Real-Time Communication SystemPoweredbyAIforSpeciallyAbled

DoneBy

TeamID:**PNT2022TMID40214**

Contributed by

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1. INTRODUCTION

1.1 Project Overview

Bysharingideas,thoughts,andexperienceswithothers,peoplegettoknowoneanother.Therearemanywaystoaccomplishthis,butoneofthefinestisthroughthegiftof"Speech."Throughspeech,everyonecaneffectivelycommunicatetheirthoughtsandunderstandeachother.Itwouldbeunjustto overlook those who are denied this precious gift: the deaf and dumb. As a result, human handsremainthepreferredmeansofcommunicationinsuchcases.

1.2 PURPOSE

Thisprojectseekstotranslatesignlanguageintoalanguagethatordinarypeoplecanunderstand,thereby makingitaccessibletoall.

2. LITERATURESURVEY

2.1 EXISTING PROBLEM

- FacebasedRealTimecommunicationfordisablepeople.Ithasautomatedrealtimebehaviormonitoring.
- Communicationlearninguserinterfacemodelforchildrenwithautismwithgoaldirected designmethod.

2.2 REFERENCES

- ImageProcessing:https://keras.io/api/preprocessing/image/
- ModelBuilding:https://youtu.be/umGJ30-15_A
- OpenCV:https://www.youtube.com/watch?v=mjKd1Tzl70I
- FlaskApp:https://www.youtube.com/watch?v=lj4I_CvBnt0
- IBM cloud account registration:https://www.youtube.com/watch?v=_4y_zD-0Q3F8&feature=emb_imp_woyt
- CNNdeployment:https://www.youtube.com/watch?v=BzouqMGJ41k

TITLE	AUTHORS	DESCRIPTION	ADVANTAGES	DISADVANTGES
DIABETES MONITORING PATCH FOR VISUALLY IMPAIRED PERSONS USING ARTIFICIAL INTELLIGENCE **YEAR:** JANUARY 2021	GOPIRAJAN PV, SHOBANA MAHALINGAM, MANICKAM M, REVATHI A.	PATCH USES AN AI ALGORITHM FOR ANALYZING DATA WHICH IS COLLECTED FROM THE BODY BY USING BIOSENSORS. PATCH COMPOSED OF GLUCOSE,TEMPERATURE, ULTRASONIC,GPS SENSOR , BUZZER. HEARING LOUD SOUND OF BUZZER THE VISUALLY IMPAIRED PERSON CAN DECIDE IF ANALYZED RESULT IS ABNORMAL.	AUTOMATED RETENIAL SCREENING, PATIENT SELF MANAGEMENT TOOLS	HUMAN FACTORS, LIMITATION OF DESIGN
LOCATING RESTROOM FOR SPECIALLY ABLED PEOPLE USING AI AND MACHINE LEARNING **YEAR:** OCTOBER 2021	PRAGATI RAIZADA, SHAGUN SABOO, SRISHTI GUPTA,	APP DESIGNED WITH ASSISTANCE OF AI AND MACHINE LEARNING, VOICE RECOGNITION, MAPS LIVE, SIGN LANGUAGE INTERPRETATION. OVERALL PURPOSE IS TO LOCATE RESTROOMS AND KEEP HYGIENE IN CONSIDER FOR THOSE WHO ARE SPECIALLY ABLED.	USEFUL FOR SPECIALLY ABLED PERSON WHO ARE VISUALLY IMPAIRED TO LOCATE RESTROOM.	DUE TO LIMITATION OF DATA OR DESIGN THE VOICE RECOGNITION TO GUIDE PEOPLE TO LOCATE IS AN SERIOUS ISSUE.
COMMUNICA-TION LEARNING USER INTERFACE MODEL FOR CHILDREN WITH AUTISM WITH GOAL DIRECTED DESIGN METHOD **YEAR:** JULY 2019	FITRILIA SUSANTI, DANANG JUNAEDI, VERONIKHA EFFENDY	CHILDREN WITH AUTISM HAVE COMMUNICATION DISORDER THAT AFFECTS THE CHILDREN FACE DIFFICULTY INTERACTING & COMMUNICATING WITH THEIR ENVIRONMENT BOTH VERBALLY & NON VERBALLY.	IT PRODUCE A USER INTERFACE MODEL BASED ON ORGANIZATION GOAL AND GOAL OF AUTISTIC CHILDREN.	USER HAS TO WAIT 30 SECONDS TO LEARN ONE THING. DUE TO THIS CHILDREN WILL DISPLAY AUTISTIC ACTIVITIES BECAUSE THEY ARE BORED AND IMPATIENT.
FACE BASED REAL TIME COMMUNICATI--ON FOR SPEECH DISABLE PEOPLE **YEAR:** JANUARY 2011	ONG CHIN ANN, BEE THENG LAU, MARLENE LU.	TO ENHANCE COMMUNICATION OF DIABLED COMMUNITY. IT HAS AUTOMATED REAL TIME BEHAVIOUR MONITORING, DESIGNED AND IMPLEMENTED WITH UBIQUITOUS.	TO ASSIST PEOPLE IN COMMUNICATI--ON NEEDS, THEY IMPROVED REAL TIME BEHAVIOUR MONITORING APP.	IN THIS MODEL IT STILL FAILED TO DETECT HUMAN FACE IF BACKLIGHT IS TOO STRONG.

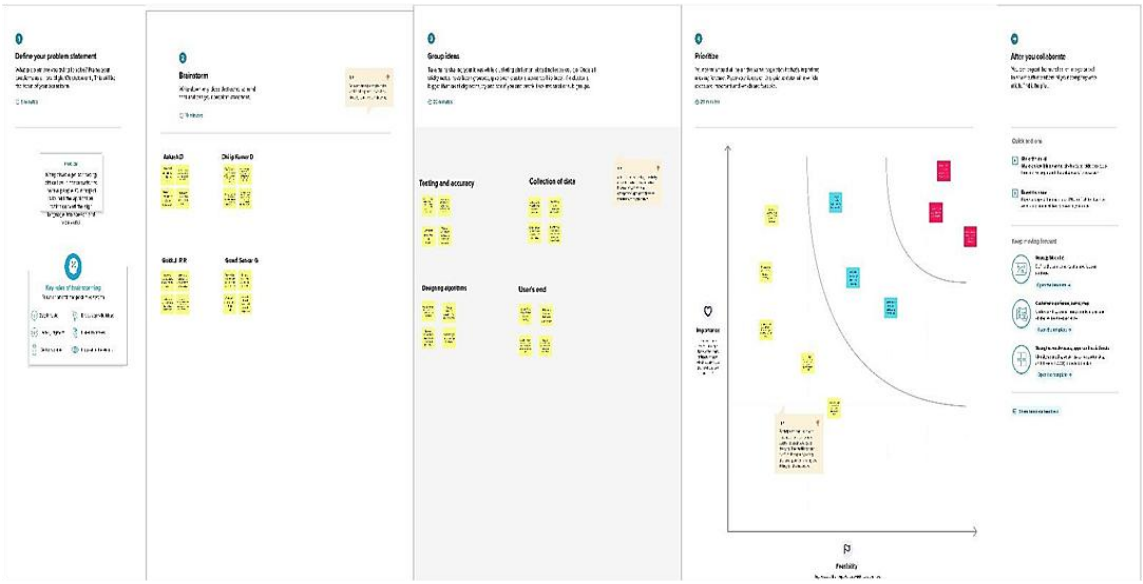
2.3 PROBLEMSTATEMENTDEFINITION

Thispaperdescribesthesystemthatovercomestheproblemfacedbythespeechandhearingimpaired.The objectivesoftheresearchareasfollow:

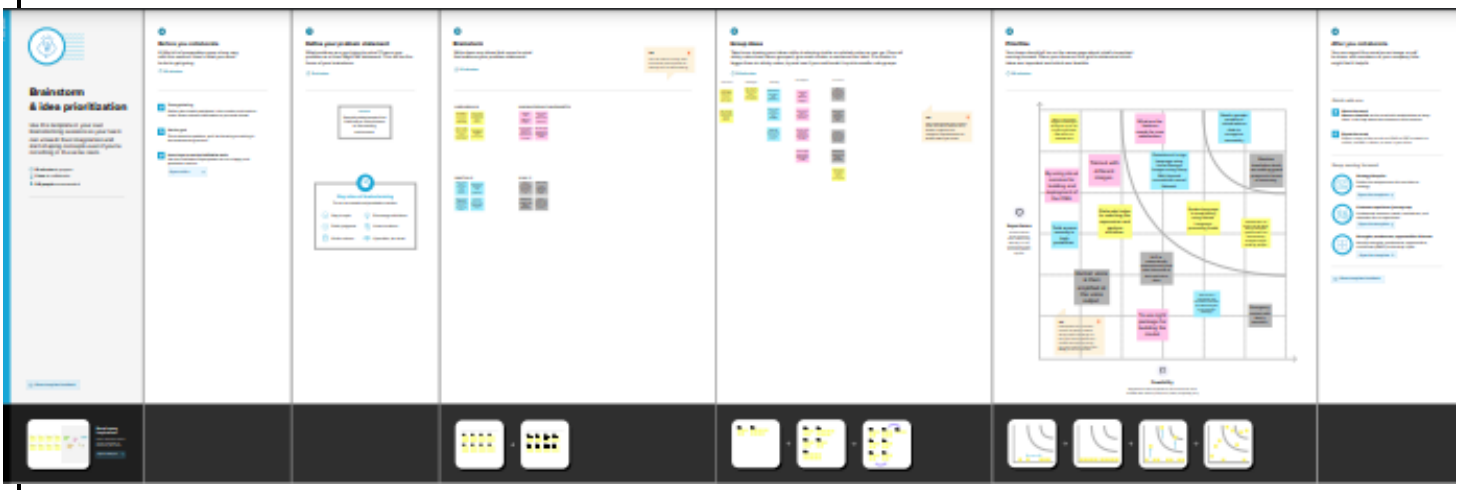
- Toaddressthechallengesfacedbydeaf-mutepersonsintheirdailylifesotheycaninteractwithNormalpeoplefeelhopeful
- ConvertingsignlanguageintohumanhearingspeechandviceversaUsingConvolutionalNeuralNetwor kinthedesiredlanguage.
- DeployingoursolutiontoprovideaFasterresponseinthedesiredlanguage.

3. IDEATION&PROPOSEDSOLUTION

3.1 EmpathyMapCanvas



3.2 Ideation&Brainstorming

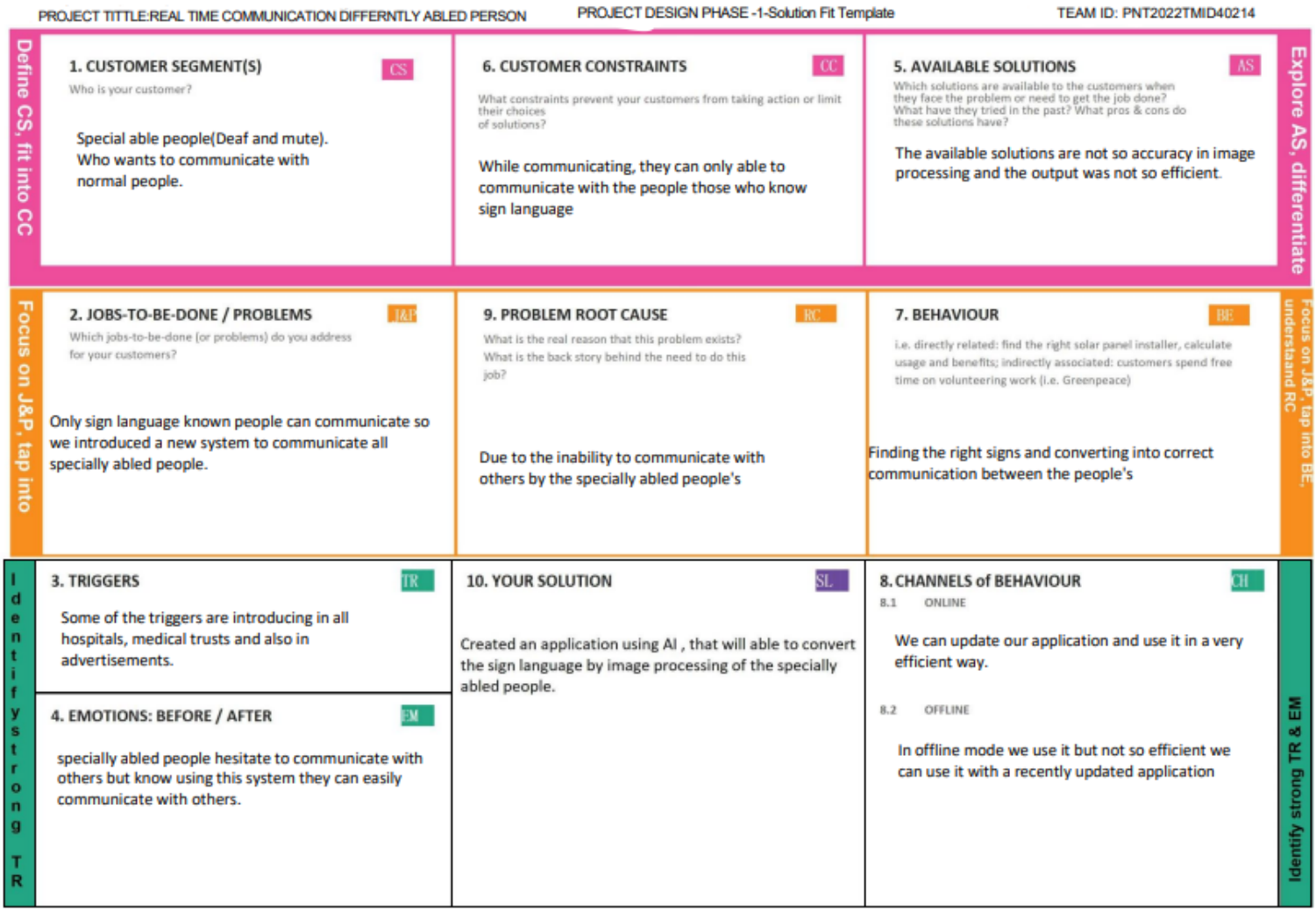


3.3 ProposedSolution

- Signlanguageisconvertedintothevoiceheardbynorma

- lpeopleusingthisapplication.
- Also,thespeechisconvertedintosignlanguagethatcanbeunderstoodbydeafanddumbin dividuals.
- Weuseconvolutionneuralnetworks(CNNs)tobuildandtrainourapp.

3.4 ProblemSolutionFit



4. REQUIREMENTANALYSIS

4.1 FunctionalRequirements

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIn Registration through Mobile Number
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP Confirmation via Message
FR-3	Update Profile	Update user biodata, profile picture, etc.
FR-4	User Authentication	Authentication can be done using fingerprints. And also can be done using face and voice recognition.
FR-5	Report	This will be more useful to improve the issues faced by deaf and mute people.

4.2 NonFunctionalRequirements

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Users can use the application which can be used in any os And people from different countries can use it.
NFR-2	**Security**	This is the challenging task to give high security to user data that can be done by encryption.
NFR-3	**Reliability**	If any bugs in the application can be rectified in a quick time to increase reliability this can be maintained by giving updates to an application.
NFR-4	**Performance**	The application server will not crash often so users can use the application without any disturbance also deaf people should see sign language through the application faster and clear without any delay
NFR-5	**Availability**	The availability of an application to users is all time except when the app is being updated but it will finish within a few minutes.
NFR-6	**Scalability**	The performance of our application will be great if more people use it at a time. It will handle the databases and backend services perfectly. So it is highly scalable in nature.

5. PROJECTDESIGN

5.1 DataFlowDiagram

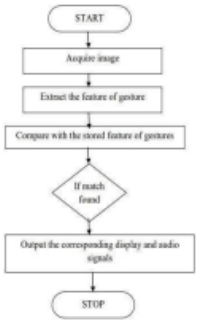
Project Design Phase-II
Data Flow Diagram & User Stories

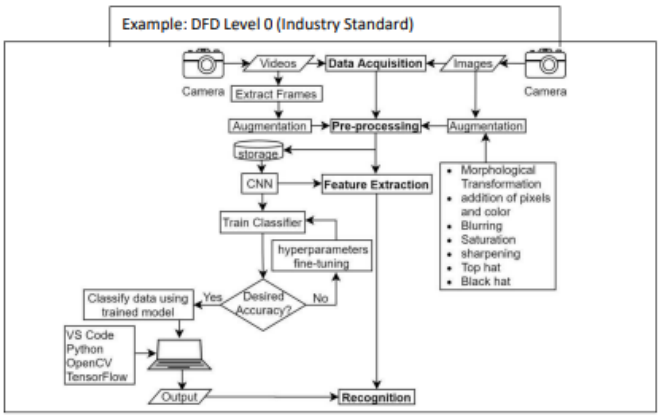
Date	07 NOVEMBER 2022
Team ID	PNT2022TMID40214
Project Name	Real-Time Communication SystemPowered by AI for Specially Abled
Maximum Marks	4 Marks

Data Flow Diagrams:

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 rightamount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

Example: (Simplified)





Technology stack

Project Design Phase-II
Technology Stack (Architecture & Stack)

Date	07 NOVEMBER 2022
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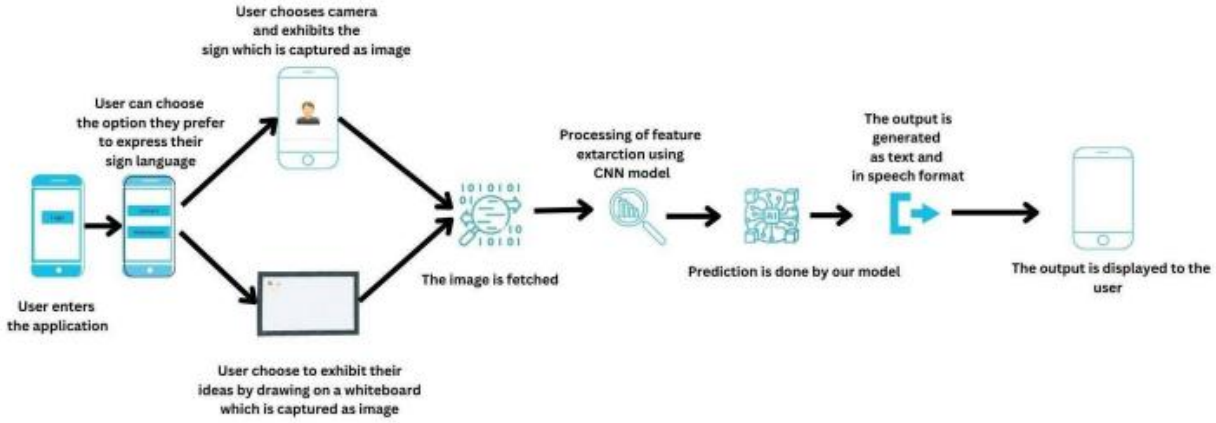
Maximum Marks	4 Marks

Technical Architecture:



Components:Datacollection,ImageProcessing,Training,Testing,Inputs,Prediction.

Characteristics:Open-sourceframeworks,SecurityImplementation,Scalablearchitecture.

5.2 UserStories

- Userscanregisterfortheapplicationbyenteringtheiremailaddresses,creatingpasswords,andconfirmingtheirpasswords.
- Uponregisteringfortheapplication,theuserwillreceiveaconfirmationemail.
- Theusercanclicktheconvertsignbutton,whichleadstothesignconversionfunctionpage.
- Ausercanshowhandsignsinfrontofthecamera,whichdetectsthemandconvertsthemintotext.
- AsaUser,Oncethetextisobtained,IcanselectSpeechmodetoconvertthetextintospeech.

6. PROJECTPLANNING&SCHEDULING

6.1 Planning&Estimation

Project Planning Phase

Project Planning (Product Backlog, Sprint Planning, Stories, Story points)

Date	18 NOV 2022
Team ID	PNT2022TMID40214
Project Name	Real-Time Communication System Powered by AI for Specially Abled
Maximum Marks	8 Marks

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data Collection	USN-1	Dataset has to be collected	12	High	PAVITHRA JAYAPRIYA
Sprint-1	Image Preprocessing	USN-2	Collected images has to be preprocessed	8	Medium	ANU LOGESHWARI JAYAPRIYA
Sprint-2	Model Building	USN-3	Import the required libraries, add the necessary layers and compile the model	12	High	ANU LOGESHWARI
Sprint-2	Model Training	USN-4	Training the image classification model using CNN	8	Medium	PAVITHRA JAYAPRIYA ANU
Sprint-3	Training & Testing	USN-5	Training the model and testing the model's	20	High	PAVITHRA ANU
Sprint-4	Implementation of the application	USN-6	Converting the input images into Speech	20	High	LOGESHWARI PAVITHRA ANU JAYAPRIYA

6.2SprintDeliverySchedule

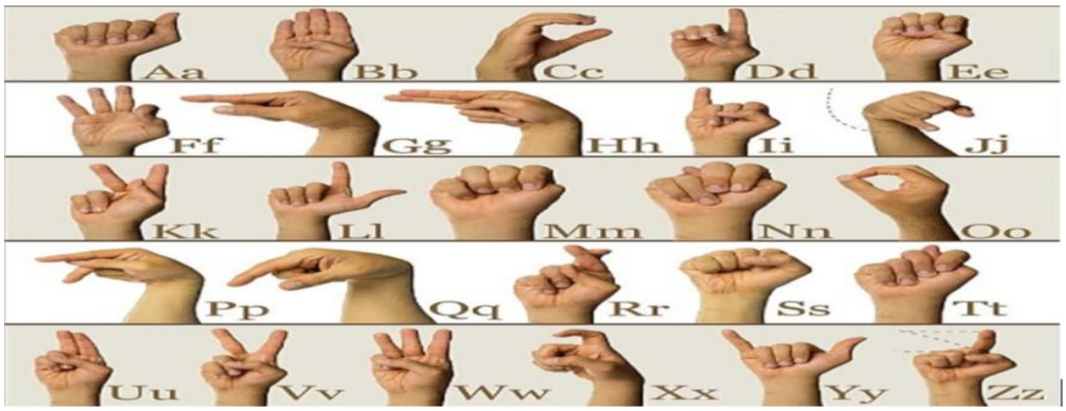
Sprint	Total Story Point	Duration	SprintStartDate	SprintEndDate(Planned)	Story PointsCompleted(asonPlannedEndDate)	SprintReleaseDate(Actual)
Sprint-1	20	6Days	24Oct2022	29Oct2022	20	29Oct2022
Sprint-2	18	6Days	31Oct2022	05Nov2022	20	31Oct2022
Sprint-3	16	6Days	07Nov2022	12Nov2022	20	07Nov2022
Sprint-4	15	6Days	14Nov2022	19Nov2022	20	14Nov2022

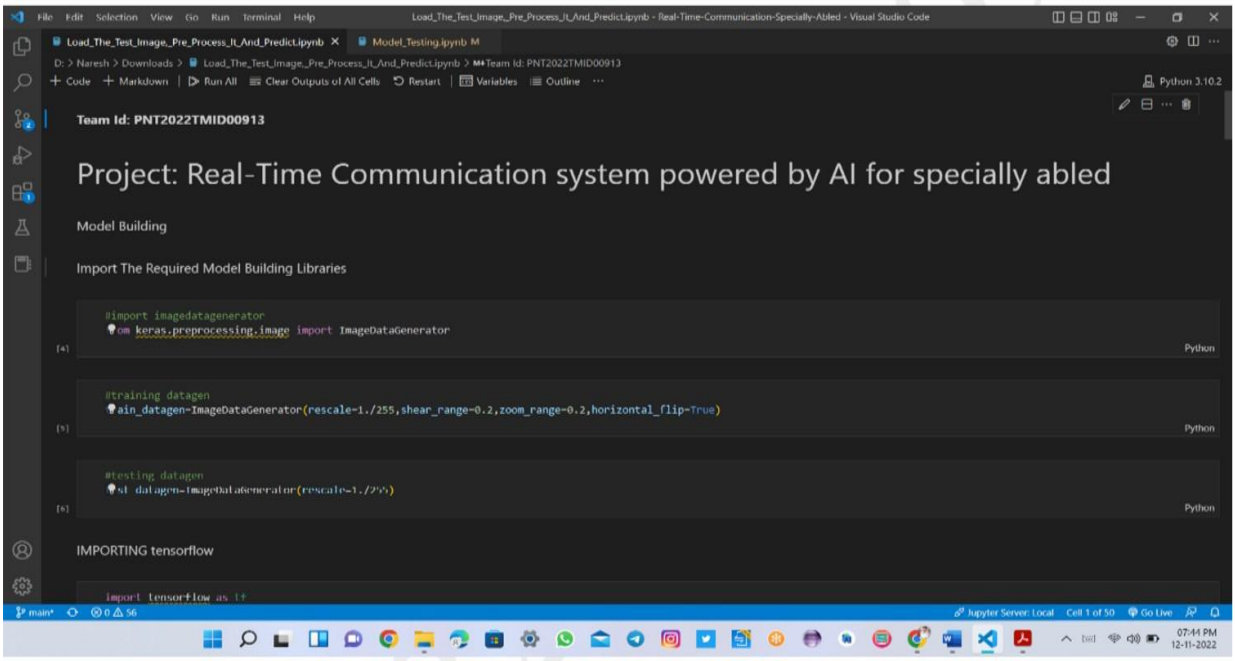
6.3Reports From JIRA

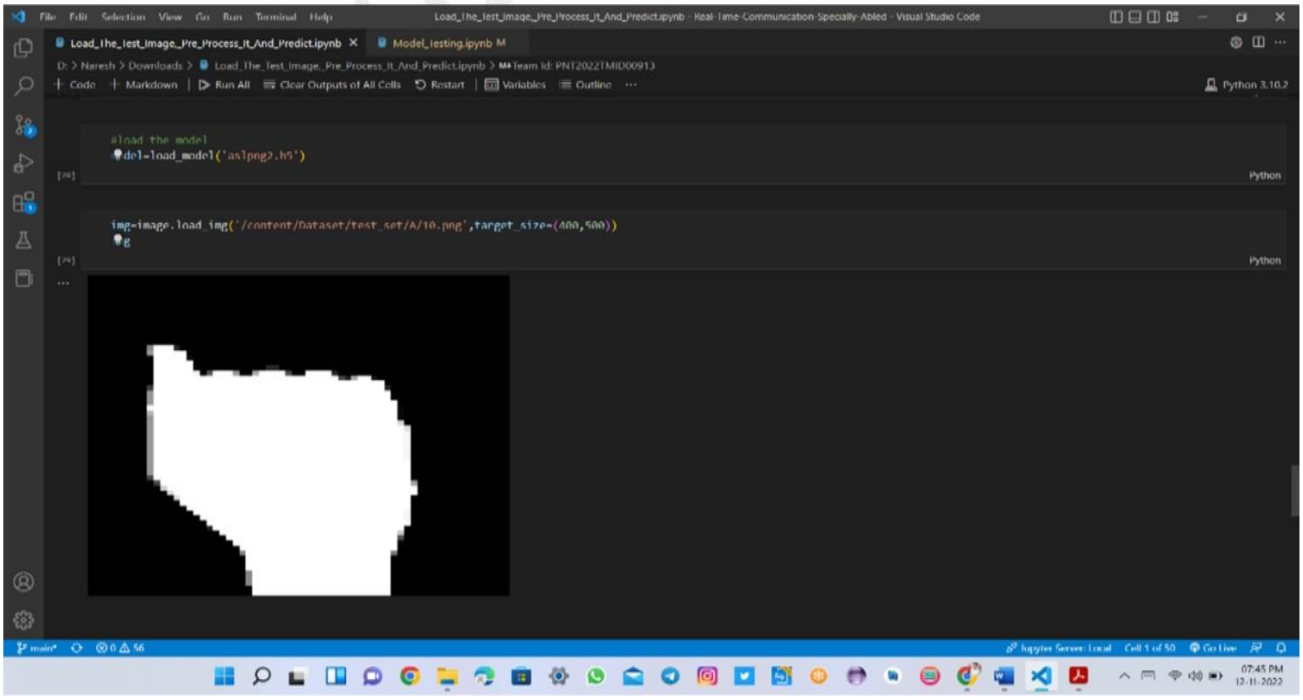
7. CODINGAND SOLUTIONING

7.1 Feature1

Theusercanchoosewhichsignlanguagetoreadbasedonthedifferentsignlanguagestandardsthatexist.



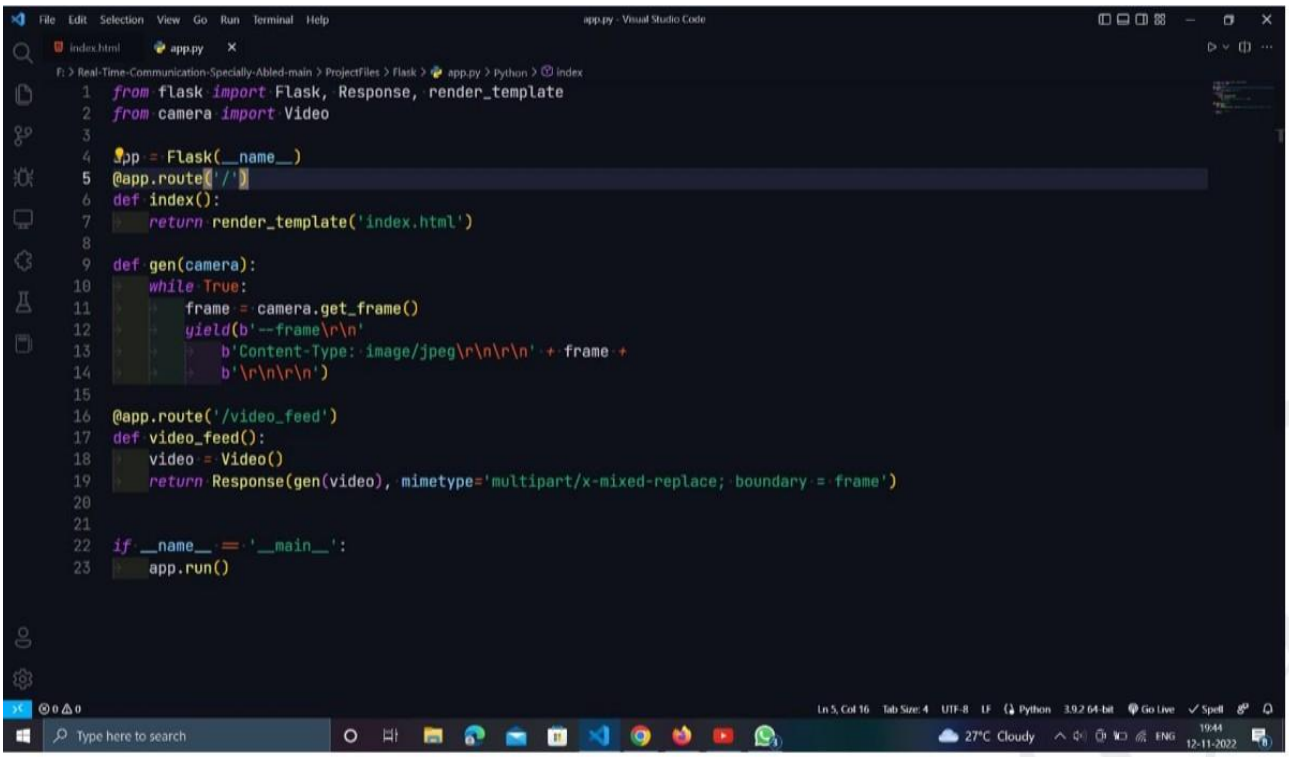




7.2Feature2

Thecommunicationgapbetweendeafanddumbpeopleandthegeneralpubliccanbebridgedwitha

mobileapplication.



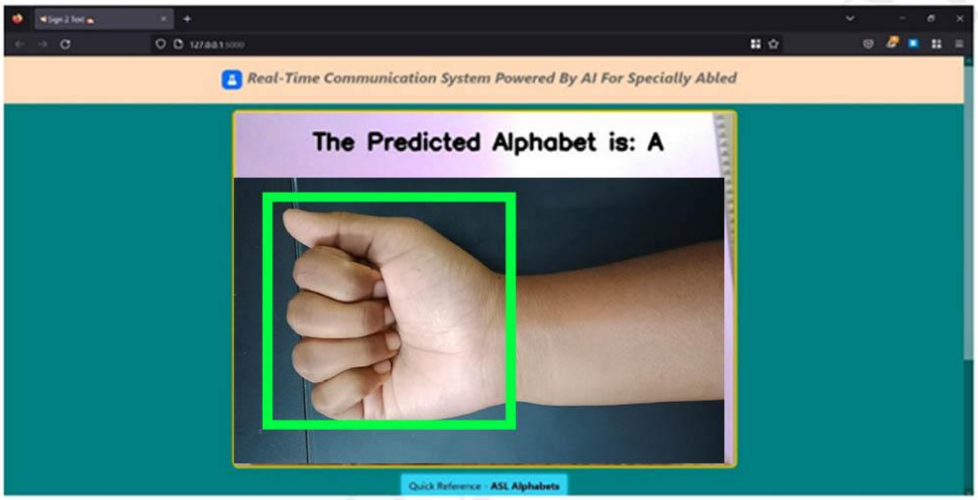
8. TESTING

8.1 Test Cases

- Ourcodewastestedonvariousangletocheckwhetheritgivesthecorrectoutput.
- Tosatisfythecustomer'sexpectationswetesteditfully.

8.2 User Acceptance Testing

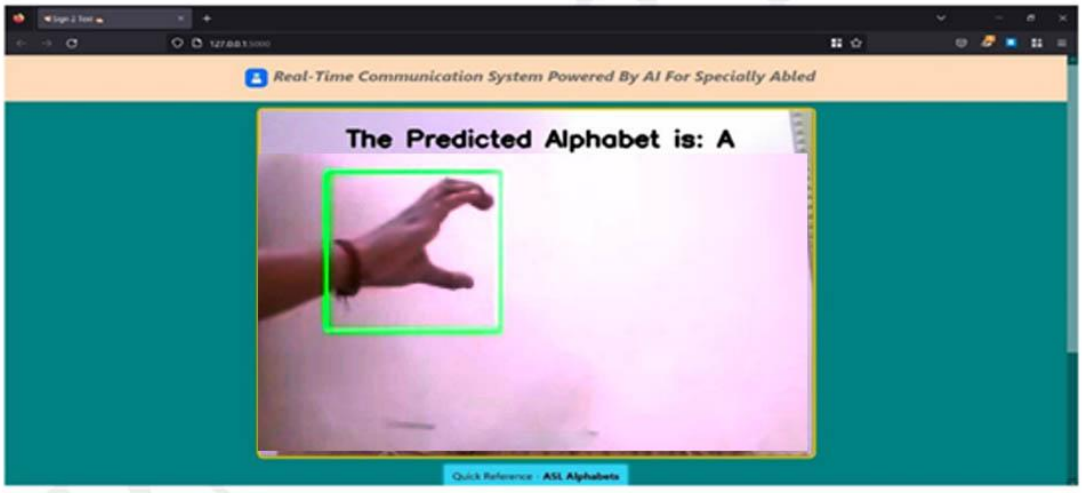
Ourprojectwastestedbyanendusertoverifythatitsworkingcorrectly.

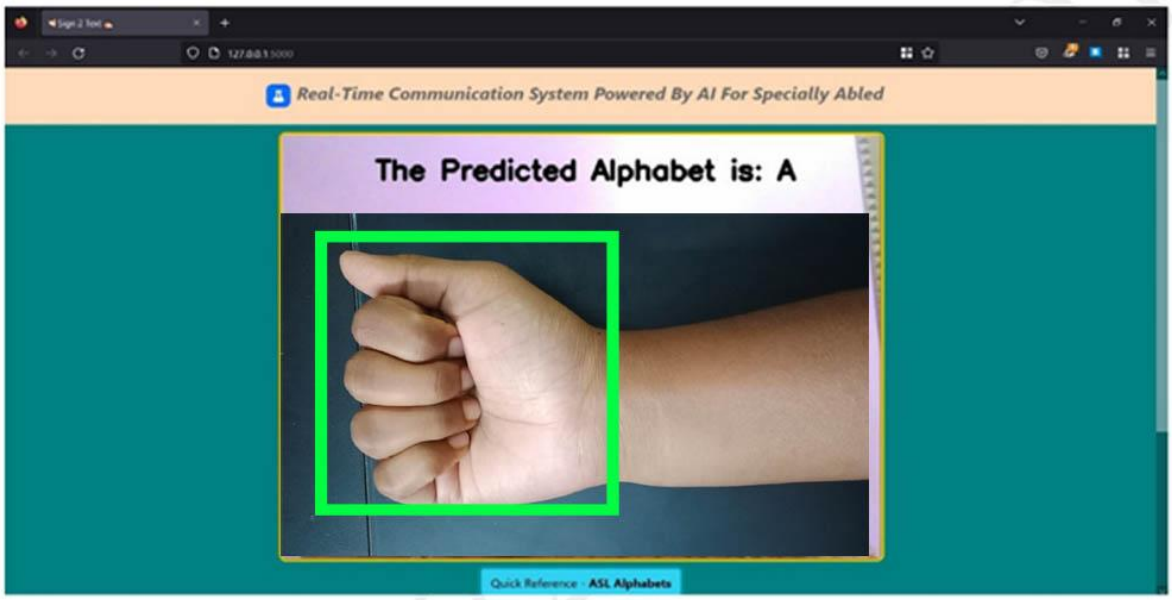


9. RESULTS

9.1 PerformanceMetrics

- Theproposedprocedurewasimplementedandtestedonasetofimages.
- Thetrainingdatabaseconsistsof15750imagesofAlphabetsfrom"A"to"I",whilethetestingdatabaseconsistsof2250imagesofAlphabetsfrom"A"to"I".
- Oncethegestureisrecognizedtheequivalentalphabetisshownonthescreen.





10. ADVANTAGES&DISADVANTAGES

Advantages:

- Thespeechisconvertedtosignlanguageveryquicktoprovidegreaterandfasterunderstandingtospeciall y-abledpeople.
- Theuserinterfaceisconvenientandsimpleforbothpeople.

Disadvantages:

- Thenumberofimagesandpixelsforthemodeltotraininthedatasetisnothighsoaccuracyismoderatelevel.
- Itwillbeimprovedbychangingthedataset.
- Currently,wehavedeployedadatasetinthemodelforthealphabetsAtoIonly.

11. CONCLUSION

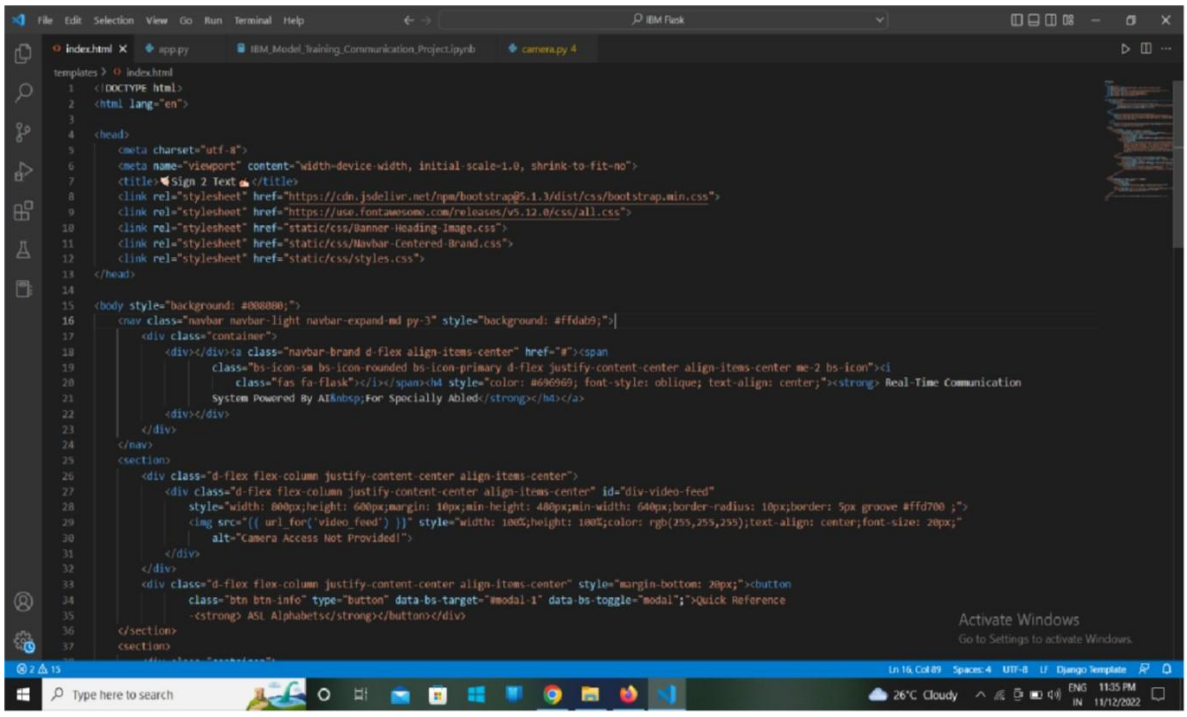
It aims to bridge the communication gap between deaf people and the rest of society. The proposedmethodology translates sign language into English alphabets that are understandable to humans.Thissystemsendshandgesturestothemodel,whorecognizesthemanddisplaystheequivalent.

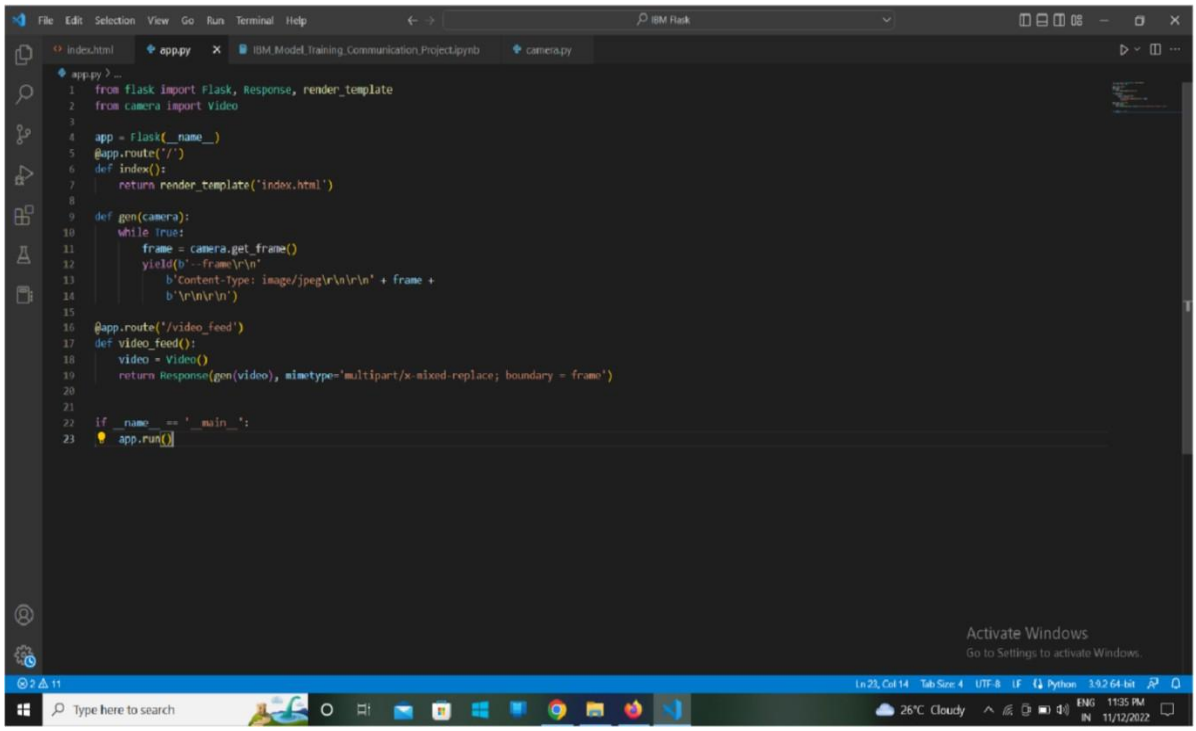
12. FUTURESCOPE

- With the introduction of gesture recognition, the web app can easily be expanded to recognizeletters beyond 'I', digits, and other symbols plus gesture recognition can also allow controllingofsoftware/hardwareinterfaces.
- Having a technology that can translate hand sign language to its corresponding alphabet is agame changer in the field of communication and Ai for specially-abled people such as thosedeafordumb.

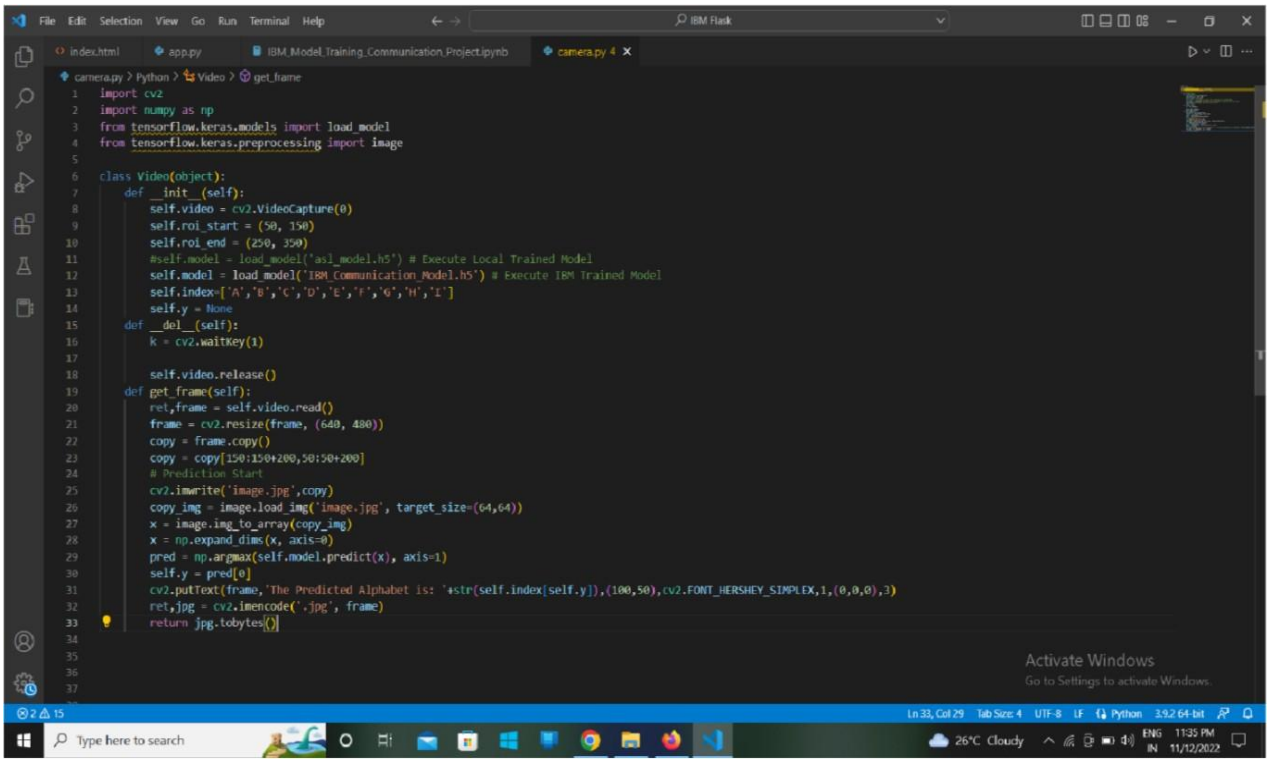
13. APPENDIX

SourceCode:

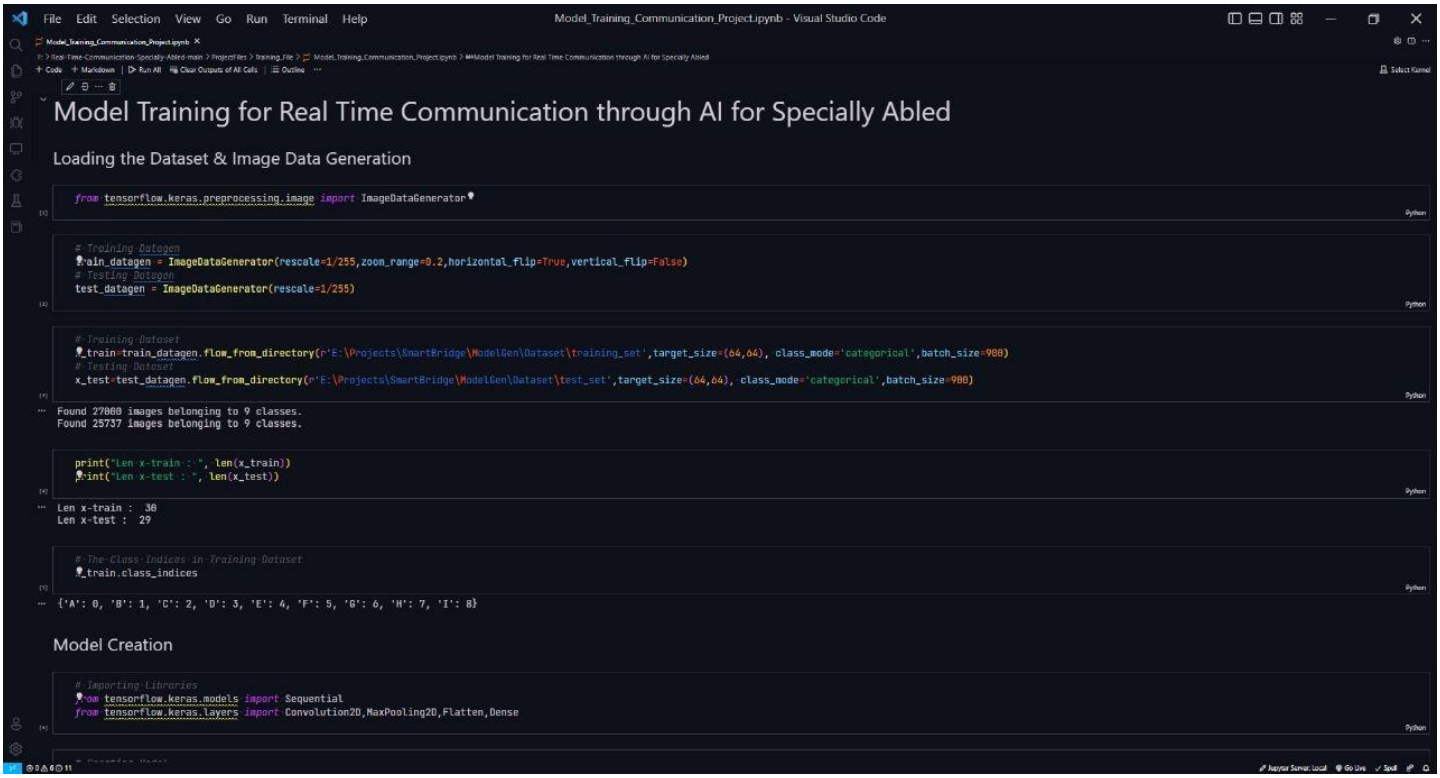




```python
from flask import Flask, Response, render_template
from camera import Video

app = Flask(__name__)
@app.route('/')
def index():
    return render_template('index.html')

def gen(camera):
    while True:
        frame = camera.get_frame()
        yield(b'--frame\r\n'
            b'Content-Type: image/jpeg\r\n\r\n' + frame +
            b'\r\n\r\n')

@app.route('/video_feed')
def video_feed():
    video = Video()
    return Response(gen(video), mimetype='multipart/x-mixed-replace; boundary = frame')


if __name__ == '__main__':
    app.run()
```



```python
import cv2
import numpy as np
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image

class Video(object):
    def __init__(self):
        self.video = cv2.VideoCapture(0)
        self.roi_start = (50, 150)
        self.roi_end = (250, 350)
        #self.model = load_model('asl_model.h5') # Execute Local Trained Model
        self.model = load_model('IBM_Communication_Model.h5') # Execute IBM Trained Model
        self.index=['A','B','C','D','E','F','G','H','I']
        self.y = None
    def __del__(self):
        k = cv2.waitKey(1)

        self.video.release()
    def get_frame(self):
        ret,frame = self.video.read()
        frame = cv2.resize(frame, (640, 480))
        copy = frame.copy()
        copy = copy[150:150+200,50:50+200]
        # Prediction Start
        cv2.imwrite('image.jpg',copy)
        copy_img = image.load_img('image.jpg', target_size=(64,64))
        x = image.img_to_array(copy_img)
        x = np.expand_dims(x, axis=0)
        pred = np.argmax(self.model.predict(x), axis=1)
        self.y = pred[0]
        cv2.putText(frame,'The Predicted Alphabet is: '+str(self.index[self.y]),(100,50),cv2.FONT_HERSHEY_SIMPLEX,1,(0,0,0),3)
        ret,jpg = cv2.imencode('.jpg', frame)
        return jpg.tobytes()
```


File Edit Selection View Go Run Terminal Help
Model_Training_Communication_Project.ipynb - Visual Studio Code
Model_Training_Communication_Project.ipynb
Model Training for Real Time Communication through AI for Specially Abled
Loading the Dataset & Image Data Generation
from tensorflow.keras.preprocessing.image import ImageDataGenerator
# Training Datagen
train_datagen = ImageDataGenerator(rescale=1/255,zoom_range=0.2,horizontal_flip=True,vertical_flip=False)
# Testing Datagen
test_datagen = ImageDataGenerator(rescale=1/255)
# Training Dataset
x_train=train_datagen.flow_from_directory(r'E:\Projects\SmartBridge\ModelGen\Dataset\training_set',target_size=(64,64), class_mode='categorical',batch_size=900)
# Testing Dataset
x_test=test_datagen.flow_from_directory(r'E:\Projects\SmartBridge\ModelGen\Dataset\test_set',target_size=(64,64), class_mode='categorical',batch_size=900)
Found 27000 images belonging to 9 classes.
Found 25737 images belonging to 9 classes.
print("Len x-train : ", len(x_train))
print("Len x-test : ", len(x_test))
Len x-train : 30
Len x-test : 29
The Class Indices in Training Dataset
x_train.class_indices
{'A': 0, 'B': 1, 'C': 2, 'D': 3, 'E': 4, 'F': 5, 'G': 6, 'H': 7, 'I': 8}
Model Creation
# Importing Libraries
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Convolution2D,MaxPooling2D,Flatten,Dense