Real Time Communication powered by AI for Specially Abled

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Industry Mentor: Divya

A Project Report Submitted in Partial fulfillment of the Requirements for the Degree of Bachelor of Engineering (Semester VII) in Electronics and Communication Engineering

PROJECT REPORT SUBMITTED BY:

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Source Code

GitHub & Project Demo Link

1.Introduction

1.1.Project 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 human understandable language so that ordinary people may understand it.

2.Literature Survey

2.1.Existing Problem

S.NO	TITLE	YEAR	AUTHOR	OBJECTIVE	TECHNIQUES	RESULT	PROBLEM
1.	"Indian Sign Language recognition"	2012	Divya Deora ,Nikesh bajaj	This represents a framework for a human –laptop interface able to spot gestures from the ISL	CNN PCA Viola-Jones face detection algorithm	Alphabets and numbers were identified successfully	It was not practical as sign language is a flow or sequence of alphabets or phrases

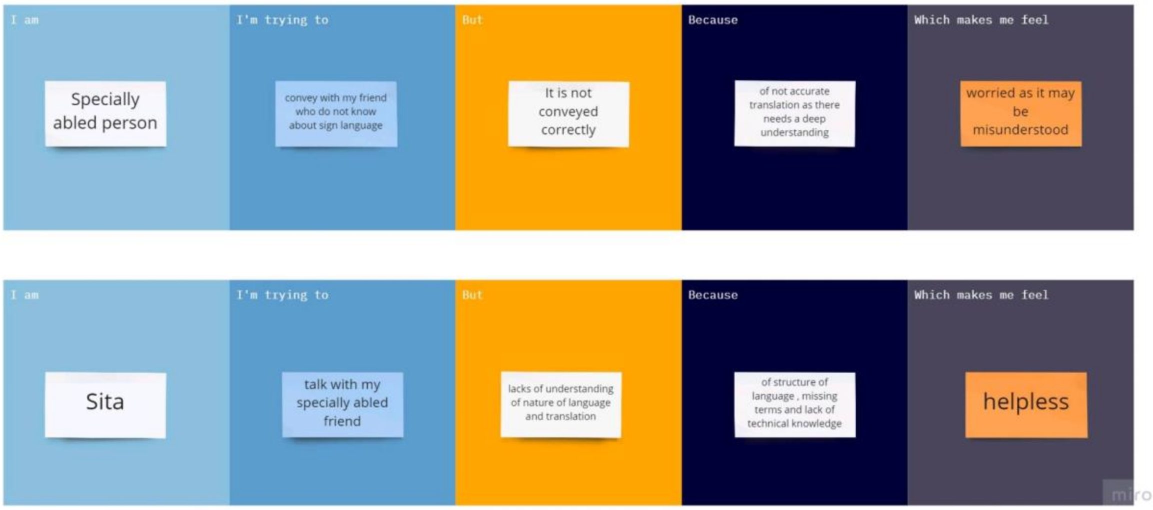
2.	“On the challenge of classifying 52 hand movements from surface electromyography”	2012	Ilja Kuzborskij , Arjan Gijsberts, Barbara Caputo	The stage of dexterity of myoelectric hand prostheses relies on volume at the characteristics illustration and next category of floor electromyographic signals .	Cross recurrence plots (CRPs) cross recurrence quantification analysis (CRQA)	This provides a contrast of diverse characteristics extraction and category strategies on a huge –scale floor electromyography database .	Inability to accurately distinguish the synchronization from methodological effects related to a rectification artifact and variation in the signal-tonoise ratio.
3.	“Real time Hand gesture recognition using the Myo armband and muscle activity detection”	2017	Macro E.benalcazar ,Cristhian Motoche , Jonathan A.zea , Andres G Jarmillo ,carlo	To present hand gesture reputation in actual time	This version takes the floor electromyography (EMG) measure at the muscle groups of the forearm through myo armband.	The result is obtained.	The proposed version can discover ways to approach any gesture of the hand through an education process.

4.	“Dynamic Hand Gesture Recognition Using 3D CNN”	2017	Mithun Channayanamath Akshay Math ,Venkat Pedigari, Shilpa Kmath, Kavita Chachadi , Faisal Sabeeh Ameen Attar	To discover Hand gestures and to gift a quick and green set of rules for classifying exceptional dynamic hand gestures in the usage of 3D – convolutional neural networks	CNN Vision based Approaches (3D model based)	Discover hand gestures .	The current conventional Answers aren’t sturdy to discover hand gestures with excessive accuracy withinside the presence of complicated styles in acting Hand gestures.

2.2.References

- Anuja V.Nair, Bindu.V, “A Review on Indian Sign Language Recognition”, International journal of computer applications.
- Archana S. Ghotkar, Rucha Khatal, Sanjana Khupase, Surbhi Asati & Mithila Hadap, “Hand Gesture Recognition for Indian Sign Language”, IEEE International Conference on Computer Communication and Informatics
- Hu Peng, “Application Research on Face Detection Technology based on OpenCV in Mobile Augmented Reality”, International Journal of Signal Processing, Image Processing and Pattern Recognition,
- J. Rekha, J. Bhattacharya, and S. Majumder, “Shape, Texture and Local Movement Hand Gesture Features for Indian Sign Language Recognition”, IEEE 3rd International Conference on Trendz in Information Sciences & Computing

2.3.Problem Statement Definition



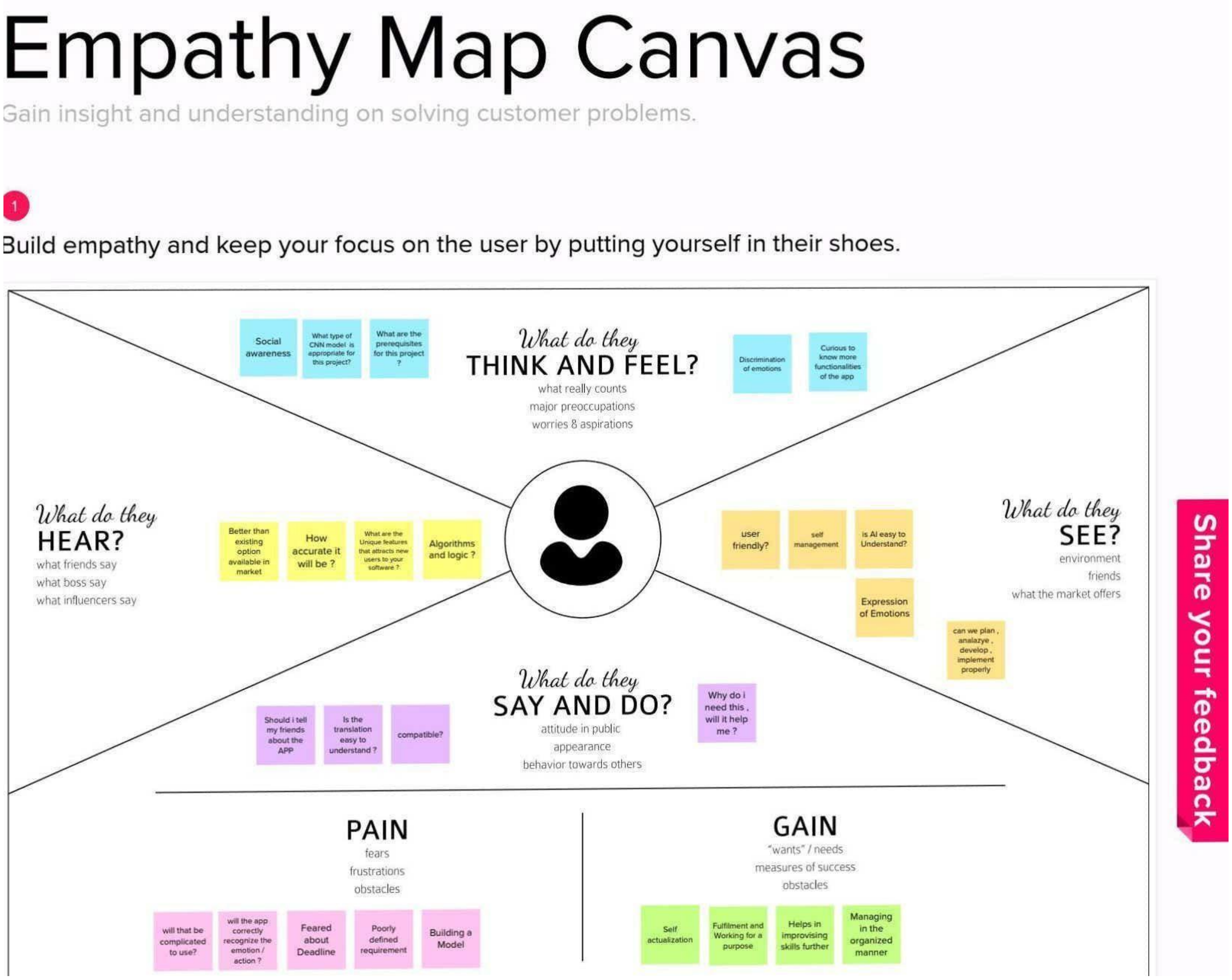
I am	I'm trying to	But	Because	Which makes me feel
Specially abled person	convey with my friend who do not know about sign language	It is not conveyed correctly	of not accurate translation as there needs a deep understanding	worried as it may be misunderstood

I am	I'm trying to	But	Because	Which makes me feel
Sita	talk with my specially abled friend	lacks of understanding of nature of language and translation	of structure of language , missing terms and lack of technical knowledge	helpless

- Communication between deaf-mute and normal people has always been a challenging task and it is very difficult for mute people to convey their message to normal people .
- 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 impaired person in any language .

3.Ideation and Proposed Solution

3.1.Empathy Map Canvas



Empathy Map Canvas

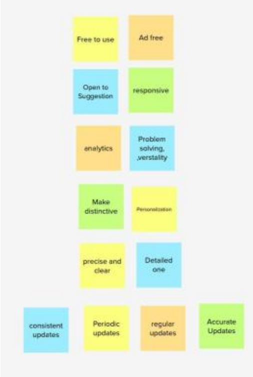
Gain insight and understanding on solving customer problems.

1

Build empathy and keep your focus on the user by putting yourself in their shoes.

What do they
THINK AND FEEL?
what really counts
major preoccupations
worries 8 aspirations
Social awareness
What type of CNN model is appropriate for this project?
What are the prerequisites for this project ?
Discrimination of emotions
Curious to know more functionalities of the app
What do they
HEAR?
what friends say
what boss say
what influencers say
Better than existing option available in market
How accurate it will be ?
What are the Unique features that attracts new users to your software ?
Algorithms and logic ?
What do they
SEE?
environment
friends
what the market offers
user friendly?
self management
is AI easy to Understand?
Expression of Emotions
can we plan , analazye , develop , implement properly
What do they
SAY AND DO?
attitude in public
appearance
behavior towards others
Should i tell my friends about the APP
Is the translation easy to understand ?
compatible?
Why do i need this , will it help me ?
PAIN
fears
frustrations
obstacles
will that be complicated to use?
will the app correctly recognize the emotion / action ?
Feared about Deadline
Poorly defined requirement
Building a Model
GAIN
"wants" / needs
measures of success
obstacles
Self actualization
Fulfilment and Working for a purpose
Helps in improvising skills further
Managing in the organized manner
Share your feedback

3.2.Ideation and Brainstorming



2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

⏱ 10 minutes

TIP

You can select a sticky note and hit the pencil [switch to sketch] icon to start drawing!

A.K.Renuha Nivetha

- user friendly
- short sentences
- precise and clear
- security and user privacy
- great UI and familiar layout
- Personalization
- Free to use
- Automatic Sort of results
- Periodic updates

S.Safiya

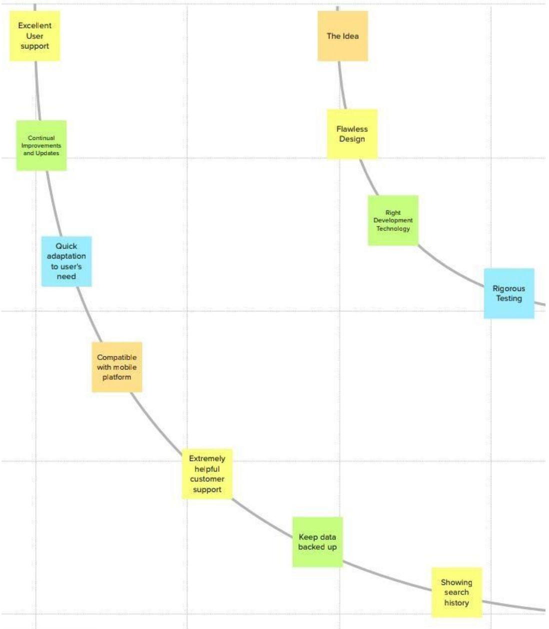
- error curable
- less interrupt of words
- facilitate communication
- Actualization
- analytics
- regular updates
- Ad free
- Easy to learn
- Good Image Resolution

M.Karthika

- frictionless navigation feature
- Ivestigative , adaptablity
- encourages user engagement
- offline work
- responsive
- fast loading time
- Show number of results in advance
- Make distinctive
- Accurate Updates

A.HaryVarsine

- Problem solving, ,verstality
- consistent color scheme
- consistent updates
- incereases listening ability
- push notifications
- understanding users insights
- Open to Suggestion
- Expeditious
- Detailed one



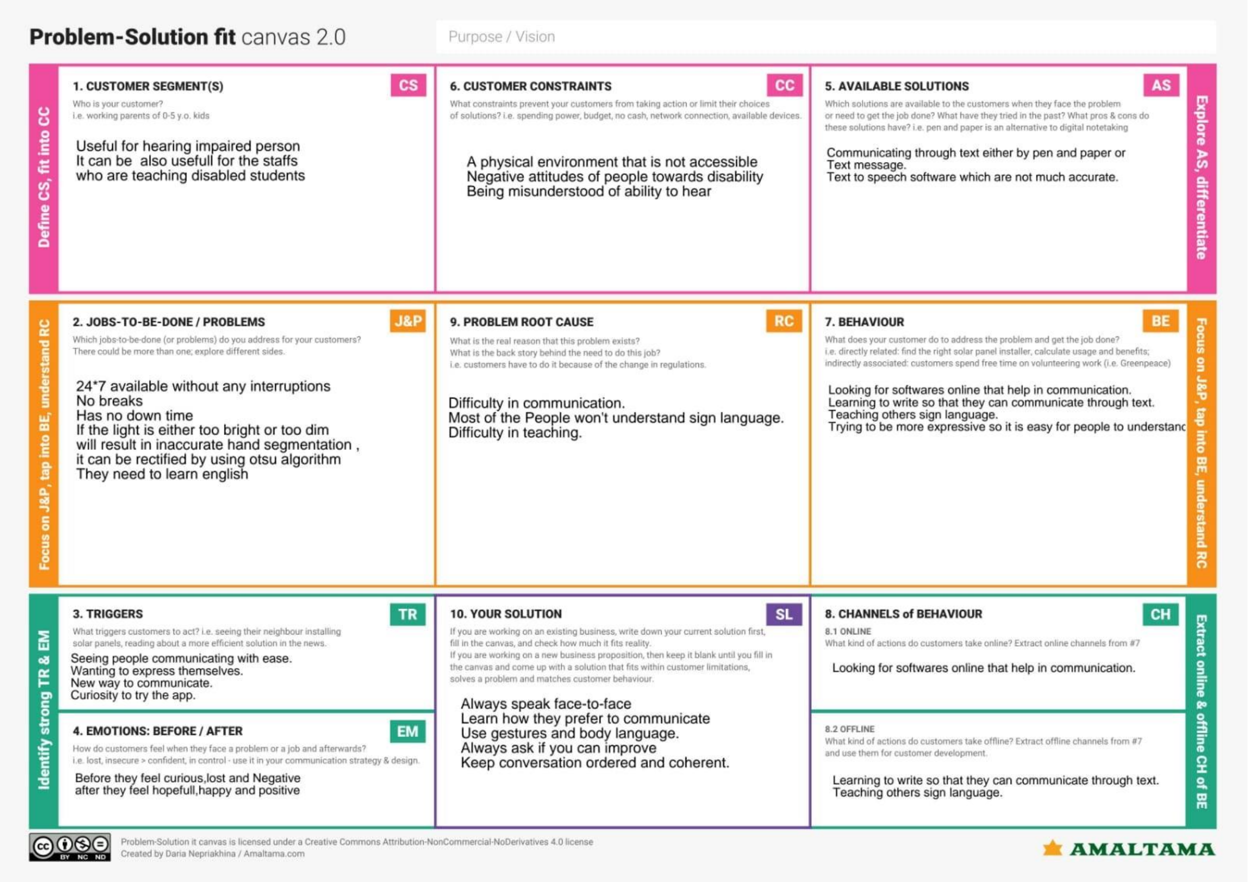
Excellent User support
Continual Improvements and Updates
Quick adaptation to user's need
Compatible with mobile platform
Extremely helpful customer support
Keep data backed up
Showing search history
The Idea
Flawless Design
Right Development Technology
Rigorous Testing

n use their
it at where
hould go on
acilitator can
ot by using
er holding the
keyboard.

3.3.Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	• Communication between specially abled people and normal person has always been a challenging task and it is very difficult for specially abled people to convey their message to normal People .
2.	Idea / Solution description	➢ An app is build by using ML and CNN to create a model that is trained on different hand gestures. ➢ By giving text input and with the help Gesture sign language equivalent and HamNoSys conversion we can use 3D avatar to read and play the converted file . ➢ For sign conversion , Pre-Processing ,Feature extraction and LDA algorithm is used for conversion.
3.	Novelty / Uniqueness	• Accuracy and simple UI • planning to inbuild a library which helps the user to learn about sign language
4.	Social Impact / Customer Satisfaction	• This is two way communication app which reduces the communication gap with the key characteristics of flexibility ,& automation. • It will be Quick adaptation to User's needs and compatible with mobile platform.
5.	Business Model (Revenue Model)	• This app provides Basic Features for free and will be easily accessible and the price will be allocated once we bring updates or new features and will collaborate with many organizations and social platforms to outspread the application .
6.	Scalability of the Solution	•By implementing this app , it enhances the communication for specially abled community and the output will be optimal for every user.

3.4.Problem Solution Fit



Problem-Solution fit canvas 2.0

Purpose / Vision

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

Who is your customer?
i.e. working parents of 0-5 y.o. kids

Useful for hearing impaired person
It can be also usefull for the staffs
who are teaching disabled students

6. CUSTOMER CONSTRAINTS CC

What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices.

A physical environment that is not accessible
Negative attitudes of people towards disability
Being misunderstood of ability to hear

5. AVAILABLE SOLUTIONS AS

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? i.e. pen and paper is an alternative to digital notetaking

Communicating through text either by pen and paper or
Text message.
Text to speech software which are not much accurate.

Explore AS, differentiate

Focus on J&P, tap into BE, understand RC

2. JOBS-TO-BE-DONE / PROBLEMS J&P

Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides.

24*7 available without any interruptions
No breaks
Has no down time
If the light is either too bright or too dim
will result in inaccurate hand segmentation ,
it can be rectified by using otsu algorithm
They need to learn english

9. PROBLEM ROOT CAUSE RC

What is the real reason that this problem exists?
What is the back story behind the need to do this job?
i.e. customers have to do it because of the change in regulations.

Difficulty in communication.
Most of the People won't understand sign language.
Difficulty in teaching.

7. BEHAVIOUR BE

What does your customer do to address the problem and get the job done?
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)

Looking for softwares online that help in communication.
Learning to write so that they can communicate through text.
Teaching others sign language.
Trying to be more expressive so it is easy for people to understanc

Focus on J&P, tap into BE, understand RC

Identify strong TR & EM

3. TRIGGERS TR

What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news.

Seeing people communicating with ease.
Wanting to express themselves.
New way to communicate.
Curiosity to try the app.

4. EMOTIONS: BEFORE / AFTER EM

How do customers feel when they face a problem or a job and afterwards?
i.e. lost, insecure > confident, in control - use it in your communication strategy & design.

Before they feel curious,lost and Negative
after they feel hopefull,happy and positive

10. YOUR SOLUTION SL

If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality.
If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour.

Always speak face-to-face
Learn how they prefer to communicate
Use gestures and body language.
Always ask if you can improve
Keep conversation ordered and coherent.

8. CHANNELS of BEHAVIOUR CH

8.1 ONLINE
What kind of actions do customers take online? Extract online channels from #7

Looking for softwares online that help in communication.

8.2 OFFLINE
What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development.

Learning to write so that they can communicate through text.
Teaching others sign language.

Extract online & offline CH of BE

AMALTAMA

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
FR-2	User confirmation	Confirmation via Email Confirmation via OTP
FR-3	Chat box	Available for 24*7 can able to report the problem directly
FR-4	Image Analyzing	Image analyzing through otsu algorithm
FR-5	Inbuilt libraries	Teaching about sign language.

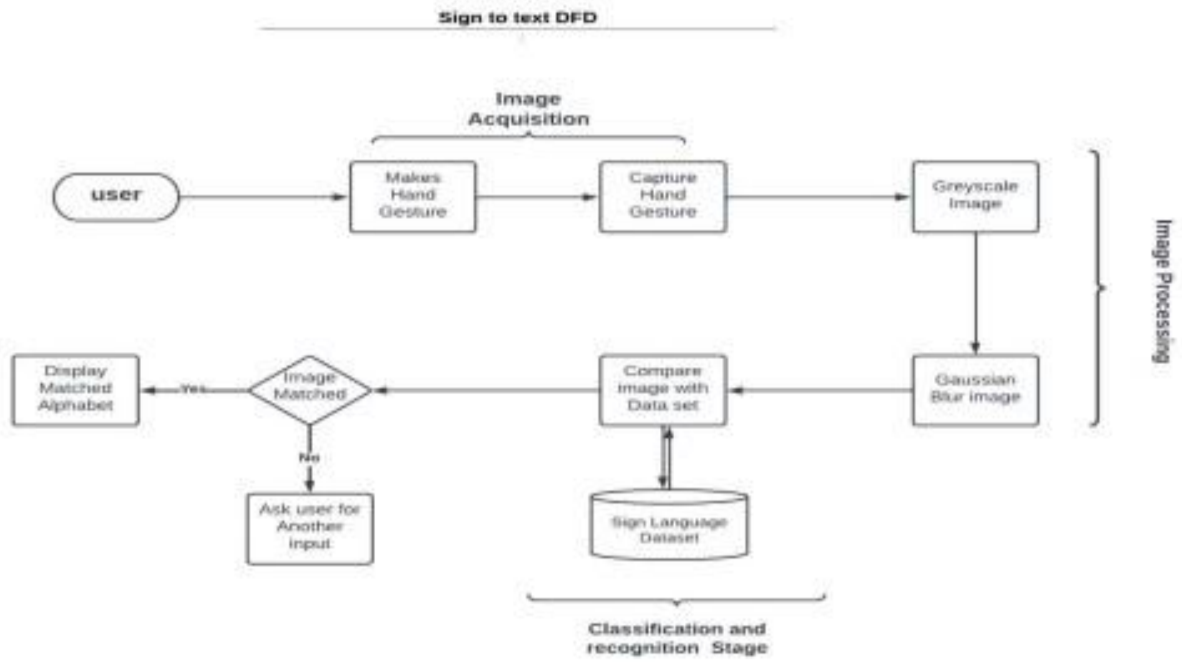
4.2.Non-Functional Requirements

FR No.	Non-Functional Requirement	Description

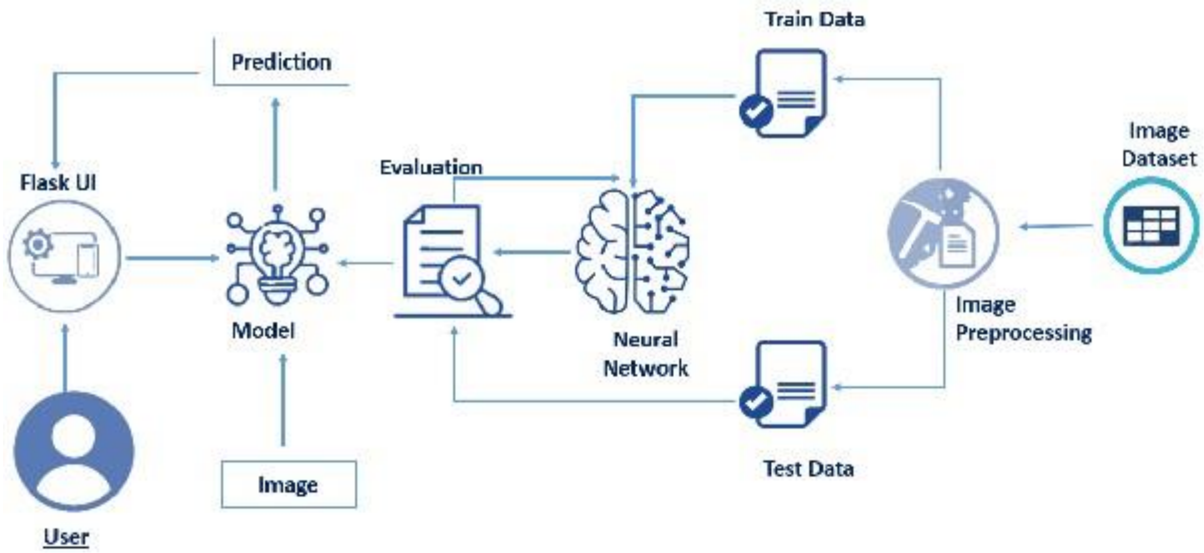
NFR-1	**Usability**	Creating an online platform that acts as a source for both the normal user and disabled people.
NFR-2	**Security**	The admin will handle the information given by the user and only authenticated users are able to change the data.
NFR-3	**Reliability**	An intimation given to the user if the wrong data was provided by the user.
NFR-4	**Performance**	This application will help the user in a better and latest manner.
NFR-5	**Availability**	User wants to communicate an information to the person to whom they want to communicate
NFR-6	**Scalability**	More users will use the application at the same time.

5.Project Design

5.1.Data Flow Diagrams



5.2.Solution and Technical Architecture



5.3.User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
User With Speech Disorder/ Any user	Web cam Permission	USN-1	As a User ,I am Able to View My Hand Signs on the Screen After Allowing the Webcam permission	I can access my camera and app functionality	High	Sprint-1
	Making Correct Hand Signs	USN-2	As a User, After Making Correct Hand Signs I am able to see the Matching alphabet with my hand sign	Correct Hand Signs Are Needed to match with	High	Sprint-1

6.Project Planning and Scheduling

6.1.Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User story Number	User Story / Task	Story Points	Priori ty	Team Members

Sprint-1	Download data set	USN-1	The data is downloaded from the Kaggle website and then the data set is classified into training and testing images.	10	High	A.K.Renuha Nivetha
Sprint-1	Image preprocessing	USN-1	In Image processing technique the first step is usually importing the	10	High	A.K.Renuha Nivetha S.Safiya M.Karthika A.HaryVarsine

			libraries that will be needed in the program. Import Keras library from that library and import the ImageDataGenerator Library to your Python script. The next step is defining the arguments for the ImageDataGenerator . Here the arguments which we are given inside the image data generator class are, rescale, shear_range, rotation range of image, and zoom range that we can consider for images. The next step is applying				
			the ImageDataGenerator arguments to the train and test dataset.				

Sprint-2	Training image	USN-2	In this training phase the ImageDataGenerator argu -ments is applied to the training images and the model is tested with several images and the model is saved.	20	High	A.K.Renuha Nivetha M.Karthika S.Safiya A.Haryvarsine
Sprint-3	Testing image	USN-3	In this testing phase the Image processing techniques is applied to the testing images and executed for prediction.	20	High	A.K.Renuha Nivetha S.Safiya M.Karthika A.HaryVarsine
Sprint-4	Evaluation metrics and accuracy	USN-4	In this phase the result, prediction, accuracy, and performance of the project are tested.	20	High	A.K.Renuha Nivetha M.Karthika S.Safiya A.Haryvarsine

MILESTONE & ACTIVITY LIST:

Activity Number	Activity Name	Detailed Activity Description	Task Assigned	Status
1.1	Access Resources	Access the resources(courses)in the project dashboard.	All Members	COMPLETED
1.2	Rocket chat registration	Join the mentoring channel via platform & rocket-chat mobile app.	All Members	COMPLETED
1.3	Access workspace	Access the guided project workspace.	All Members	COMPLETED
1.4	IBM Cloud registration	Register on IBM Academic Initiative & Apply Feature code for IBM Cloud Credits.	All Members	COMPLETED

1.5	Project Repository Creation	Create GitHub account & Collaborate with Project Repository in project workspace.	All Members	COMPLETED
1.6	Environment Setup	Set-up the Laptop / Computers Based on the prerequisites for each technology track.	All Members	COMPLETED
2.1	Literature survey	Literature survey on the selected project & Information Gathering.	All Members	COMPLETED
2.2	Technology Training	Attend the technology trainings as Per the training Calendar.	All Members	COMPLETED
2.3	Empathy Map	Prepare Empathy Map Canvas to capture the user Pains & Gains, Prepare list of problem statements	All Members	COMPLETED
2.4	Technology Training	Attend the technology trainings as Per the training Calendar.	All Members	COMPLETED
2.5	Brainstorming	List the ideas (at least 4 per each team member) by organizing the brainstorm session and prioritize the ideas	All Members	COMPLETED
2.6	Technology Training	Attend the technology trainings as Per the training Calendar.	All Members	COMPLETED
3.1	Proposed Solution Document	Prepare the proposed solution document, which includes the novelty, feasibility of idea, business model, social impact, scalability of solution, etc.	All Members	COMPLETED
3.2	Technology Training	Attend the technology trainings as per the training Calendar.	All Members	COMPLETED

3.3	Problem - Solution fit & Solution Architecture	Prepare problem - solution fit document & Solution Architecture.	All Members	COMPLETED
3.4	Technology Training	Attend the technology trainings as per the training Calendar.	All Members	COMPLETED
4.1	Customer Journey Map	Prepare the customer journey maps to understand the user interactions & experiences with the application (entry to exit).	All Members	COMPLETED
4.2	Technology Training	Attend the technology trainings as per the training Calendar.	All Members	COMPLETED
4.3	Functional Requirements& Data Flow Diagrams	Prepare The Functional Requirement Document & DataFlow Diagrams.	All Members	COMPLETED
4.4	Technology Architecture	Prepare Technology Architecture of the solution.	All Members	COMPLETED
4.5	Technology Training	Attend the technology trainings as per the training Calendar.	All Members	COMPLETED
5.1	Milestone & Activity List	Prepare Milestone & Activity List.	All Members	COMPLETED
5.2	Sprint Delivery Plan	Prepare Sprint Delivery Plan.	All Members	COMPLETED
6	Data Collection	Collect datasets from different open sources likekaggle.com, data.gov, UCI machine learning repository, etc.	All Members	COMPLETED

7.1	Image Preprocessing	Importing the Image	All Members	COMPLETED

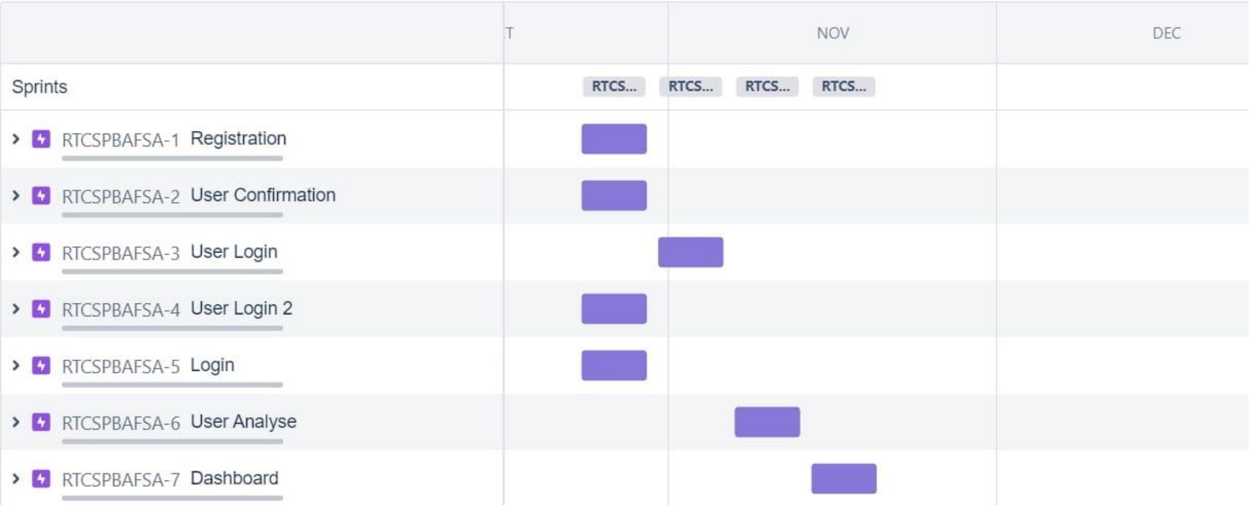
		DataGenerator Library		
7.2	Image Preprocessing	Define the parameters/arguments for ImageDataGenerator class.	All Members	COMPLETED
7.3	Image Preprocessing	Applying ImageDataGenerator functionality to trainset and test set.	All Members	COMPLETED

8.1	Model Building	Importing the model building libraries.	All Members	COMPLETED
8.2	Model Building	Initializing the model.	All Members	COMPLETED
8.3	Model Building	Adding CNN Layers.	All Members	COMPLETED
8.4	Model Building	Adding Dense Layers	All Members	COMPLETED
8.5	Model Building	Configuring the learning process	All Members	COMPLETED
8.6	Model Building	Training the Model	All Members	COMPLETED
8.7	Model Building	Save the model	All Members	COMPLETED
8.8	Model Building	Predictions	All Members	COMPLETED
9.1	Test the model	OpenCV for video processing.	All Members	COMPLETED
9.2	Application Building	Creating an account in Twilio service.	All Members	COMPLETED
9.3	Train CNN Model on IBM	Register for IBM Cloud	All Members	COMPLETED
9.31	Train CNN Model on IBM	Train Image Classification Model	All Members	COMPLETED

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



RTCSPBAFSA-1	Registration
RTCSPBAFSA-2	User Confirmation
RTCSPBAFSA-3	User Login
RTCSPBAFSA-4	User Login 2
RTCSPBAFSA-5	Login
RTCSPBAFSA-6	User Analyse
RTCSPBAFSA-7	Dashboard

7.Coding and Solutioning(Explain the features added in the project along with the code)

7.1.Feature 1

1.IMAGE DATA GENERATOR

Keras ImageDataGenerator is used for getting the input of the original data and further, it makes the transformation of this data on a random basis and gives the output containing only the data that is newly transformed. It does not add the data.from keras.preprocessing.image import ImageDataGenerator

2.PARAMETRES

2.1.Rescale:

The ImageDataGenerator class can be used to rescale pixel values from the range of 0-255 to the range 0-1 preferred for neural network models. Scaling data to the range of 0-1 is traditionally referred to as normalization.

2.2.Shear Range:

Shear range means that the image will be distorted along an axis, mostly to create or rectify the perception angles. It's usually used to augment images so that computers can see how humans see things from different angles.

2.3.Rotation range:

ImageDataGenerator class allows you to randomly rotate images through any degree between 0 and 360 by providing an integer value in the rotation_range argument. When the image is rotated, some pixels will move outside the image and leave an empty area that needs to be filled in.

2.4.Zoom Range:

The zoom augmentation method is used to zoom the image. This method randomly zooms the image either by zooming in or it adds some pixels around the image to enlarge the image. This method uses the zoom_range argument of the ImageDataGenerator class. We can specify the percentage value of the zooms either in a float range in the form of an array.

2.5.Horizontal Flip:

Horizontal flip basically flips both rows and columns horizontally. So for this, we have to pass the horizontal_flip=True argument in the ImageDataGenerator constructor.

3.CONVOLUTION NEURAL NETWORK:

A CNN is a kind of network architecture for deep learning algorithms and is specifically used for image recognition and tasks that involve the processing of pixel data. There are other types of neural networks in deep learning, but for identifying and recognizing objects, CNNs are the network architecture of choice. The layers used in the CNN algorithm are Convolutional ,maxpooling, and flatten layers.

3.1.Convolutional Layer:

A convolutional layer is the main building block of a CNN. It contains a set of filters (or kernels), parameters of which are to be learned throughout the training. The size of the filters is usually smaller than the actual image. Each filter convolves with the image

Convolution layer is used for image processing to blur and sharpen images, but also to perform other operations.from keras.layers import Convolution2D

3.2.Maxpooling Layer:

Max pooling is a pooling operation that selects the maximum element from the region of the feature map covered by the filter.from keras.layers import MaxPooling2D

3.4.Flatten Layer:

Flattening is used to convert all the resultant 2-Dimensional arrays from pooled feature maps into a single long continuous linear vector. The flattened matrix is fed as input to the fully connected layer to classify the image.from keras.layers import Flatten

4.DENSE LAYER:

Dense Layer is used to classify images based on output from convolutional layers.

7.2.Feature 2

Importing Keras libraries import

keras.preprocessing.image import ImageDataGenerator

Importing ImageDataGenerator from Keras

```
train_datagen=ImageDataGenerator(rescale=1./255,shear_range=0.2,rotation_rang
e=180,zoom_r ange=0.2,horizontal_flip=True)
test_datagen=ImageDataGenerator(rescale=1./255,shear_range=0.2,rotation_range
=180,zoom_ra nge=0.2,horizontal_flip=True)
```

Applying ImageDataGenerator functionality to train dataset

```
x_train= train_datagen.flow_from_directory('dataset/training_set', target_size=(64,64),
         batch_size=300,class_mode='categorical', color_mode = "grayscale")
```

```
x_test= test_datagen.flow_from_directory('dataset/test_set', target_size=(64,64),
        batch_size=300,class_mode='categorical', color_mode = "grayscale")
```

Importing Model Building Libraries

#to define the linear Initialization import

sequential from keras.models import

Sequential

#to add layers import

Dense from

keras.layers import

Dense

#to create Convolutional kernel import

convolution2D from keras.layers import

Convolution2D

```
#import Maxpooling layer
from keras.layers import
MaxPooling2D #import flatten
layer from keras.layers
import Flatten
```

Initializing the model

```
model = Sequential()
```

Adding CNN Layers

```
model.add(Convolution2D(32,(3,3),input_shape=(64,64,3),activ
ation='relu')) #add maxpooling layers
model.add(MaxPooling2D(pool_si ze=(2,2))) #add faltten layer
model.add(Flatten())
```

Add Dense layers

```
model.add(Dense(units=512, activation='relu'))


 model.add(Dense(units=9,
     activation='softmax'))
```

compiling the model

```
model.compile(loss='categorical_crossentropy', optimizer='adam',
metrics=['accuracy'])
```

Fit and Save the model

```
model.fit_generator(x_train, steps_per_epoch=24, epochs=10,
validation_data=x_test, validation_steps=40)
#steps_per_epoch = no. of train images//batch size model.save('aslpng1.h5')
```

Test the model

```
  #import the packages and
     load the saved model
    Fromkeras.modelsimport
load_model import numpy
as np import cv2
model=load_model(‘aslpng1.h5)
```

Pre-Process and Prediction

```
  from skimage.transform import resize
     def detect(frame):
            img = resize(frame,(64,64,1)) img
            = np.expand_dims(img,axis=0)
            if(np.max(img)>1):
                  img = img/255.0
            prediction = model.predict(img)
            print(prediction)
            prediction = model.predict_classes(img)
            print(prediction)


      frame = cv2.imread(r"C:\Users\Renu Alwar\Project\dataset\test_set\I\1.png")
      data = detect(frame)
```

Flask Application

Load the required packages

```
import numpy as np import cv2 import os from
keras.models import load_model from flask import
Flask, render_template, Response from
tensorflow.keras.models import Sequential import
tensorflow as tf from gtts import gTTS global graph
global writer from skimage.transform import resize
```

Initialize the graph , load the model

```
# graph=tf.get_default_graph() graph=
tf.compat.v1.get_default_graph() writer
= None model =
load_model('aslpng1.h5')
vals = ['A', 'B', 'C', 'D', 'E', 'F', 'G', 'H', 'I']
vs = cv2.VideoCapture(0)
pred = " "



app = Flask(__name__)
print("[INFO] accessing video stream...")Configure the home page

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

Predictions

```
def detect(frame):
    img = resize(frame,(64,64,1))
    img = np.expand_dims(img,axis=0)
    if(np.max(img)>1):
        img = img/255.0
    with graph.as_default(): prediction =
            model.predict_classes(img)
    print(prediction)
    pred=vals[prediction[0]]
    print(pred)
    return pred
```

Calling video feed from HTML page

```
@app.route('/video feed')
def video_feed():
        return Response(gen(), mimetype='multipart/x-mixed-
              replace; boundary=frame')
        if __name__ == '__main__':
        app.run(host='0.0.0.0', debug=True,use_reloader=False)
```

Building the HTML page

```
   <!DOCTYPE html>
   <html lang="en">

    <head>
    <meta charset="utf-8">
     <meta name="viewport" content="width=device-width, initial-scale=1.0, shrink-to-
fit=no">
      <title>SmartBridge_WebApp_VideoTemplate</title>
       <link rel="stylesheet"  href=
"https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/css/bootstrap.min.css">
       < link rel="stylesheet"
href="https://use.fontawesome.com/releases/v5.12.0/css/all.css">
        <link rel="stylesheet" href="static/css/Banner-Heading-Image.css">
         <link rel="stylesheet" href="static/css/Navbar-Centered-Brand.css">
          <link rel="stylesheet" href="static/css/styles.css">
           </head>
<body style="background: rgb(39,43,48);">
       <nav class="navbar navbar-light navbar-expand-md py-3" style="background:
                                                  #212529;">
   <div class="container">
       <div></div><a class="navbar-brand d-flex align-items-center" href="#"><span
      class="bs-icon-sm bs-icon-rounded bs-icon-primary d-flex justify-content-center
      align-items-center me-2 bs-icon"><i>
    class="fas fa-flask"></i></span><span style="color: rgb(255,255,255);">Real-Time
                                                Communication
                  System Powered By AI&nbsp;For Specially Abled</span></a>
    <div></div>
    </div>
    </nav>
    <section>
  <div class="d-flex flex-column justify-content-center align-items-center"> <div
           class="d-flex flex-column justify-content-center align-items-center"
           id="div-video-feed"
       style="width: 640px;height: 480px;margin: 10px;min-height: 480px;min-width:
             640px;border-radius: 10px;border: 4px dashed rgb(255,255,255) ;">
             <img src="{{ url_for('video_feed') }}" style="width: 100%;height:
                                 100%;color:rgb(255,255,255); text-
   align: center;font-size: 20px;" alt="Camera Access Not
   Provided!"> </div>
  </div>

    <div class="d-flex flex-column justify-content-center align-items-center"
    style="margin-bottom: 10px;"><button
```

```
                class="btn btn-info" type="button" data-bs-target="#modal-1" data-bs-
toggle="modal">Quick Reference
                -<strong> ASL Alphabets</strong></button></div>
    </section>
    <section>
        <div class="container">
            <div class="accordion text-white" role="tablist" id="accordion-1">
                <div class="accordion-item" style="background: rgb(33,37,41);">
                    <!-- <h2 class="accordion-header" role="tab"><button
class="accordion-button" data-bs-toggle="collapse"
                            data-bs-target="#accordion-1 .item-1" aria-expanded="true" aria-
                            controls="accordion-1 .item-1"
                            style="background: rgb(39,43,48);color: rgb(255,255,255);">About
The Project</button></h2> -->
                    <div class="accordion-collapse collapse show item-1" role="tabpanel"
data-bs-parent="#accordion-1">
                        <!-- <div class="accordion-body">
                            <p class="mb-0">Artificial Intelligence has made it possible to
handle our daily activities
                                in new and simpler ways. With the ability to automate tasks that
normally require human
                                intelligence, such as speech and voice recognition, visual
perception, predictive text
                                functionality, decision-making, and a variety of other tasks, AI
can assist people with
                                disabilities by significantly improving their ability to get around
and participate in
                                daily activities.<br><br>Currently, Sign Recognition is available
<strong>only for
                                    alphabets A-I</strong> and not for J-Z, since J-Z alphabets
also require Gesture
                                Recognition for them to be able to be predicted correctly to a
certain degree of
                                accuracy.</p>
                        </div> -->
                    </div>
                </div>
div class="accordion-item" style="background: rgb(33,37,41);">
```

```
                    <h2 class="accordion-header" role="tab"><button class="accordion-button
collapsed"
                            data-bs-toggle="collapse" data-bs-target="#accordion-1 .item-2"
aria-expanded="false"
                            aria-controls="accordion-1 .item-2"
                            style="background: rgb(39,43,48);color: rgb(231,241,255);">Developed
By</button></h2>
                    <div class="accordion-collapse collapse item-2" role="tabpanel"
data-bs-parent="#accordion-1">
                        <div class="accordion-body">
                            <p class="mb-0">
                            <br><br>1.<strong>A.K.Renuha Nivetha</strong><br>2.
                                <strong>M.Karthika</strong><br>3. <strong>S.Safiya</strong><br>
                                <strong>A.Haryvarsine</strong>
                            </p>
                        </div>
                    </div>
                </div>
            </div>
        </div>

</section>
    <div class="modal fade" role="dialog" tabindex="-1" id="modal-1">
        <div class="modal-dialog" role="document">
            <div class="modal-content">
                <div class="modal-header">
                    <h4 class="modal-title">American Sign Language - Alphabets</h4><button
type="button"
                        class="btn-close" data-bs-dismiss="modal" aria-label="Close"></button>
   </div>
   <div class="modal-body"><img src="{{ url_for('static', filename='img/ASL_Alphabets.png') }}"
                                                            width="100%"></div>
                <div class="modal-footer"><button class="btn btn-secondary" type="button" data-bs-
                        dismiss="modal">Close</button></div>
            </div>
        </div>
    </div>
    <script
src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/js/bootstrap.bundle.min.js"></script>
</body>
   </html>
```

Train CNN Model on IBM

```
!pip install watson-machine-learning-client --upgrade
from ibm_watson_machine_learning import APIClient
wml_credentials = {
    "url": "https://us-south.ml.cloud.ibm.com",
    "apikey": "bo7jwrTNIcq_BpNESKVEVjLn9Ccs7xi6YhUGiapVImDt"
}
client = APIClient(wml_credentials)
```

Save to Deployment Space

```
def guid_from_space_name(client, space_name):
    space = client.spaces.get_details()
    return (next(item for item in space['resources'] if item['entity']["name"] ==
space_name)['metadata']['id'])
]:
space_uid = guid_from_space_name(client, 'SignLanguageDetection')
print("Space UID : ", space_uid) client.set.default_space(space_uid)
 client.software_specifications.list()
software_spec_uid = client.software_specifications.get_uid_by_name("tensorflow_rt22.1-py3.9")
 software_spec_uid
model_details = client.repository.store_model(model='IBM_TrainedModel.tgz', meta_props={
    client.repository.ModelMetaNames.NAME: "CNN",
    client.repository.ModelMetaNames.SOFTWARE_SPEC_UID:
 software_spec_uid, client.repository.ModelMetaNames.TYPE: "tensorflow_2.7"})
 model_id = client.repository.get_model_uid(model_details) model_id
```

Successfully Downloaded Trained Model

```
client.repository.download('829d4f20-bfcd-4681-826f-12d6eff4c26f','TrainModel.tgz')
```

8.Testing

8.1.Test Cases

Test case ID	Feature Type	Cornponent	Test Scenario	Pre-Requisite	Steps TO Execute	Test Data	Expected Result	Actual Result	Statu	Commnets	TC for Automation(Y/N)	BUG ID	Executed By
TC 001	Functional	Web Cam Detection	Verify user is able to access web cam from the app		1 Click on the App icon 2.Wait untill the app loads 3.Check whether web cam is used for n detection		Web cam turns on when the app opens	Working as expected	Pass				
TC_002	Functional	Hand Sign Detection	Verify that the Hand sign is detected		1 Make Handsigns That are in Dataset 2.Wait untill the Hand sign is matched with data set 3.Success if we get the desired al habet		Hand Sign gets detected	Working as expected	Pass	The Background must be blank so that the Hand signs are dear			

	Test Scenarios
1	Verify user is able to access camera
2	Verify Whether Handsigns are detected or not

8.2.User Acceptance Testing

Purpose of Document

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	Subtotal
By Design	2	0	0	0	3
Duplicate	0	0	0	0	0
External	0	1	0	0	1
Fixed	3	1	0	0	4
Not Reproduced	0	0	0	0	0
Skipped	0	0	0	0	0
Won't Fix	0	0	0	0	0
Totals	6	1	0	0	0

Test Case Analysis

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

Section	Total Cases	Not Tested	Fail	Pass
Client Application	2	0	0	2
Print Engine	5	0	0	5
Security	0	0	0	0

Version Control	2	0	0	2
Final Report Output	1	0	0	0

9.Result

9.1.Performance Metrics

S.No.	Parameter	Values
1.	Model Summary	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.
2..	Accuracy	Training Accuracy -0.9976 Validation Accuracy -0.7

10.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 theyrequire 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, butthat 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 the 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

https://drive.google.com/drive/folders/1PY8s54Py052Jaf9sCMXXHs8zoVLR0Qg0?usp=share_link

Github link https://github.com/IBM-EPBL/IBM-Project-10252-1659152713

Project Demo link
https://drive.google.com/file/d/1uS7ILuxXQ6PvaxyZx2ZT9ByfXlGNPlge/vi ew?usp=share_link