REAL-TIME COMMUNICATION SYSTEM POWERED BY AI FOR SPECIALLY ABLED

Submitted By

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1. INTRODUCTION

1.1 Overview

People get to know one another by sharing their ideas, thoughts, and experiences with those around them. There are numerous ways to accomplish this, the best of which is the gift of "Speech." Everyone can very convincingly transfer their thoughts and understand each other through speech. It will be unjust if we overlook those who are denied this priceless gift: the deaf and dumb. In such cases, the human hand has remained the preferred method of communication.

1.2 Purpose

The project's purpose is to create a system that translates sign language into a humanunderstandable language so that ordinary people may understand it.

2. LITERATURE SURVEY

2.1 Existing problem

Some of the existing solutions for solving this problem are:

Technology

One of the easiest ways to communicate is through technology such as a smart phone or laptop. A deaf person can type out what they want to say and a person who is blind or has low vision can use a screen reader to read the text out loud. A blind person can also use voice recognition software to convert what they are saying in to text so that a person who is Deaf can then read it.

Interpreter

If a sign language interpreter is available, this facilitates easy communication if the person who is deaf is fluent in sign language. The deaf person and person who is blind can communicate with each other via the interpreter. The deaf person can use sign language and the interpreter can speak what has been said to the person who is blind and then translate anything spoken by the blind person into sign language for the deaf person.

Just Speaking

Depending on the deaf person's level of hearing loss, they may be able to communicate with a blind person who is using speech. For example, a deaf person

may have enough residual hearing (with or without the use of an assistive hearing device such as a hearing aid) to be able to decipher the speech of the person who is blind or has low vision. However, this is often not the most effective form of communication, as it is very dependent on the individual circumstances of both people and their environment (for example, some places may have too much background noise).

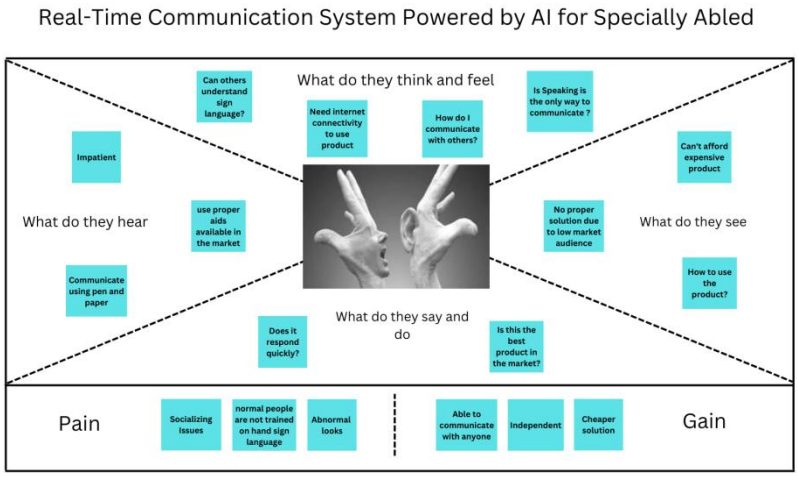
2.2 Proposed solution

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

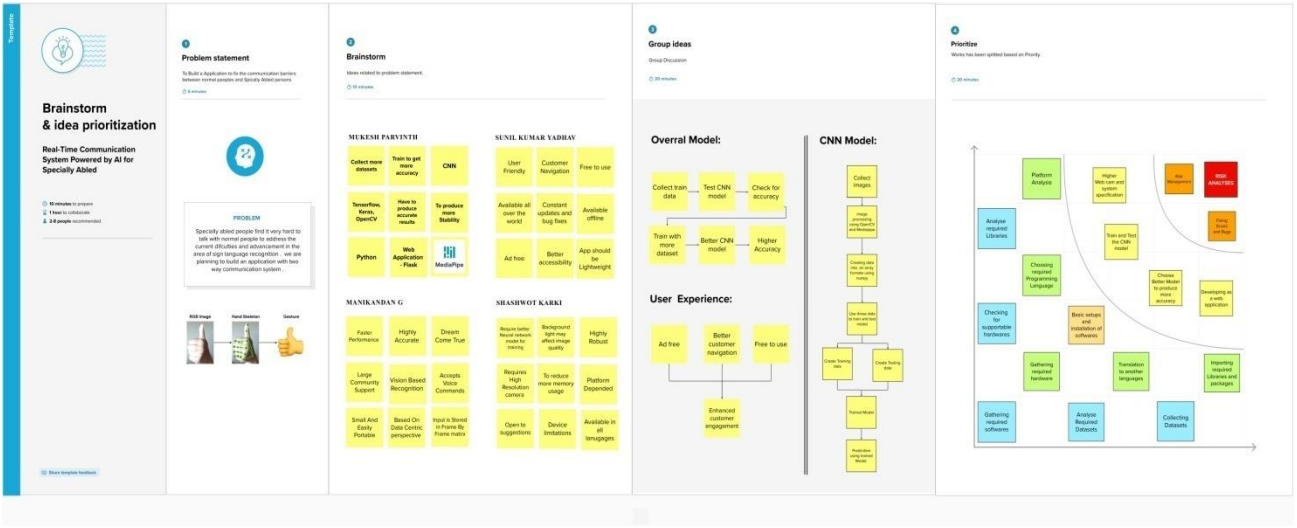
1. To design and develop a system which lowers the communication gap between speechhearing impaired and normal world.
2. To build a communication system that enables communications between deaf-dumb person and a normal person.
3. A convolution neural network is being used to develop a model that is trained on various hand movements. This model is used to create an app. This programme allows deaf and hard of hearing persons to communicate using signs that are then translated into humanreadable text.

3.IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



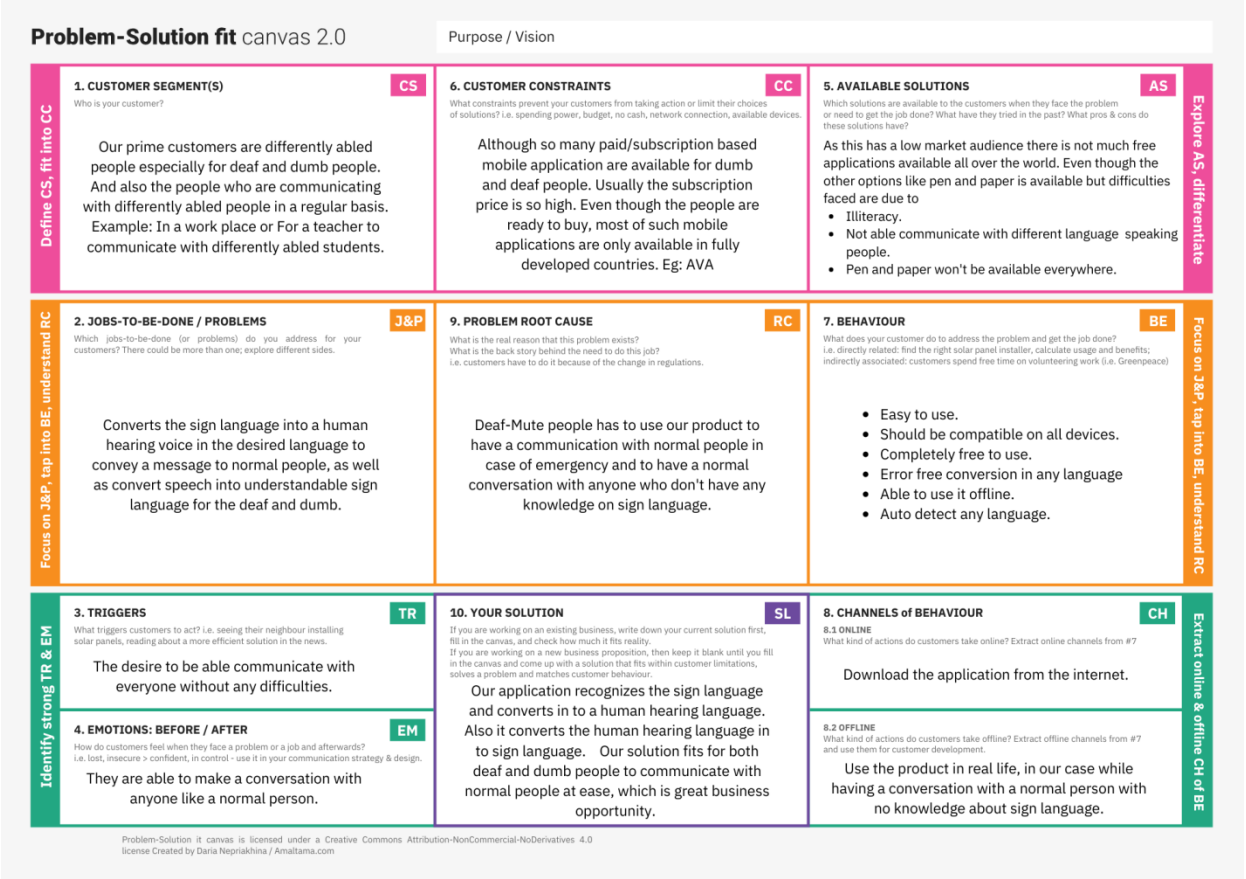
3.2 Ideation & Brainstorming



3.3 Proposed Solution

An application for deaf and dumb people to convey their information using signs which get converted to human-understandable language and speech in Artificial Intelligence. By using voice conversation system with hand gesture recognition and translation will be very useful to have a proper conversation. This makes two people to communicate in a easier and a efficient wayWe are using Convolution neural network to create a model that is trained on different hand gestures and an app is built for the use this mode. AI has been deployed/used in an efficient manner in the development of this idea. Communicating with others and being connected in the society and remove accessibility barriers. With clear results, two people can communicate with each other. First, we offer free usage for everyone. Once our product is familiarized among people, we will turn the users to get the premium subscriptions by offering them with more premium features. As long as our product is beneficial to the users, subscriptions will increase which is a great business model, as this worked in case of many top MNC's around the world. Useful in organization where communication between co-workers is much important. Can make collaborations with government.

3.4 Problem Solution fit



4. REQUIREMENT ANALYSIS

4.1 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	Registration through Form. Registration through Gmail. Registration through LinkedIn.
FR-2	User Authentication	Confirmation via mail. Confirmation via OTP. Confirmation via voice recognition for visually impaired.
FR-3	Reporting	Any problems faced by customer should be reported automatically.
FR-4	Audit tracking	Streamline their audit processes and comply with regulations or internal policies.
FR-5	Historical data	Collected data about past events must be used to improve the further translations.

4.2 Non-functional Requirements:

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

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The User Interface should be contrast enough for the partially blind people and also should be colorblind friendly UI.
NFR-2	**Security**	Should be resistive to cyberattacks as the information shared is very confidential.

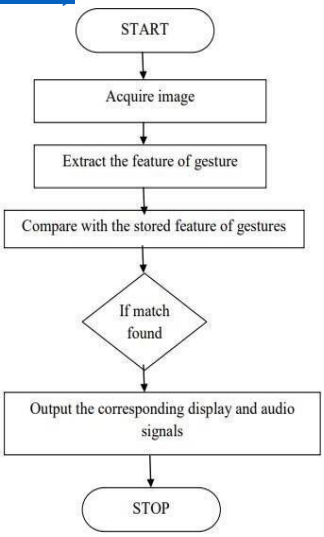
NFR-3	**Reliability**	Support should be provided for in-house or remote accessibility for external resources if required.
NFR-4	**Performance**	The site should load in 5 seconds when the number of simultaneous users are greater than 50000.
NFR-5	**Availability**	Continuous availability of our service must be provided all the time.
NFR-6	**Scalability**	The application should run seamlessly with more than 50000 users at the same time.

5. PROJECT DESIGN

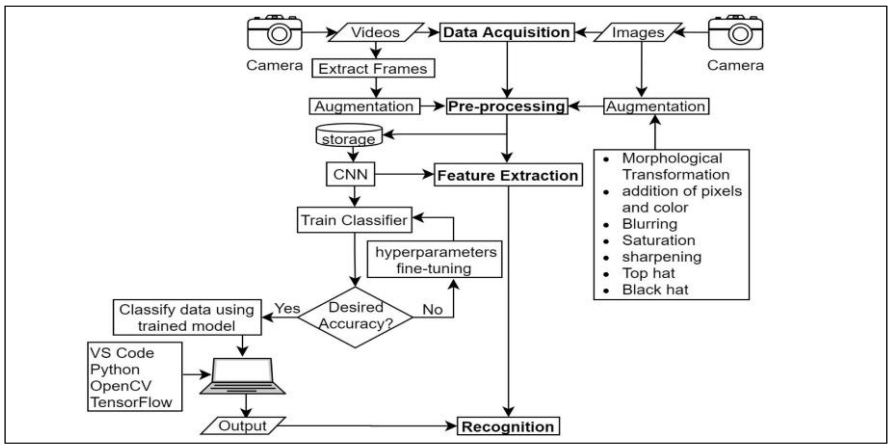
5.1 Data Flow Diagrams

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 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.

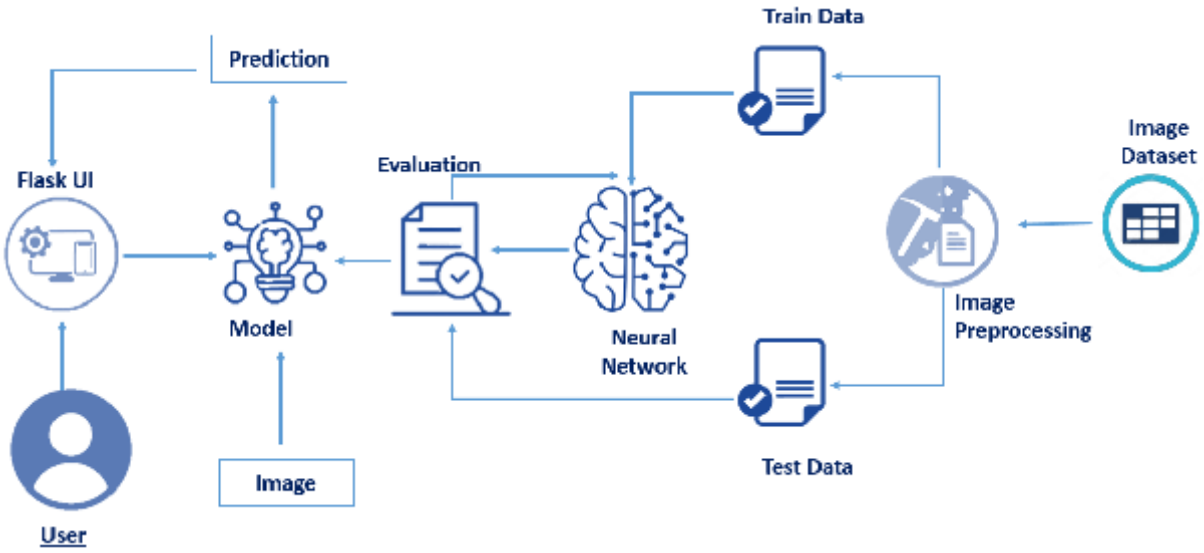
Example: (Simplified)



Example: DFD Level 0 (Industry Standard)



5.2 Solution & Technical Architecture



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.

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 <u>Convert</u> sign** , <u>which</u> 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**	I can **take the queries from the customer care and perform necessary phases again.**	High	Sprint-2

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

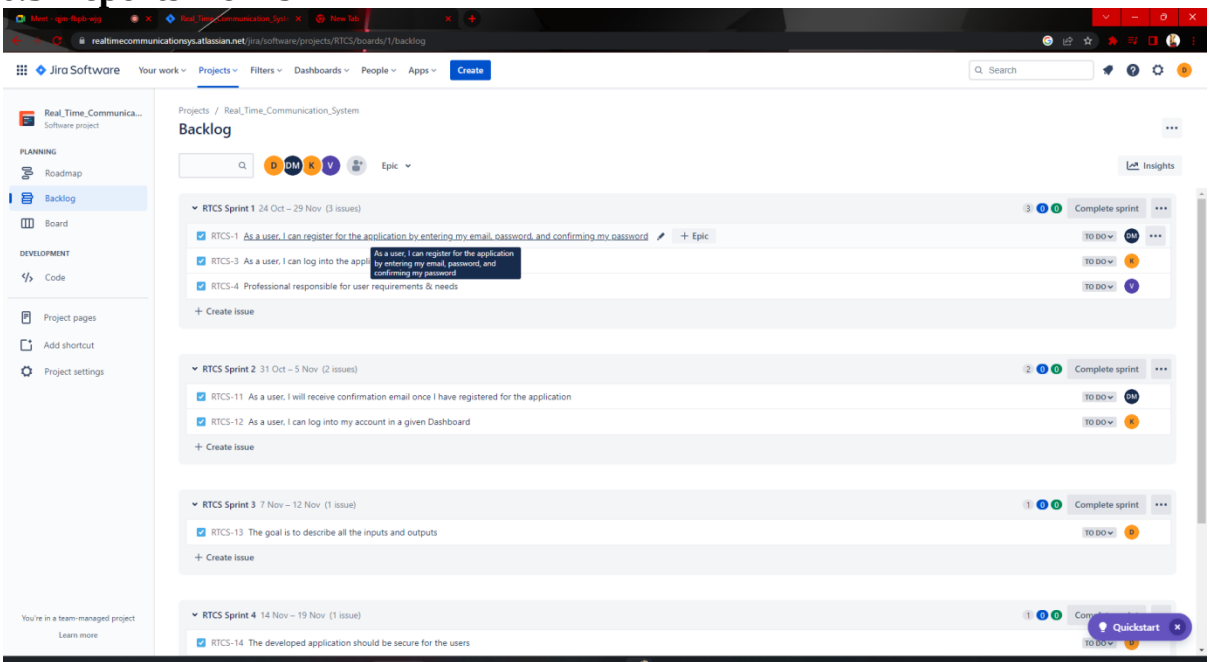
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	Mukesh Parvinth R Manikandan G
Sprint-2		USN-2	As a user, I will receive confirmation email onceI have registered for the application	1	High	Sunil Kumar Yadhav Shaswot Karki
Sprint-1	Login	USN-3	As a user, I can log into the application by entering email & password	1	Medium	Mukesh Parvinth R Manikandan G
Sprint-2	Dashboard	USN-4				

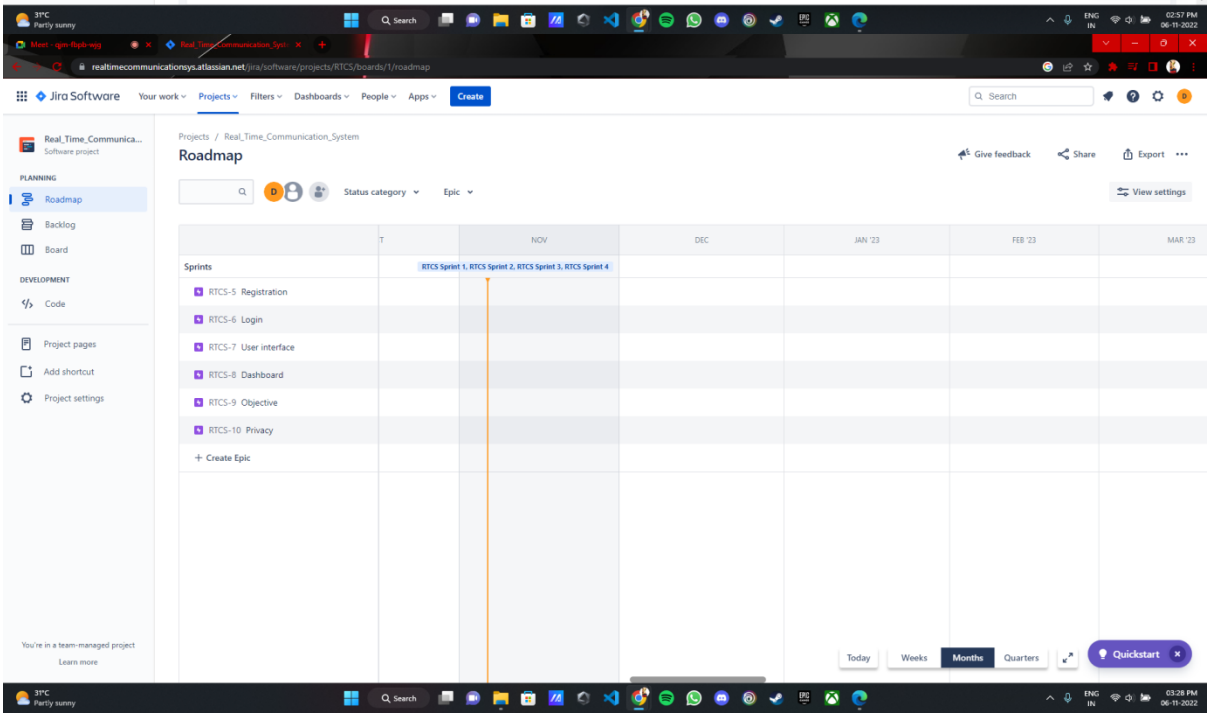
Sprint-1	User interface	USN-5	Professional responsible for user requirements &needs	1	High	Mukesh Parvinth R Manikandan G Sunil Kumar Yadhav Shaswot Karki
Sprint-3	Objective	USN-6	The goal is to describe all the inputs and outputs	1	High	Sunil Kumar Yadhav Shaswot Karki
Sprint-4	Privacy	USN-7	The developed application should be secure for the users	1	High	Mukesh Parvinth R Manikandan G

6.2 Sprint Delivery Schedule

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	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

6.3 Reports from JIRA





7. CODING & SOLUTIONING

Feautre 1:

datacollect.py

```
import cv2 as cv
from cvzone.HandTrackingModule import HandDetector
import numpy as np
import math
import time
import trainlist
import os

def collectData(save_folder):
    cap=cv.VideoCapture(0)
    detector = HandDetector(maxHands=1)
    offset=20
    img_size=300
    counter=0

    while counter<100:
        ret,img=cap.read()
        hands,img=detector.findHands(img)
        if hands:
            hand=hands[0]
            x,y,w,h=hand['bbox']
            #Image empty
            img_bg=np.ones((img_size,img_size,3), np.uint8)*255
            croped_img=img[y-offset:y+ h+offset,x-offset:x+ w+offset]

            aspect_ratio=h/w

            if aspect_ratio>1:
                k=img_size/h
                wCal= math.ceil(k*w)
                img_resize=cv.resize(croped_img,(wCal,img_size))
                wGap =math.ceil((img_size-wCal)/2)
                img_bg[:,wGap:wCal+wGap] = img_resize
            else:
                k=img_size/w
                hCal= math.ceil(k*h)
```

```
            img_resize=cv.resize(croped_img,(img_size,hCal))
            hGap =math.ceil((img_size-hCal)/2)
            img_bg[hGap:hCal+hGap,:] = img_resize


        cv.imshow("Image_croped",croped_img)
        #img_bw=cv.cvtColor(img_bg,cv.COLOR_BAYER_BG2GRAY)
        cv.imshow("Image_bg",img_bg)

    cv.imshow("Image",img)
    key=cv.waitKey(1)

    if key==ord("s"):
        counter +=1
        cv.imwrite(f"{save_folder}/Image_{time.time()}.jpg",img_bg)
        print(counter)


save_folder="Data/Train_2/"
dataset=trainlist.dataset

for data in dataset:
    data=save_folder+data
    print("\nStarting to Collect "+data)
    try:
        os.mkdir(data)
        collectData(data)
    except:
        continue
    print(data)
```

Feautre 2:

Train.py

```
import tensorflow as tf
import trainlist
import os

TRAIN_DIR="./Data/Train"
VALIDATE_DIR="./Data/Test"
dataset=trainlist.dataset


def train_model():
```

```
train_datagen=tf.keras.preprocessing.image.ImageDataGenerator(rescale=
1./255,shear_range=0.2,zoom_range=0.2,horizontal_flip=True)

train_generator=train_datagen.flow_from_directory(TRAIN_DIR,target_s
ize=(224,224),class_mode="categorical",batch_size=300)


validate_datagen=tf.keras.preprocessing.image.ImageDataGenerator(resca
le=1./255,shear_range=0.2,zoom_range=0.2,horizontal_flip=True)

validate_generator=validate_datagen.flow_from_directory(VALIDATE_D
IR,target_size=(224,224),class_mode="categorical",batch_size=300)

   model=tf.keras.Sequential([

tf.keras.layers.Conv2D(64,(3,3),activation="relu",input_shape=(224,224,3))
,
      tf.keras.layers.MaxPooling2D(2,2),

tf.keras.layers.Conv2D(128,(3,3),activation="relu",input_shape=(112,112)),
      tf.keras.layers.MaxPooling2D(2,2),

tf.keras.layers.Conv2D(256,(3,3),activation="relu",input_shape=(56,156)),
      tf.keras.layers.MaxPooling2D(2,2),

tf.keras.layers.Conv2D(512,(3,3),activation="relu",input_shape=(28,28)),
      tf.keras.layers.MaxPooling2D(2,2),

tf.keras.layers.Conv2D(512,(3,3),activation="relu",input_shape=(14,14)),
      tf.keras.layers.MaxPooling2D(2,2),
      tf.keras.layers.Flatten(),
      tf.keras.layers.Dropout(0.5),
      tf.keras.layers.Dense(256,activation="relu"),
      tf.keras.layers.Dense(10,activation="softmax")

   ])


model.compile(loss="categorical_crossentropy",optimizer="adam",metric
s=["accuracy"])
```

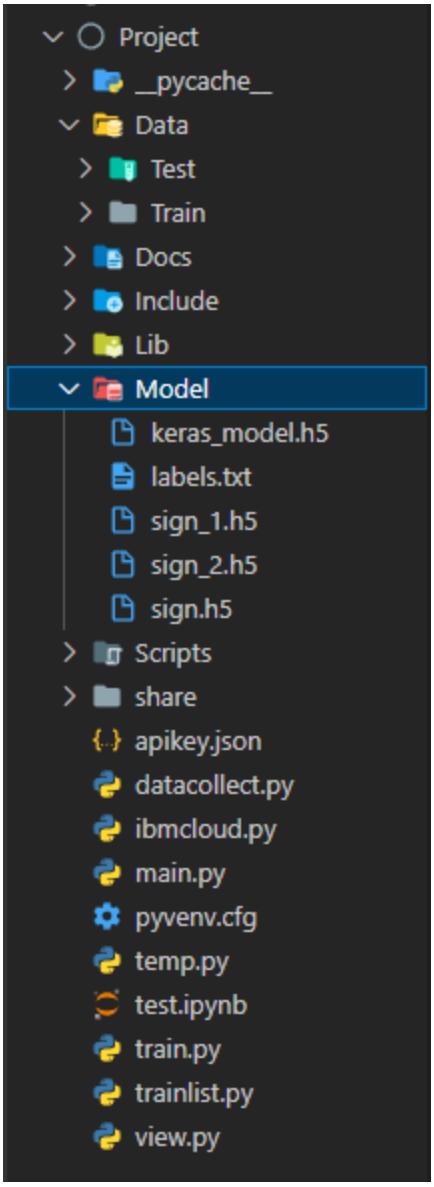
```
model.fit_generator(train_generator,epochs=10,validation_data=validate_g
enerator,verbose=1,validation_steps=10,steps_per_epoch=20)

    model.save("sign_1.h5")

    print("Model Trained Sucessfully...")

def train_list(dataset):

    f=open("labels_1.txt","w+")

    for i in range(len(dataset)):
        f.write(str(i)+" "+dataset[i]+"\n")

    f.close()

    print("Dataset list as been sucessfully created")

train_model()
train_list(dataset)
```

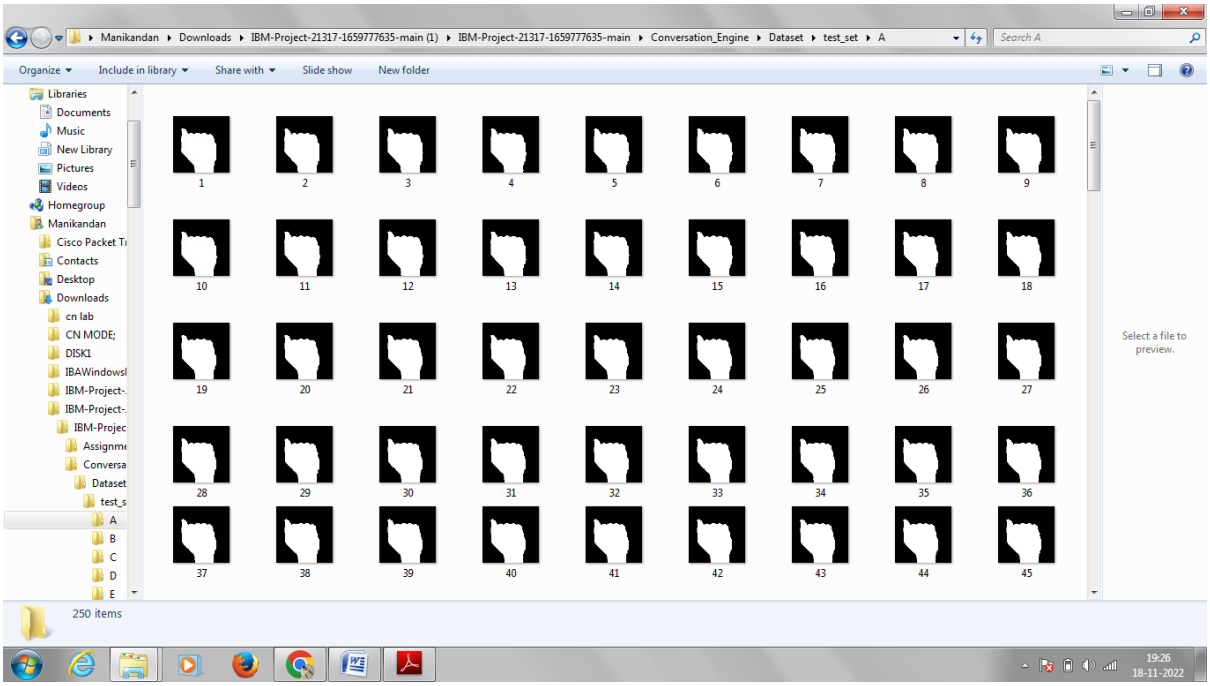
View.py

```
import cv2 as cv
from cvzone.HandTrackingModule import HandDetector
import numpy as np
import math
from cvzone.ClassificationModule import Classifier
import trainlist

cap=cv.VideoCapture(0)
detector = HandDetector(maxHands=1)
offset=20
img_size=300
classifier=Classifier("./Model/keras_model.h5","./Model/labels.txt")
labels=trainlist.dataset

def display():
    list=[" "]
    count=0
    while True:
        ret,img=cap.read()
        img_out=img.copy()
        hands,img=detector.findHands(img)
        if hands:
            hand=hands[0]
            x,y,w,h=hand['bbox']
            #Image empty
            img_bg=np.ones((img_size,img_size,3), np.uint8)*255
            croped_img=img[y-offset:y+ h+offset,x-offset:x+ w+offset]

            aspect_ratio=h/w

            if aspect_ratio>1:
                k=img_size/h
                wCal= math.ceil(k*w)
                img_resize=cv.resize(croped_img,(wCal,img_size))
                wGap =math.ceil((img_size-wCal)/2)
                img_bg[:,wGap:wCal+wGap] = img_resize
                prediction,index=classifier.getPrediction(img_bg)
                print(labels[index])

            else:
                k=img_size/w
                hCal= math.ceil(k*h)
```

```
            img_resize=cv.resize(croped_img,(img_size,hCal))
            hGap =math.ceil((img_size-hCal)/2)
            img_bg[hGap:hCal+hGap,:] = img_resize
            prediction,index=classifier.getPrediction(img_bg)
            print(labels[index])

        cv.putText(img_out,labels[index],(x,y-
20),cv.FONT_HERSHEY_COMPLEX,2,(255,255,255),2)

        cv.imshow("Image_croped",croped_img)
        cv.imshow("Image_bg",img_bg)

        gesture=labels[index]
        count+=1
        if count==30:
            if gesture!=list[-1]:
                list.append(gesture)
            count=count-30
        print(list)
    cv.imshow("Image",img_out)
    key=cv.waitKey(1)

    if key==ord('q'):
        break

display()
cap.release()
cv.destroyAllWindows()
```

8. TESTING
8.1 Test Cases





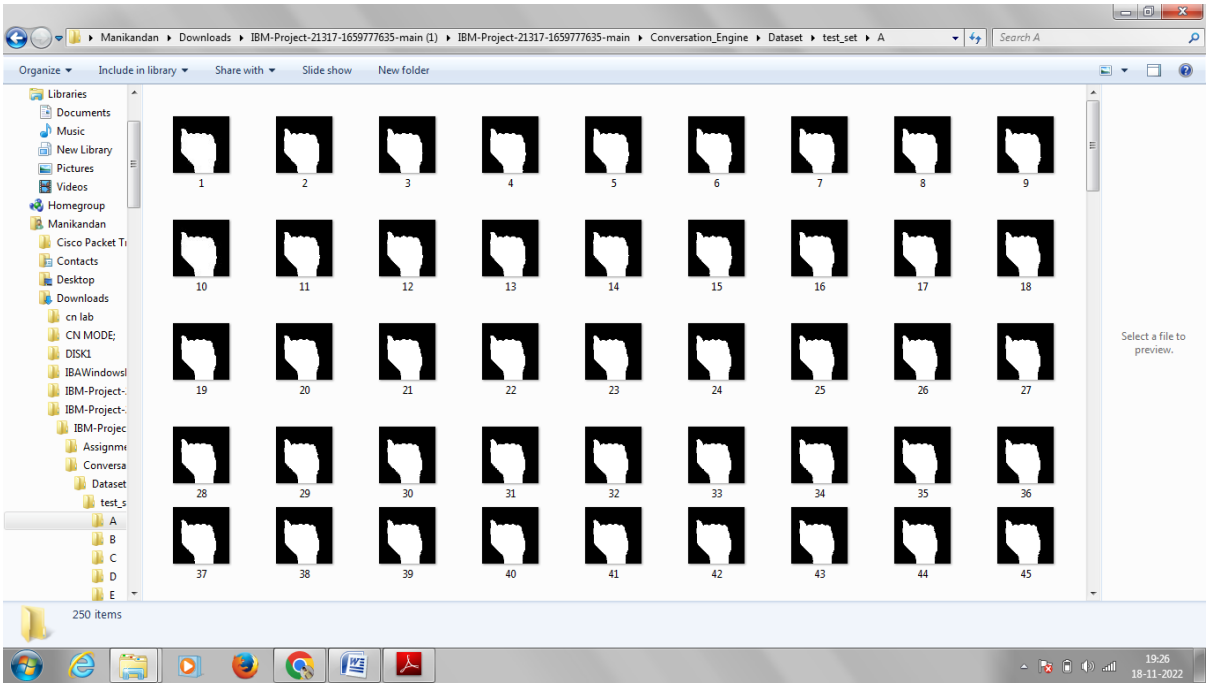
Test case ID	Feature Type	Component	Test Scenario	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation (Y/ N)	BUG ID	Executed By
Home Page	UI	Home Page	Verify the UI elements	1. Enter the local host url and click go. 2. Verify home page with below ui element	Localhost/webapp/image.html	Application should show below UI elements: 1.Home button	Working as expected	PASS	Successful	Y		Manikandan G Mukesh Pravinth R

Classify Page Tc 001	Functional	Translate Page	Verify user is able to Captured image	1. upload the image . 2. Click Translate buttopn	Capture image	User should Capture the image	Working as expected	PASS	Successful	Y		Sunil kumar yadav Shashwot karki

.

Classify Page Tc 002	Functional	PredictPage	Verify user is able to Captured image	1. Capture 2. image 3. Click Translate buttopn	Capture image	User should Capture the image	Working as expected	PASS	Successful	Y		Shashwot Karki
Classify Page Tc 003	Functional	PredictPage	Verify user is able to Capture image	1. Capture the image . 2. Click analyze buttopn	Capture image	User should Capture the image	Working as expected	PASS	Successful	Y		Mukesh Pravinth R
Classify Page Tc 004	Functional	PredictPage	Verify user is able to Capture image	1. Capture the image . 2. Click analyze buttopn	Capture image	User should Capture dthe image	Working as expected	PASS	Successful	Y		Manikandan G

8.2 User Acceptance Testing



Purpose of User Acceptance Testing

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

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	Severity 5	Subtotal
By Design	2	2	1	1	1	7
Duplicate	1	0	1	0	0	2
External	2	0	0	2	0	4

Fixed	3	2	1	1	0	7
Not Reproduced	0	0	1	1	0	2
Skipped	0	0	0	0	0	0
Won't Fix	0	0	0	0	0	0
Totals	8	4	4	5	1	22

Test Case Analysis

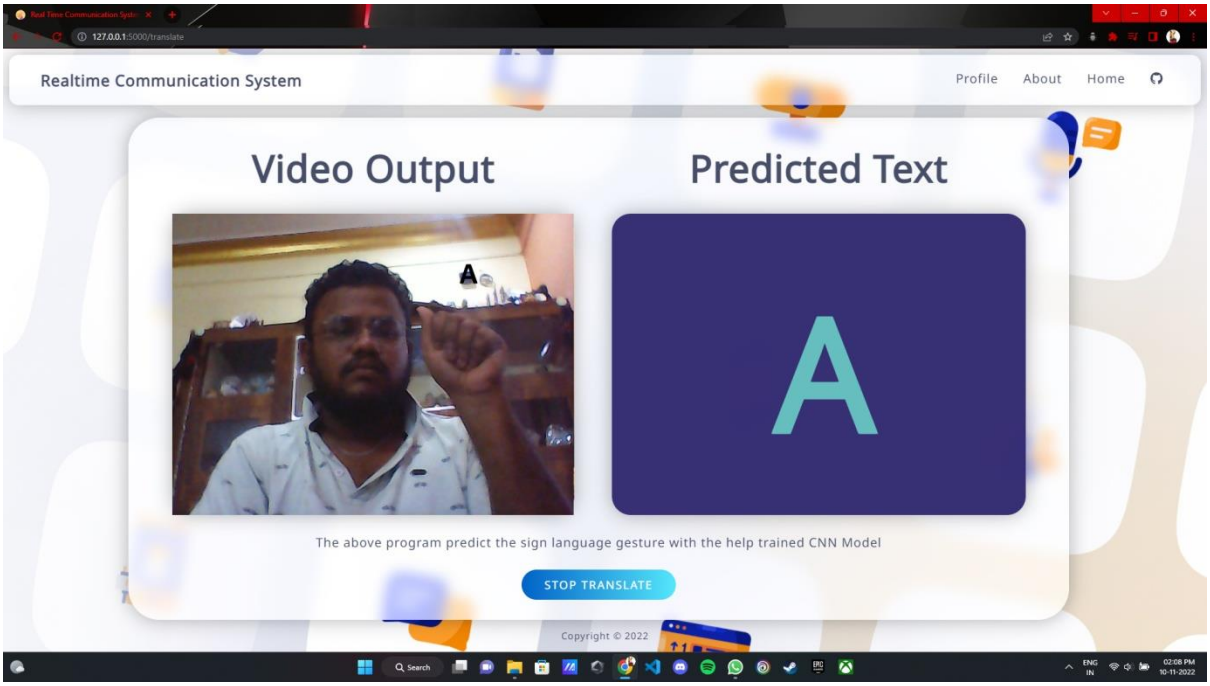
shows the number of test cases that have passed, failed, and untested

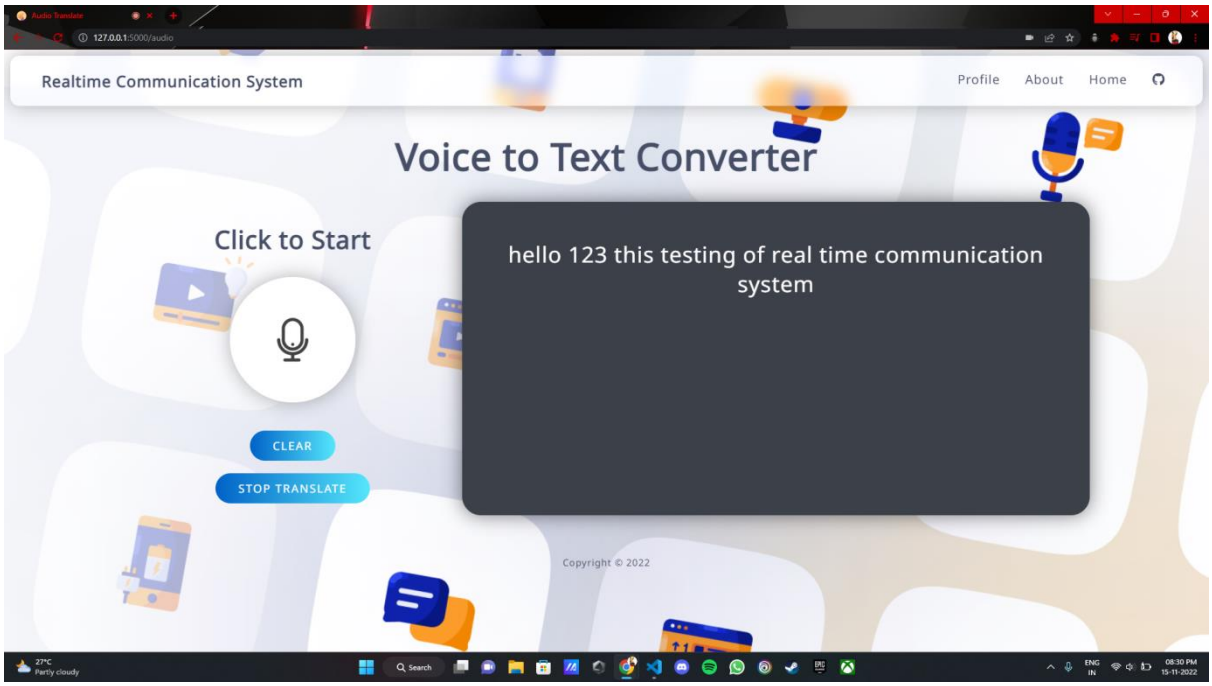
Section	**Total cases**	**Not Tested**	**Fail**	**Pass**
Home page	6	0	0	6
Image Page	5	0	0	5
Prediction Page	3	0	0	3
Report Page	3	0	0	3

9. RESULTS

9.1 Performance Metrics

The proposed procedure was implemented and tested with set of images. The set of 15750 images of Alphabets from “A” to “I” are used for training database and a set of 2250 images of Alphabets from “A” to “I” are used for testing database. Once the gesture is recognise the equivalent Alphabet is shown on the screen.





10. ADVANTAGES & DISADVANTAGES

Advantages:

1. It is possible to create a mobile application to bridge the communication gap between deaf and dumb persons and the general public.
2. As different sign language standards exist, their dataset can be added, and the user can choose which sign language to read.

Disadvantages:

1. The current model only works from alphabets A to I.
2. In absence of gesture recognition, alphabets from J cannot be identified as they require some kind of gesture input from the user.
3. As the quantity/quality of images in the dataset is low, the accuracy is not great, but that can easily be improved by change in dataset.

11. CONCLUSION

Sign language is a useful tool for facilitating communication between deaf and hearing people. Because it allows for two-way communication, the system aims to bridge the communication gap between deaf people and the rest of society. The proposed methodology translates language into English alphabets that are understandable to humans.

This system sends hand gestures to the model, who recognises them and displays the equivalent Alphabet on the screen. Deaf-mute people can use their hands to perform sign language, which will then be converted into alphabets, thanks to this project.

12. FUTURE SCOPE

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 the specially abled people such as deaf and dumb. With introduction of gesture recognition, the web app can easily be expanded to recognize letters

beyond 'I', digits and other symbols plus gesture recognition can also allow controlling of software/hardware interfaces.

13. APPENDIX

Source Code:

Profile.html

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <meta http-equiv="X-UA-Compatible" content="IE=edge">
   <meta name="viewport" content="width=device-width, initial-scale=1.0">
   <link rel="stylesheet" href="../static/about.css">
   <link rel="stylesheet" href="../static/main.css">
   <link rel="stylesheet" href="../static/index.css">
   <link rel="shortcut icon" href="../static/img/favicon_1.ico" type="image/x-icon">
   <link rel="preconnect" href="https://fonts.googleapis.com">
   <link rel="preconnect" href="https://fonts.googleapis.com">
   <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
   <link href="https://fonts.googleapis.com/css2?family=Noto+Sans&display=swap" rel="stylesheet">
   <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
   <link href="https://fonts.googleapis.com/css2?family=Noto+Sans&display=swap" rel="stylesheet">
   <script src="https://kit.fontawesome.com/872673ab28.js" crossorigin="anonymous"></script>
   <title>Realtime Communication System</title>

</head>
<body>
   <div class="nav_head">
      <div class="nav_title"><h1>Realtime Communication System</h1></div>
      <div class="icons">
         <ul class="header-list">
            <li class="header-list-elements"><a class="link-tag" id="profile_page" href='./profile'>Profile</a></li>
            <li class="header-list-elements"><a class="link-tag" href="/about">About</a></li>
```

```
            <li class="header-list-elements"><a class="link-tag" href="/home">Home</a></li>
            <li class="header-list-elements"><a class="link-tag" href="https://github.com/IBM-EPBL/IBM-Project-26558-1660029470" target="_blank"><i class="fa-brands fa-github"></i></a></li>
        </ul>
    </div>
</div>

<h1 class="title">Account</h1>

<div class="persons">

</div>

<footer>
    <p id="copyrights" style="color: #474E68; font-size:20px; text-align:center;"></p>
</footer>
<script>
    const d = new Date();
    document.getElementById("copyrights").innerHTML ="Copyright © "+ d.getFullYear();

    const main = document.querySelector('.persons');

    function isUserLoggedIn(){
        const isUser = JSON.parse(localStorage.getItem('isLoggedIn'));
        if(isUser){
            const userData = JSON.parse(localStorage.getItem('user'));

            main.innerHTML = `      <div class="cont">
                <div class="row">
                    <div class="c1">
                        <div class="bg"><img src="../static/img/619c00c608a8d833960e55a3_Benefits of a full stack Developer.png" alt="A"></div>
                        <div class="pro"><img src="../static/img/profilepic.jpg" alt="B"></div>
                        <div class="main">
                            <h2>${userData.name}</h2>
                            <p style="color: #474E68 ; font-style:italic;">
                                <b>${userData.role} <br></b>
```

```
                    </p>
                </div>
                <div class="social">
                    <a href="/" target="_blank"><i class="fa-brands fa-facebook"></i></a>
                    <a href="/" target="_blank"><i class="fa-solid fa-at"></i></a>
                    <a href="/" target="_blank"><i class="fa-brands fa-linkedin"></i></a>
                    <a href="/" target="_blank"><i class="fa-brands fa-github"></i></a>
                </div>
            </div>
            <div class="c2">
                <div class="heading">
                    <h2>Profile Details</h2>
                </div>
                <div class="mid">
                    <h3>
                        <table>
                            <tr>
                                <td>Name</td>
                                <td>: </td>
                                <td>${userData.name}</td>
                            </tr>
                            <tr>
                                <td>Email</td>
                                <td>: </td>
                                <td>${userData.email}</td>
                            </tr>
                            <tr>
                                <td>Role</td>
                                <td>: </td>
                                <td>${userData.role}</td>
                            </tr>
                            <tr>
                                <td>Disability</td>
                                <td>: </td>
                                <td>${userData.disability}</td>
                            </tr>
                        </table>
                    </h3>
                    <div class="sign_btn_da" style="text-align:left;">
```

```
                        <a class="btn" id="logout_btn" style="margin-right:20px;
font-size: 15px">Log out</a>
                        <a id="edit_btn" style="font-size: 15px">Edit</a>
                        </div>
                    </div>
                </div>
            </div>
        </div>`

        }else{
            location.href = "/";
        }
    }

    window.addEventListener('load', isUserLoggedIn);

    window.onload = function(){
        const logoutbtn = document.querySelector('.btn');
        logoutbtn.addEventListener('click', function logOutUser(event){
            localStorage.clear();
            location.reload();
        });
    }

</script>
</body>
</html>
```

Index.html

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <link rel="preconnect" href="https://fonts.googleapis.com">
    <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
    <link
href="https://fonts.googleapis.com/css2?family=Noto+Sans&display=swap"
rel="stylesheet">
    <link rel="preconnect" href="https://fonts.googleapis.com">
    <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
```

```
    <link
href="https://fonts.googleapis.com/css2?family=Roboto+Mono:wght@300;400;
500&display=swap" rel="stylesheet">
    <script                    src="https://kit.fontawesome.com/872673ab28.js"
crossorigin="anonymous"></script>
    <!-- CSS only -->
    <link
href="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/dist/css/bootstrap.min.css"
rel="stylesheet"                                                integrity="sha384-
Zenh87qX5JnK2Jl0vWa8Ck2rdkQ2Bzep5IDxbcnCeuOxjzrPF/et3URy9Bv1W
TRi" crossorigin="anonymous">
    <!-- JavaScript Bundle with Popper -->
    <script
src="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/dist/js/bootstrap.bundle.min.j
s"                                                              integrity="sha384-
OERcA2EqjJCMA+/3y+gxIOqMEjwtxJY7qPCqsdltbNJuaOe923+mo//f6V8Qb
sw3" crossorigin="anonymous"></script>
    <link rel="stylesheet" href="../static/index.css">
    <link rel="shortcut icon" href="../static/img/favicon_1.ico" type="image/x-
icon">

    <title>Realtime Communication System</title>
</head>
<body class="body_trans">

        <div class="nav_head">
            <div class="nav_title"><h1 style="font-weight: 600;" >Realtime
Communication System</h1></div>
            <div class="icons">
                <ul class="header-list">
                    <li          class="header-list-elements"><a          class="link-tag"
id="profile_page" href='profile'>Profile</a></li>
                    <li          class="header-list-elements"><a          class="link-tag"
href="/about">About</a></li>
                    <li          class="header-list-elements"><a          class="link-tag"
href="/home">Home</a></li>
                    <li          class="header-list-elements"><a          class="link-tag"
href="https://github.com/IBM-EPBL/IBM-Project-26558-1660029470"
target="_blank"><i class="fa-brands fa-github"></i></a></li>
                </ul>
            </div>

        </div>
```

```
<div class="home_page">

    <div class="main_page">
      <div class="main_btn">
        <div class="main_btn_head">
          <h2 style="font-size: 2.5vw; font-weight: 600; margin:40px 0px;
" >
            Realtime communication system<br>
            powered by A.I. for specially abled<br>

          </h2>
        </div>
        <div class="main_btn_msg">
          <p style="margin:0px;" >
            A sign language is a way of communicating by using the
hands and other parts of the body.
            It should not be confused with body language.Sign languages
are an important way for deaf people to communicate.
          </p>
        </div>
        <div class="main_btn_foot">
          <a href="choice" onclick="server.on_rec()">START
TRANSLATE</a>
        </div>
      </div>
      <div class="main_img">
        <img style="width:80%;" src="../static/img//sign_lang_1.png"
alt="sign lang">
      </div>
    </div>
    <!-- Main_Page -->
    <div class="main_content">

      <div class="sign_cont">
        <div class="sign_txt">
          <h1>What is sign language?</h1>
        <p>
          Sign language is manual communication commonly used by
people who are deaf.
          Sign language is not universal; people who are deaf from
different countries speak different sign languages.
```

The gestures or symbols in sign language are organized in a linguistic way.

Each individual gesture is called a sign.

Each sign has three distinct parts: the handshape, the position of the hands, and the movement of the hands.

American Sign Language (ASL) is the most commonly used sign language in the United States.

<img src="../static/img/ppl.jpg" alt="ppl">

<h1>Project Description</h1>

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.

<img src="../static/img/modelCNN.png" alt="cnn" >

```
        </div>

        <div class="slide_cont">
            <div class="slide_head">
                <h1 style="font-size: 5vw; font-weight: 600; margin:50px 0px;"
>Output Preview</h1>
            </div>
            <img src="../static/img/output.png" alt="out">

        </div>

        <div class="problem_cont">

            <img src="../static/img/deaf.jpg" alt="">

            <div class="problem_txt">
                <h1>
                    How do we solve the problem
                </h1>
                <p>
                    A translator is usually needed when an ordinary person wants
to communicate with a deaf one.
                    But with our tool we eliminate the need of dependency. We
introduce our effiecient sign language detection tool which translates in
milliseconds.
                    For prototype our tool can detect any alphabets.
                    We look forward to develop our product in future. Be sure to
check it out.
                </p>
            </div>

        </div>

        <div class="tech_cont">

            <div class="tech_txt">
                <h1 style="font-size: 5vw; font-weight: 600; margin:50px 0px"
>Technology Stack</h1>
            </div>

            <div class="tech_double_con">
```

```
                <div class="slide_main_tech">
                    <div class="carousel slide " id="banner" data-bs-ride="carousel">
                        <div class="carousel-inner">
                            <div class="carousel-item active" data-bs-interval="5000">
                                <img src="../static/img/front-end-gif.gif" class="w-100 d-block h-25">
                            </div>
                            <div class="carousel-item" data-bs-interval="5000">
                                <img src="../static/img/back-end-gif.gif" class="w-100 h-25 d-block">
                            </div>
                            <div class="carousel-item" data-bs-interval="5000">
                                <img src="../static/img/Ml.gif" class="w-100 d-block">
                            </div>
                        </div>
                        <div>
                            <button data-bs-target="#banner" data-bs-slide="prev" class="carousel-control-prev ">
                                <span class="carousel-control-prev-icon"></span>
                            </button>
                            <button data-bs-target="#banner" data-bs-slide="next" class="carousel-control-next ">
                                <span class="carousel-control-next-icon"></span>
                            </button>
                            <div class="carousel-indicators">
                                <button class="active" data-bs-slide-to="0" data-bs-target="#banner"></button>
                                <button data-bs-slide-to="1" data-bs-target="#banner"></button>
                                <button data-bs-slide-to="2" data-bs-target="#banner"></button>
                        </div>

                    </div>

                </div>

            </div>
```

```
                <div class="tech_img">
                    <br>
                    <br>
                    <br>
                    <img src="../static/img/html_icon.png" alt="HTML">
                    <img src="../static/img/css_icon.png" alt="CSS">
                    <img src="../static/img/javascript_logo.png"
alt="JAVASCRIPT">
                    <img src="../static/img/python_icon.png" style="padding:24px;"
alt="PYTHON">
                    <img src="../static/img/flask-logo.png" style="padding: 14px
10px;" alt="FLASK">
                    <img src="../static/img/tensorflow_logo.png"
style="padding:24px;" alt="TENSORFLOW">
                    <img src="../static/img/OpenCV_logo.png"
style="padding:24px;" alt="OPENCV">
                    <img src="../static/img/mediapipe.png" alt="MEDIAPIPE">
                </div>

            </div>


        </div>



    </div>


    <footer>
        <p id="copyrights" style="color: #474E68; font-size:15px; text-
align:center; margin-top:20px;"></p>
    </footer>
    <script>
        const d = new Date();
        document.getElementById("copyrights").innerHTML ="Copyright © "+
d.getFullYear();
    </script>



</body>
</html>
```

Signup.html

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <meta http-equiv="X-UA-Compatible" content="IE=edge">
   <meta name="viewport" content="width=device-width, initial-scale=1.0">
   <link
href="https://cdn.jsdelivr.net/npm/bootstrap@5.0.1/dist/css/bootstrap.min.css"
rel="stylesheet">
   <meta charset="UTF-8">
   <meta http-equiv="X-UA-Compatible" content="IE=edge">
   <meta name="viewport" content="width=device-width, initial-scale=1.0">
   <title>Sign Up</title>
   <link rel="preconnect" href="https://fonts.googleapis.com">
   <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
   <link
href="https://fonts.googleapis.com/css2?family=Noto+Sans&display=swap"
rel="stylesheet">
   <script src="https://kit.fontawesome.com/872673ab28.js"
crossorigin="anonymous"></script>
   <link
href="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/dist/css/bootstrap.min.css"
rel="stylesheet" integrity="sha384-
Zenh87qX5JnK2Jl0vWa8Ck2rdkQ2Bzep5IDxbcnCeuOxjzrPF/et3URy9Bv1W
TRi" crossorigin="anonymous">
   <link rel="stylesheet" href="../static/index.css">
   <link rel="stylesheet" href="../static/signup.css">
   <link rel="shortcut icon" href="../static/img/favicon_1.ico" type="image/x-
icon">
</head>

<body>

   <div class="nav_head" style="background: rgba(255,255,255,0.8) ;" >
      <div class="nav_title"><h1 style="font-weight: 600; margin-top:25px; "
>Realtime Communication System</h1></div>
      <div class="icons">
         <ul class="header-list">
            <!-- <li class="header-list-elements"><a class="link-tag"
id="profile_page" href='profile'>Profile</a></li> -->
            <!-- <li class="header-list-elements"><a class="link-tag"
href="/about">About</a></li> -->
```

```
            <!-- <li class="header-list-elements"><a class="link-tag"
href="/">Home</a></li> -->
            <li class="header-list-elements"><a class="link-tag"
href="https://github.com/IBM-EPBL/IBM-Project-26558-1660029470"
target="_blank"><i class="fa-brands fa-github"></i></a></li>
          </ul>
        </div>
    </div>


    <div class="container py-5">
        <div class="row">
            <div class="col-lg-5 col-md-8 mx-auto shadow rounded-5">
                <h2 class="text-center fw-bold mb-3">Sign up</h2>
                <form name="google-sheet">
                    <div id="form_alerts"></div>
                    <div class="form-group mb-3">
                        <label for="name" class="form-label">Name</label>
                        <input type="text" id="name" name="name" class="form-
control" placeholder="Enter your name" required>
                    </div>
                    <div class="form-group mb-3">
                        <label for="email" class="form-label">Email</label>
                        <input type="email" id="email" name="email" class="form-
control" placeholder="Enter your email address" required>
                    </div>
                    <div class="form-group mb-3">
                        <label for="password" class="form-label">Password</label>
                        <input type="password" id="password" name="password"
class="form-control" placeholder="Enter your password" required>
                    </div>
                    <div class="form-group mb-3">
                        <label for="inputRole" class="form-label">Role</label>
                        <!-- <textarea id="message" name="message" class="form-
control" placeholder="Enter your message" rows="5" required></textarea> -->
                        <select class="form-select" id="inputRole" name="inputRole"
aria-label="Default select example">
                            <option selected>Select</option>
                            <option value="Software Engineer">Software
Engineer</option>>
                            <option value="Student">Student</option>>
                            <option value="Teacher">Teacher</option>>
                        </select>
```

```
                </div>
                <div class="form-group mb-3">
                    <label for="inputDisability" class="form-
label">Disability</label>
                    <!-- <textarea id="message" name="message" class="form-
control" placeholder="Enter your message" rows="5" required></textarea> -->
                    <select class="form-select" id="inputDisability"
name="inputDisability" aria-label="Default select example">
                        <option value="">Select</option>>
                        <option value="Deaf">Deaf</option>>
                        <option value="Dumb">Dumb</option>>
                        <option value="Normal">Normal</option>>
                    </select>
                </div>
                <div style="text-align:center ;" >
                    <button class="an" type="submit">Sign up</button><br>
                    Already a member? <a href="/">Login</a>
                </div>
            </form>
        </div>
    </div>
</div>

<script src="https://code.jquery.com/jquery-3.6.0.min.js"></script>
<script
src="https://cdn.jsdelivr.net/npm/bootstrap@5.0.1/dist/js/bootstrap.bundle.min.j
s"></script>
<script>


    const scriptURL =
"aHR0cHM6Ly9zY3JpcHQuZ29vZ2xlLmNvbS9tYWNyb3Mvcy9BS2Z5Y2J6
M1dYSHlUSV95eXNvc1pOQm1ITnpZbVZnMWNaNHBib08zS0t1Nkx1OHd
PUHpSeTJ3b21BQVlKSVBpbEtkdWI2b0gvZXhlYw==";
    const form = document.forms['google-sheet']

    function send(){
        fetch(atob(scriptURL), { method: 'POST', body: new FormData(form)})
        .then(response => $("#form_alerts").html("<div class='alert alert-
success'>Sign up successfully.</div>"))
        .catch(error => $("#form_alerts").html("<div class='alert alert-
danger'>Details not sent.</div>"))
    }
```

```
        form.addEventListener('submit', e => {
            e.preventDefault()
            fetch(atob(scriptURL))
            .then((response) => {
                return response.json()
            })
            .then((data) => {
                var ok = 0;
                const inputEmail= document.querySelector('#email').value;
                const inputPassword = document.querySelector("#password").value;
                for(var i=1;i<data.length;i++)
                {
                    if(data[i][1] == inputEmail)
                    {
                        ok=0;
                        if(true)
                        {
                            $("#form_alerts").html("<div class='alert alert-danger'>Mail id
already exist.</div>");
                            break;
                        }
                    }
                    else{
                        console.log("Failure");
                        console.log(inputEmail);
                        ok=1;
                    }
                    }

                if(ok==1){
                    $("#form_alerts").html("<div class='alert alert-success'>Sign up
successfully</div>");
                    console.log("Failure - Final");
                    send();
                    setInterval(function(){
                        window.location.href = "/";
                    }, 1000);
                }

            })
        })
    </script>
```

```
    <footer>
        <p id="copyrights" style="color: #fff; font-size:20px; text-
align:center;"></p>
    </footer>
    <script>
        const d = new Date();
        document.getElementById("copyrights").innerHTML ="Copyright © "+
d.getFullYear();
    </script>
</body>
</html>
```

Login.html

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <link
href="https://cdn.jsdelivr.net/npm/bootstrap@5.0.1/dist/css/bootstrap.min.css"
rel="stylesheet">
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Log in</title>
    <script src="https://code.jquery.com/jquery-3.6.0.min.js"></script>
    <script
src="https://cdn.jsdelivr.net/npm/bootstrap@5.0.1/dist/js/bootstrap.bundle.min.j
s"></script>
    <link rel="preconnect" href="https://fonts.googleapis.com">
    <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
    <script src="https://cdn.jsdelivr.net/npm/drive-db"></script>
    <link
href="https://fonts.googleapis.com/css2?family=Noto+Sans&display=swap"
rel="stylesheet">
    <script src="https://kit.fontawesome.com/872673ab28.js"
crossorigin="anonymous"></script>
    <link
href="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/dist/css/bootstrap.min.css"
rel="stylesheet" integrity="sha384-
```

```
Zenh87qX5JnK2Jl0vWa8Ck2rdkQ2Bzep5IDxbcnCeuOxjzrPF/et3URy9Bv1W
TRi" crossorigin="anonymous">
   <link rel="stylesheet" href="../static/index.css">
   <link rel="stylesheet" href="../static/signup.css">
   <link rel="shortcut icon" href="../static/img/favicon_1.ico" type="image/x-
icon">
</head>

<body>

   <div class="nav_head" style="background: rgba(255,255,255,0.8) ;" >
      <div class="nav_title"><h1 style="font-weight: 600; margin-top:25px;"
>Realtime Communication System</h1></div>
      <div class="icons">
         <ul class="header-list">
            <!-- <li class="header-list-elements"><a class="link-tag"
id="profile_page" href='profile'>Profile</a></li> -->
            <!-- <li class="header-list-elements"><a class="link-tag"
href="/about">About</a></li> -->
            <!-- <li class="header-list-elements"><a class="link-tag"
href="/">Home</a></li> -->
            <li class="header-list-elements"><a class="link-tag"
href="https://github.com/IBM-EPBL/IBM-Project-26558-1660029470"
target="_blank"><i class="fa-brands fa-github"></i></a></li>
         </ul>
      </div>
   </div>


   <div class="container py-5">
      <div class="row">
         <div class="col-lg-5 col-md-8 mx-auto shadow rounded-5 ">
            <h2 class="text-center fw-bold mb-3 p-2">Log in</h2>
            <form name="google-sheet">
               <div id="form_alerts"></div>
               <div class="form-group mb-3">
                  <label for="email" class="form-label">Email</label>
                  <input type="email" id="email" name="email" class="form-
control" placeholder="Enter your email address" required>
               </div>
               <div class="form-group mb-3">
                  <label for="password" class="form-label">Password</label>
```

```
                    <input type="password" id="password" name="password"
class="form-control" placeholder="Enter your password" required>
                </div>

                <div style="text-align:center ;" >
                    <button class="an" type="submit">Login</button><br>
                    Don't have an account? <a href="/signup">Sign Up</a>
                </div>
            </form>
        </div>
    </div>
</div>

<script>

    const scriptURL =
"aHR0cHM6Ly9zY3JpcHQuZ29vZ2xlLmNvbS9tYWNyb3Mvcy9BS2Z5Y2J6
M1dYSHlUSV95eXNvc1pOQm1ITnpZbVZnMWNaNHBib08zS0t1Nkx1OHd
PUHpSeTJ3b21BQVlKSVBpbEtkdWI2b0gvZXhlYw==";
    const form = document.forms['google-sheet']
    // console.log(mail,pass)

    form.addEventListener('submit', e => {
        e.preventDefault()
        fetch(atob(scriptURL))
        .then((response) => {
            return response.json()
            // if(response.status == 200){
            //     // window.location.href = "/home"
            // }
        })
        .then((data) => {

            function storeUserInfo(i){
                const userName = data[i][0];
                const userEmail = data[i][1];
                const userRole = data[i][3];
                const userDisability = data[i][4];
                console.log(userName,userEmail,userRole,userDisability)

                if(userName == "" || userEmail== "" || userRole == "" ||
userDisability == ""  ){
                    alert("Please enter the details");
```

```
        }else{
            userInfo = {
                name: userName,
                email: userEmail,
                role: userRole,
                disability: userDisability
            }
            localStorage.setItem('isLoggedIn', true);
            localStorage.setItem('user', JSON.stringify(userInfo));
            //alert("Login Successful");
            //window.location.href = "/";
        }
    }

    var ok = 0;
    const inputEmail= document.querySelector('#email').value;
    const inputPassword = document.querySelector("#password").value;
    for(var i=1;i<data.length;i++)
    {
        if(data[i][1] == inputEmail && data[i][2] == inputPassword)
        {
            ok=0;
            storeUserInfo(i);
            if(true)
            {
                $("#form_alerts").html("<div class='alert alert-success'>Sign
in successfully.</div>");

                setInterval(function(){
                    window.location.href = "/home"
                }, 1000);
                //window.location.href = "/home"
                break;
            }
        }
        else{
            console.log("Failure");
            console.log(inputEmail);
            ok=1;
        }
        }

    if(ok==1){
```

```
                $("#form_alerts").html("<div class='alert alert-danger'>Account not found</div>");
            }

        })
    })

</script>


<footer>
    <p id="copyrights" style="color: #fff; font-size:20px; text-align:center;"></p>
</footer>
<script>
    const d = new Date();
    document.getElementById("copyrights").innerHTML ="Copyright © "+ d.getFullYear();
</script>
</body>
</html>
```

Github Link:
https://github.com/IBM-EPBL/IBM-Project-26558-1660029470
Demo Video Link:
https://drive.google.com/file/d/1aBTII-5sADSIAOHKkSq3u523AQw8FsPL/view?usp=share_link