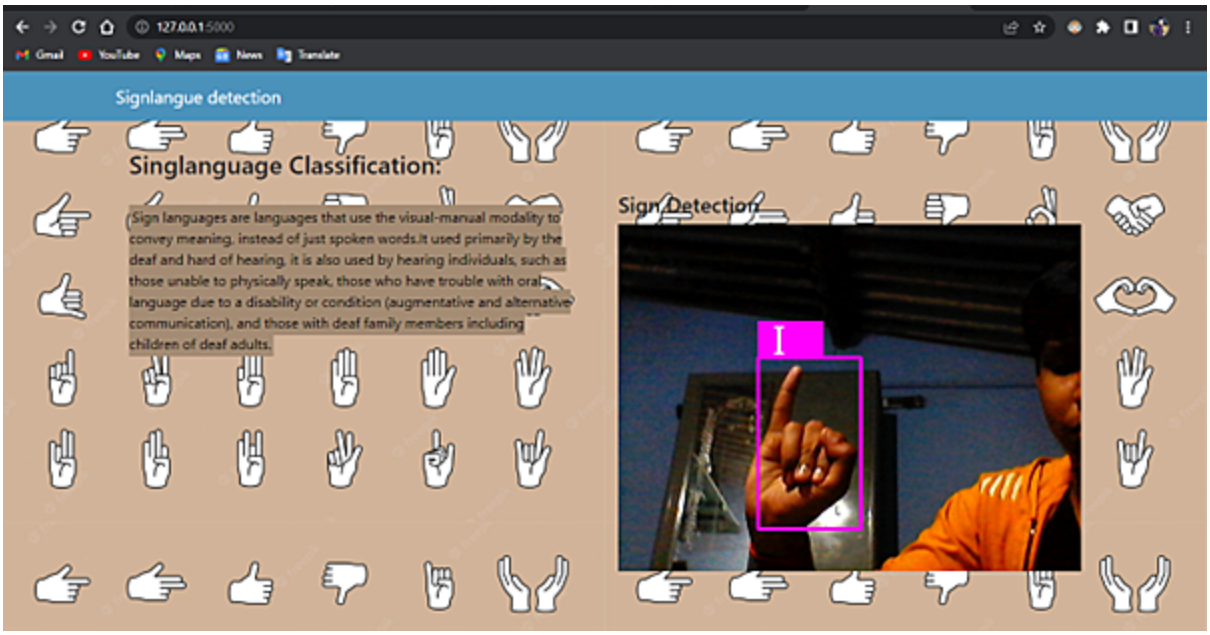
Sign Detection
F


127.0.0.1:5000
Gmail
YouTube
Maps
News
Translate
Signlangue detection
Singlanguage Classification:
(Sign languages are languages that use the visual-manual modality to convey meaning, instead of just spoken words.It used primarily by the deaf and hard of hearing, it is also used by hearing individuals, such as those unable to physically speak, those who have trouble with oral language due to a disability or condition (augmentative and alternative communication), and those with deaf family members including children of deaf adults.
Sign Detection
H


127.0.0.1:5000
Gmail
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Maps
News
Translate
Signlangue detection
Singlanguage Classification:
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Sign Detection
I

GitHub Link :

https://github.com/IBM-EPBL/IBM-Project-52323-1660996405

Project Demo Link :

https://drive.google.com/file/d/1EJxzPICn9H5qCM9u1LlEe5UB8ZotlDBF/view?usp=drivesdk