

Real-Time Communication System Powered by AI for Specially Abled

Done By

Team ID: PNT2022TMID40214

**Contributed
by**

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1. INTRODUCTION

1.1 Project Overview

By sharing ideas, thoughts, and experiences with others, people get to know one another. There are many ways to accomplish this, but one of the finest is through the gift of "Speech." Through speech, everyone can effectively communicate their thoughts and understand each other. It would be unjust to overlook those who are denied this precious gift: the deaf and dumb. As a result, human hands remain the preferred means of communication in such cases.

1.2 PURPOSE

This project seeks to translate sign language into a language that ordinary people can understand, thereby making it accessible to all.

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM

- Face based Real Time communication for disable people. It has automated real time behavior monitoring.
- Communication learning user interface model for children with autism with goal directed design method.

2.2 REFERENCES

- Image Processing: <https://keras.io/api/preprocessing/image/>
- Model Building: https://youtu.be/umGJ30-15_A
- OpenCV: <https://www.youtube.com/watch?v=mjKd1Tzl70I>
- Flask App: 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
- CNN deployment: <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.

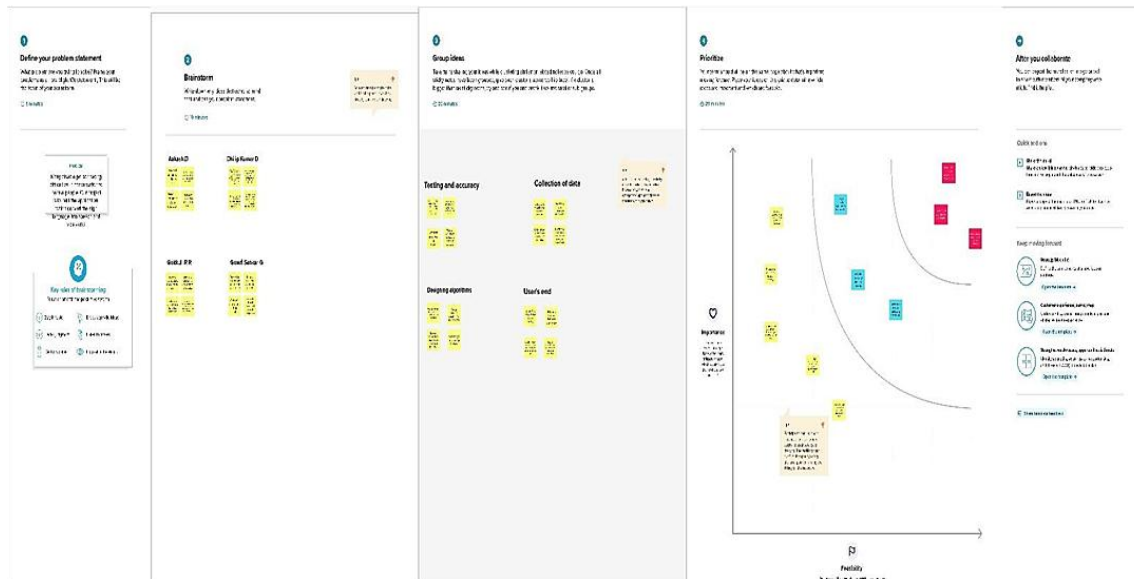
2.3 PROBLEMSTATEMENTDEFINITION

This paper describes the system that overcomes the problem faced by the speech and hearing impaired. The objectives of the research are as follow:

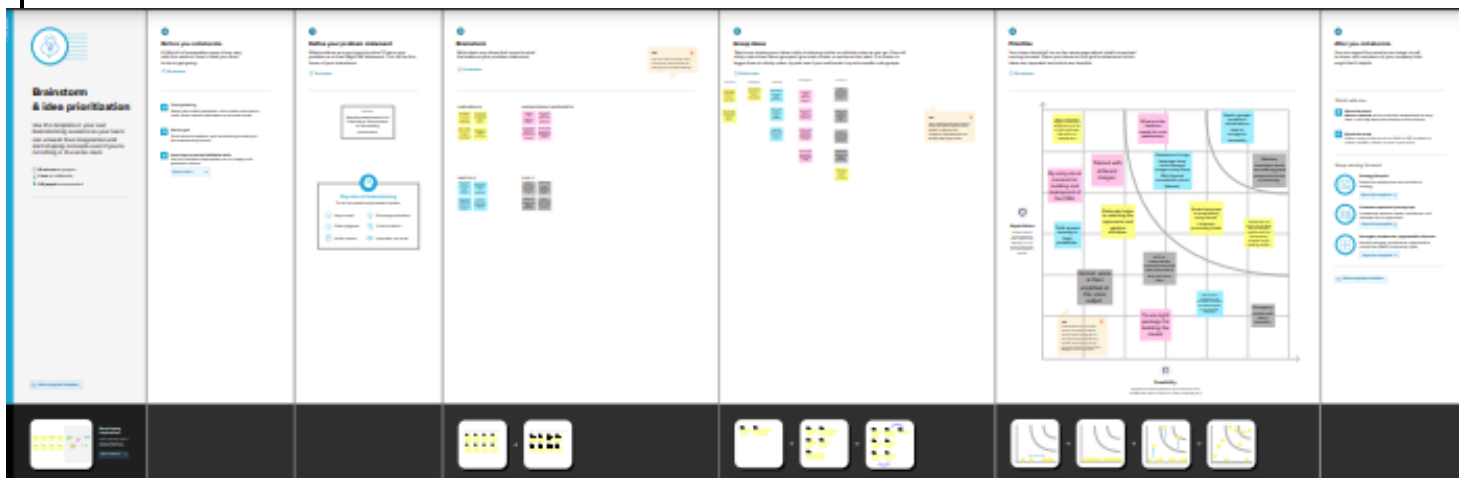
- To address the challenges faced by deaf-mute persons in their daily life so they can interact with Normal people feel hopeful
- Converting sign language into human hearing speech and vice versa Using Convolutional Neural Network in the desired language.
- Deploying our solution to provide a Faster response in the desired language.

3. IDEATION&PROPOSEDSOLUTION

3.1 EmpathyMapCanvas



3.2 Ideation&Brainstorming



3.3 ProposedSolution

- Signlanguageisconvertedintothevoiceheardbynorma
- lpeopleusingthisapplication.
- Also,thespeechisconvertedintosignlanguage thatcanbeunderstoodbydeafanddumbindividuals.
- Weuseconvolutionneuralnetworks(CNNs)to buildandtrainourapp.

3.4 ProblemSolutionFit

PROJECT TITLE:REAL TIME COMMUNICATION DIFFERNTLY ABLED PERSON			PROJECT DESIGN PHASE -1-Solution Fit Template			TEAM ID: PNT2022TMID40214		
Define CS, fit into CC	<div>1. CUSTOMER SEGMENT(S)<div>Who is your customer?</div><div>Special able people(Deaf and mute). Who wants to communicate with normal people.</div></div>	<div>6. CUSTOMER CONSTRAINTS<div>What constraints prevent your customers from taking action or limit their choices of solutions?</div><div>While communicating, they can only able to communicate with the people those who know sign language</div></div>	<div>5. AVAILABLE SOLUTIONS<div>Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have?</div><div>The available solutions are not so accuracy in image processing and the output was not so efficient.</div></div>	Explore AS, differentiate				
	<div>2. JOBS-TO-BE-DONE / PROBLEMS<div>Which jobs-to-be-done (or problems) do you address for your customers?</div><div>Only sign language known people can communicate so we introduced a new system to communicate all specially abled people.</div></div>	<div>9. PROBLEM ROOT CAUSE<div>What is the real reason that this problem exists? What is the back story behind the need to do this job?</div><div>Due to the inability to communicate with others by the specially abled people's</div></div>	<div>7. BEHAVIOUR<div>I.e. directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (I.e. Greenpeace)</div><div>Finding the right signs and converting into correct communication between the people's</div></div>	Focus on J&P, tap into BE, understand RC				
Identify strong TR	<div>3. TRIGGERS<div>Some of the triggers are introducing in all hospitals, medical trusts and also in advertisements.</div></div>	<div>10. YOUR SOLUTION<div>Created an application using AI , that will able to convert the sign language by image processing of the specially abled people.</div></div>	<div>8. CHANNELS of BEHAVIOUR<div>8.1 ONLINE<div>We can update our application and use it in a very efficient way.</div></div><div>8.2 OFFLINE<div>In offline mode we use it but not so efficient we can use it with a recently updated application</div></div></div>	Identify strong TR & EM				
	<div>4. EMOTIONS: BEFORE / AFTER<div>specially abled people hesitate to communicate with others but know using this system they can easily communicate with others.</div></div>							

4. REQUIREMENT ANALYSIS

4.1 Functional Requirements

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 NonFunctional Requirements

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

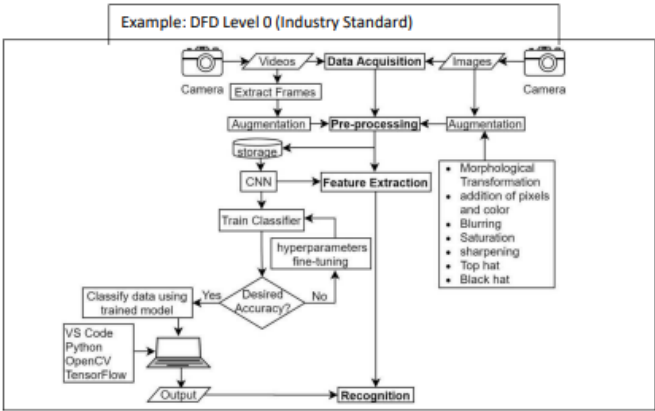
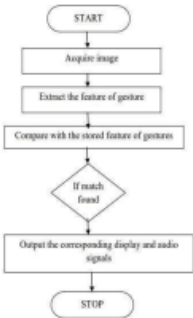
Project Design Phase-II
Data Flow Diagram & User Stories

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)

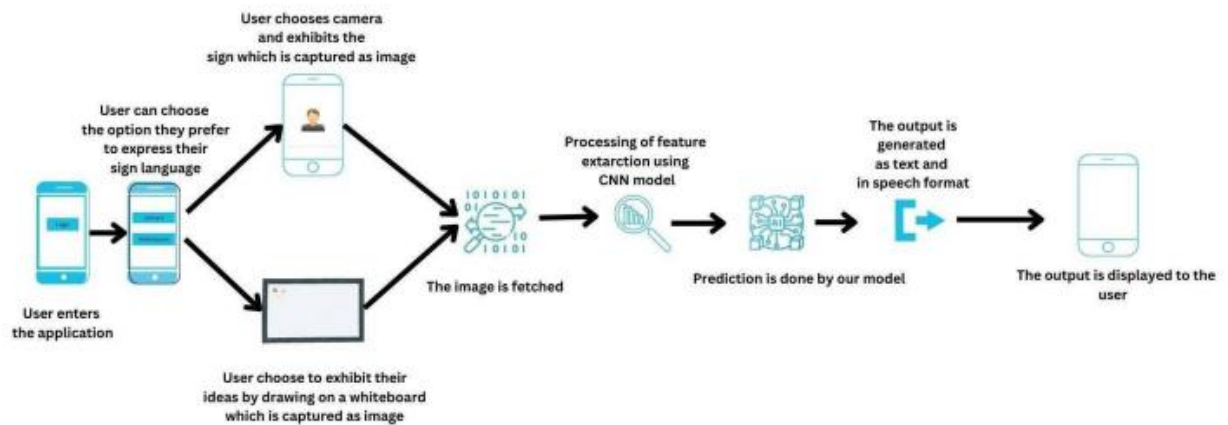


Technology stack

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-source frameworks, Security Implementation, Scalable architecture.

5.2 User Stories

- Users can register for the application by entering their email addresses, creating passwords, and confirming the passwords.
- Upon registering for the application, the user will receive a confirmation email.
- The user can click the convert sign button, which leads to the sign conversion function page.
- A user can show hands in front of the camera, which detects them and converts them into text.
- As a User, Once the text is obtained, I can select Speech mode to convert the text into speech.

6. PROJECT PLANNING & 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

6.2 Sprint Delivery Schedule

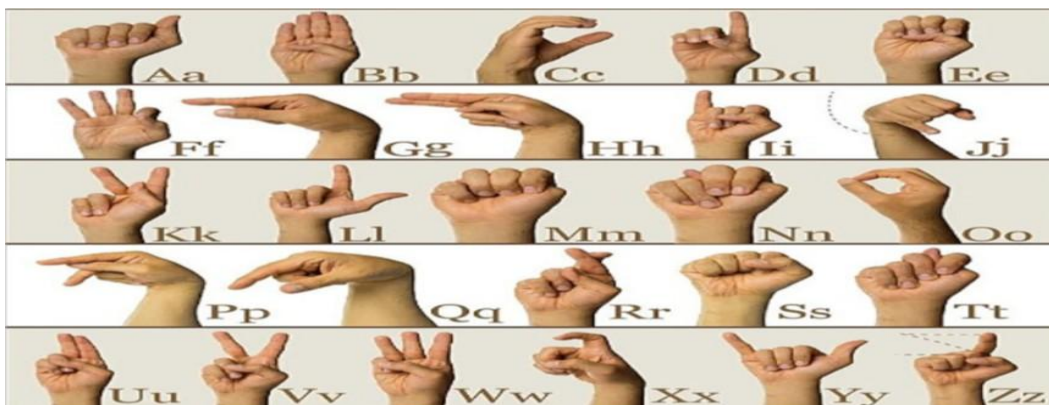
Sprint	Total Story Point	Duration	SprintStartDate	SprintEndDate(Planned)	Story PointsCompleted(as on PlannedEnd Date)	SprintReleaseDate(Actual)
Sprint-1	20	6Days	24Oct2022	29Oct2022	20	29Oct2022
Sprint-2	18	6Days	31Oct2022	05Nov2022	20	31Oct2022
Sprint-3	16	6Days	07Nov2022	12Nov2022	20	07Nov2022
Sprint-4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

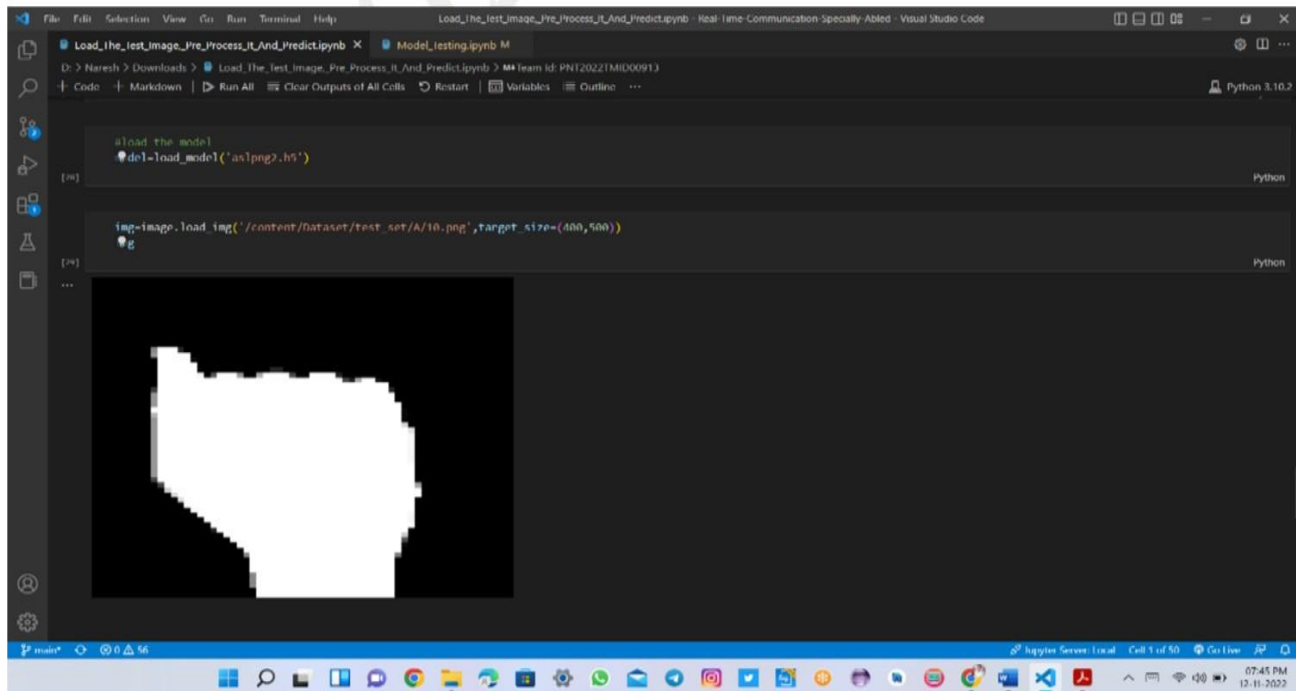
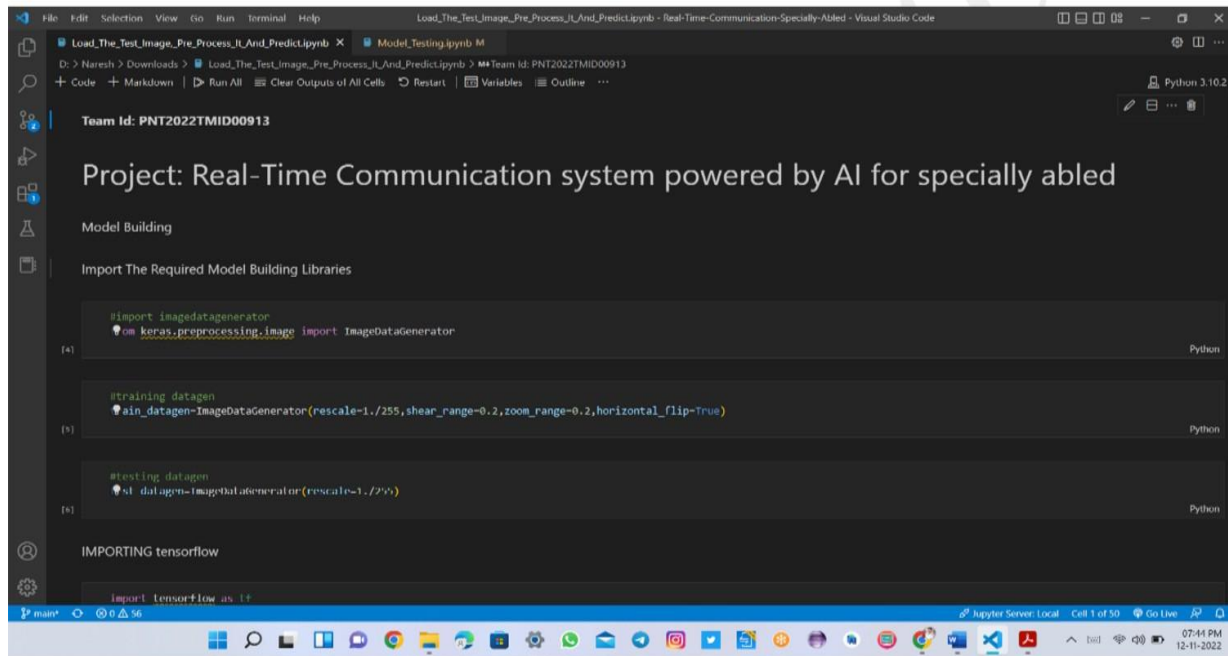
6.3 Reports From JIRA

7. CODING AND SOLUTIONING

7.1 Feature 1

The user can choose which sign language to read based on the different sign language standards that exist.

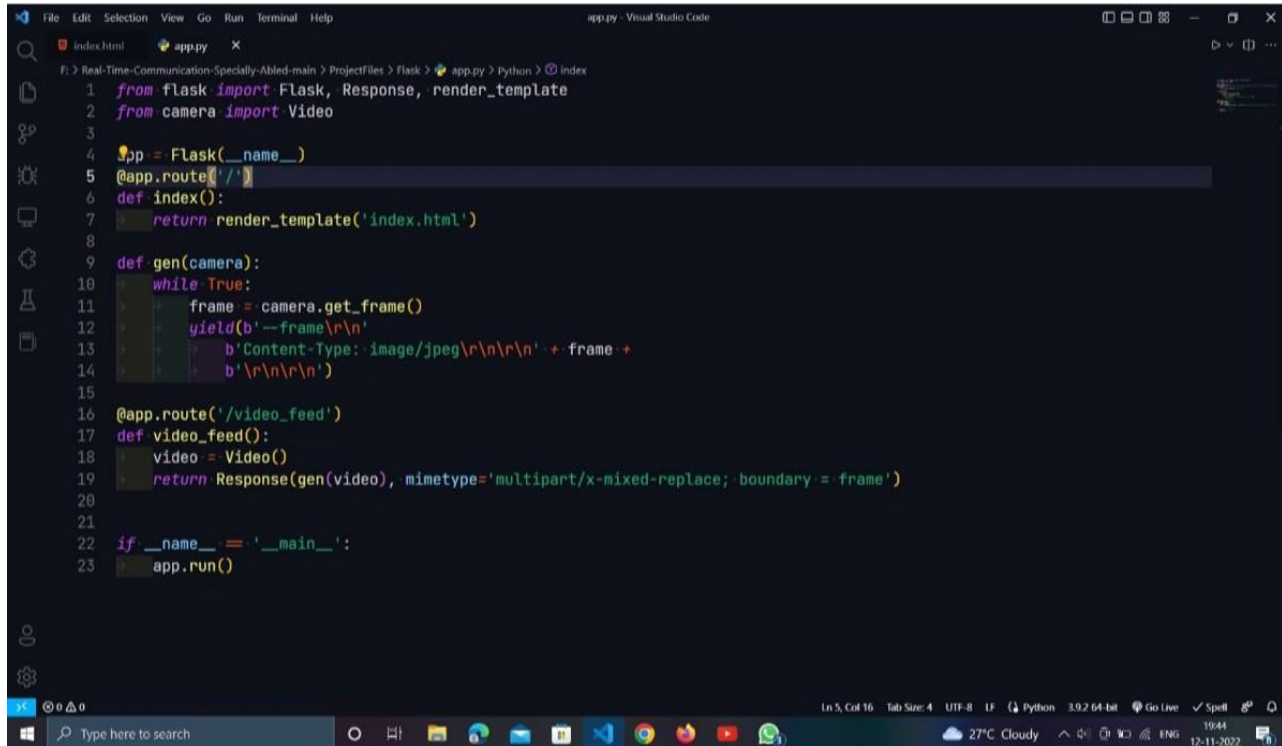




7.2 Feature 2

The communication gap between deaf and dumb people and the general public can be bridged with a

mobileapplication.

A screenshot of a Visual Studio Code editor window. The editor is open to a file named 'app.py'. The code is a Python Flask application. It imports Flask, Response, and render_template from flask, and Video from camera. It creates an app = Flask(__name__). There is a route '/' with a function index() that returns render_template('index.html'). There is a generator function gen(camera) that uses a while True loop to get frames from camera.get_frame() and yield them as b'--frame\r\n' with a Content-Type header. There is a route '/video_feed' with a function video_feed() that creates a Video object and returns a Response with the generator. The main block is if __name__ == '__main__': app.run(). The status bar at the bottom shows 'Ln 5, Col 16', 'Tab Size: 4', 'UTF-8', 'LF', 'Python', '3.9.2 64-bit', 'Go Live', '✓ Spell', and '1944'. The system tray at the bottom right shows '27°C Cloudy', '12-11-2022', and a battery icon.

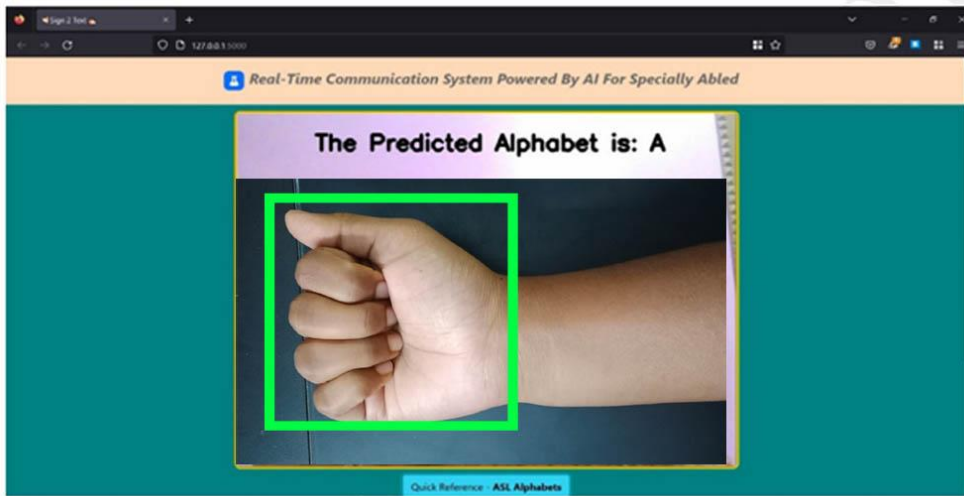
8. TESTING

8.1 Test Cases

- > Ourcodewastestedonvariousangletocheckwhetheritgivesthecorrectoutput.
- > Tosatisfythecustomer'sexpectationswetesteditfully.

8.2 User Acceptance Testing

Ourprojectwastestedbyanendusertoverifythatitsworkingcorrectly.



9. RESULTS

9.1 Performance Metrics

- The proposed procedure was implemented and tested on a set of images.
- The training database consists of 15750 images of Alphabets from "A" to "I", while the testing database consists of 2250 images of Alphabets from "A" to "I".
- Once the gesture is recognized, the equivalent alphabet is shown on the screen.





10. ADVANTAGES&DISADVANTAGES

Advantages:

- The speech is converted to sign language very quick to provide greater and faster understanding to specially-abled people.
- The user interface is convenient and simple for both people.

Disadvantages:

- The number of images and pixels for the model to train in the dataset is not high so accuracy is moderate level.
- It will be improved by changing the dataset.
- Currently, we have deployed a dataset in the model for the alphabets A to I only.

11. CONCLUSION

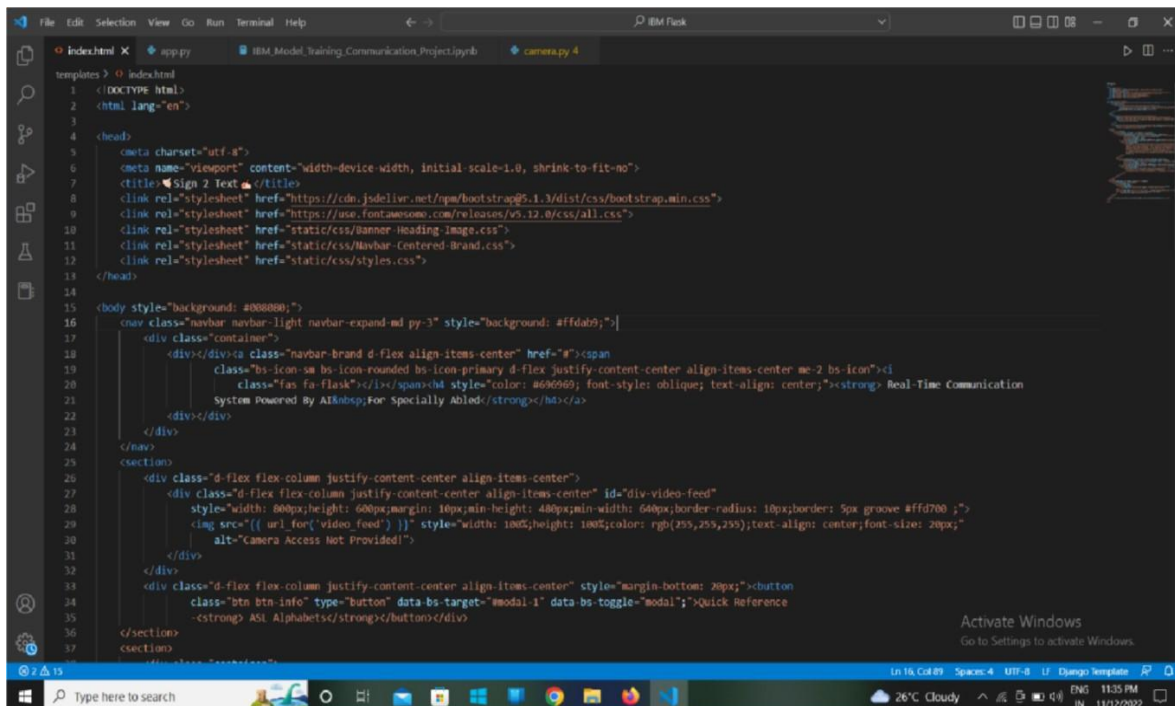
It aims to bridge the communication gap between deaf people and the rest of society. The proposed methodology translates sign language into English alphabets that are understandable to humans. This system sends hand gestures to the model, which recognizes them and displays the equivalent.

12. FUTURESCOPE

- With the introduction of gesture recognition, the web app can easily be expanded to recognize letters beyond 'T', digits, and other symbols plus gesture recognition can also allow controlling of software/hardware interfaces.
- Having a technology that can translate hand sign language to its corresponding alphabet is a game changer in the field of communication and AI for specially-abled people such as those deaf or dumb.

13. APPENDIX

Source Code:



```
1 <!DOCTYPE html>
2 <html lang="en">
3
4 <head>
5   <meta charset="utf-8">
6   <meta name="viewport" content="width=device-width, initial-scale=1.0, shrink-to-fit=no">
7   <title>Sign 2 Text</title>
8   <link rel="stylesheet" href="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/css/bootstrap.min.css">
9   <link rel="stylesheet" href="https://use.fontawesome.com/releases/v5.12.0/css/all.css">
10  <link rel="stylesheet" href="static/css/Banner-Heading-Image.css">
11  <link rel="stylesheet" href="static/css/Navbar-Centered-Brand.css">
12  <link rel="stylesheet" href="static/css/styles.css">
13 </head>
14
15 <body style="background: #008080;">
16   <nav class="navbar navbar-light navbar-expand-md py-3" style="background: #ffdeb3;">
17     <div class="container">
18       <div></div><div class="navbar-brand d-flex align-items-center" href="#"><span
19         class="bs-icon-sm bs-icon-rounded bs-icon-primary d-flex justify-content-center align-items-center me-2 bs-icon"><i
20         class="fas fa-flask"></i></span><h4 style="color: #008080; font-style: oblique; text-align: center;">Real Time Communication
21         System Powered By AI</h4></div>
22     </div>
23   </nav>
24   <section>
25     <div class="d-flex flex-column justify-content-center align-items-center">
26       <div class="d-flex flex-column justify-content-center align-items-center" id="div-video-feed"
27         style="width: 800px; height: 600px; margin: 10px; min-height: 480px; min-width: 640px; border-radius: 10px; border: 5px groove #ffd700;">
28         
30       </div>
31     </div>
32     <div class="d-flex flex-column justify-content-center align-items-center" style="margin-bottom: 20px;"><button
33       class="btn btn-info type="button" data-bs-target="#modal-1" data-bs-toggle="modal">Quick Reference
34     </div>
35   </section>
36   <section>
37     <strong>ASI Alphabets</strong></div>
```



```
File Edit Selection View Go Run Terminal Help
IBM Model Training Communication Project.ipynb camera.py

app.py > ...
1 from flask import Flask, Response, render_template
2 from camera import Video
3
4 app = Flask(__name__)
5 @app.route('/')
6 def index():
7     return render_template('index.html')
8
9 def gen(camera):
10     while True:
11         frame = camera.get_frame()
12         yield(b'--frame\r\n'
13              b'Content-Type: image/jpeg\r\n\r\n' + frame +
14              b'\r\n\r\n')
15
16 @app.route('/video_feed')
17 def video_feed():
18     video = Video()
19     return Response(gen(video), mimetype='multipart/x-mixed-replace; boundary=frame')
20
21
22 if __name__ == '__main__':
23     app.run()
```

Activate Windows
Go to Settings to activate Windows.

Ln 23, Col 14 Tab Size 4 UTF-8 LF Python 3.9.2 64-bit

```
File Edit Selection View Go Run Terminal Help
IBM Model Training Communication Project.ipynb camera.py 4 x

camera.py > Python > Video > get_frame
1 import cv2
2 import numpy as np
3 from tensorflow.keras.models import load_model
4 from tensorflow.keras.preprocessing import image
5
6 class Video(object):
7     def __init__(self):
8         self.video = cv2.VideoCapture(0)
9         self.roi_start = (50, 150)
10        self.roi_end = (250, 350)
11        self.model = load_model('asl_model.h5') # Execute Local Trained Model
12        self.model = load_model('IBM Communication Model.h5') # Execute IBM Trained Model
13        self.index = ['A', 'B', 'C', 'D', 'E', 'F', 'G', 'H', 'I']
14        self.y = None
15    def __del__(self):
16        k = cv2.waitKey(1)
17
18        self.video.release()
19    def get_frame(self):
20        ret, frame = self.video.read()
21        frame = cv2.resize(frame, (640, 480))
22        copy = frame.copy()
23        copy = copy[150:150+200, 50:50+200]
24        # Prediction Start
25        cv2.imwrite('image.jpg', copy)
26        copy_img = image.load_img('image.jpg', target_size=(64, 64))
27        x = image.img_to_array(copy_img)
28        x = np.expand_dims(x, axis=0)
29        pred = np.argmax(self.model.predict(x), axis=1)
30        self.y = pred[0]
31        cv2.putText(frame, 'The Predicted Alphabet is: ' + str(self.index[self.y]), (100, 50), cv2.FONT_HERSHEY_SIMPLEX, 1, (0, 0, 0), 3)
32        ret, jpg = cv2.imencode('.jpg', frame)
33        return jpg.tobytes()
```

Activate Windows
Go to Settings to activate Windows.

Ln 33, Col 29 Tab Size 4 UTF-8 LF Python 3.9.2 64-bit

File Edit Selection View Go Run Terminal HelpModel_Training_Communication_Project.ipynb - Visual Studio Code

Model_Training_Communication_Project.ipynb X

File Training File Reports View Code Run All Clear Outputs of All Cells Outline

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 Datasets
train_datagen = ImageDataGenerator(rescale=1/255, zoom_range=0.2, horizontal_flip=True, vertical_flip=False)
Testing Datasets
test_datagen = ImageDataGenerator(rescale=1/255)

Training Dataset
train=train_datagen.flow_from_directory(r'E:\Projects\SmartBridge\ModelGen\Dataset\training_set', target_size=(64,64), class_mode='categorical', batch_size=988)
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=988)

Found 27868 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 : 38
len x-test : 29

The Class Indices in Training Dataset
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