REAL TIME COMMUNICATION FOR SPECIALLY ABLED PEPOLE

TEAM ID - PNT2022TMID42209

REAL TIME COMMUNICATION FOR SPECIALLY ABLED PEPOLE

NALAIYA THIRAN PROJECT BASED LEARNING ON PROFESSIONAL READLINESS FOR INNOVATION, EMPLOYNMENT AND ENTERPRENEURSHIP

A PROJECT REPORT

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1.INTRODUCTION

1.1 Project Overview

Category: Artificial Intelligence

Team ID : PNT2022TMID42209

Project Description:

The goal of this project was to build a neural network able to classify which letter of the American Sign Language(ASL) alphabet is being signed, given an image of a signing hand. This project is a first step towards building a possible sign language translator, which can take communications in sign language and translate them into written and oral language. Such a translator would greatly lower the barrier for many deaf and mute individuals to be able to better communicate with others in day to day interactions. This goal is further motivated by the isolation that is felt within the deaf community. Loneliness and depression exists in higher rates among the deaf population, especially when they are immersed in a hearing world . Most research implementations for this task have used depth maps generated by depth camera and high resolution images. The objective of this project was to see if neural networks are able to classify signed ASL letters using simple images of hands taken with a personal device such as a laptop webcam.

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 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.

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

A literature survey or a literature review in a project report is that section which shows the various analyses and research made in the field of your interest and the results already published, taking into account the various parameters of the project and the extent of the project. It is the most important part of your report as it gives you a direction in the area of your research. It helps you set a goal for your analysis - thus giving you your problem statement.

2.1 Existing problem

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.

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. References

TITLE: Innovative study of an AI voice based smart device to assist deaf people
AUTHOR: Dhaya Sindhu Battina
YEAR: 2021

Assistive technology consists of a wide range of hardware and software tools that enable a person to receive information in the format that suits their needs best. These Various technology may be available to the deaf.many items, including cochlear implants, loop systems,accessibility,FM technology and assistive listening devices,visual warning systems, videophones, and much more . Recognizing the worth and boundaries of different assistive devices can be advantageous for both.Artificial intelligence (AI) enables computers to learn from existing experiences, adapt to new information, and perform tasks that are similar to those carried out by humans . The vast majority of artificial intelligence applications that users know of today – ranging from chess playing robots to self-driving vehicles – are primarily reliant on deep learning and computational linguistics.Computers may be taught to do particular jobs by 2.1 Existing Problem 2.2 References processing huge quantities of data and detecting trends in the data. This is accomplished via the use of various technologies.

TITLE:Communication system for deaf and dumb people
AUTHOR: Shraddha R. Ghorpade, Prof. Surendra K. Waghmare2
YEAR: 2019

People with disabilities are having a difficult time keeping up with the rapidly evolving technology, which is one of the major issues that our society is dealing with. For those with disabilities, having access to communication tools has become crucial. typically deaf and stupid people use sign language to communicate, but they struggle to do so with non-sign language users language. Information is the main topic of

communication between normal and deaf individuals using sign language, which is expressive and natural. So that we can converse with them and comprehend what they're saying, we need a translation. A language translation technology converts common sign language into voice, enabling regular people to communicate with one another. When it comes to communicating with other people,sign language (SL) is the primary method of communication for hearing-impaired individuals and other groups. It is conveyed via both manual (body and hand movements) and non-manual (face expressions) characteristics. All of these characteristics are combined to create utterances that communicate the meaning of words or statements.

2.3. Problem Statement Definition

Communication is the only medium by which we can share our thoughts or convey the message but communications between deaf-mute and a normal person has always ben 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.

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

Definition:

An empathy map canvas is a more in-depth version of the original empathy map, which helps identify and describe the user's needs and pain points. And this is valuable information for improving the user experience. An empathy map canvas helps brands provide a better experience for users by helping teams understand the perspectives and mindset of their customers. Using a template to create an empathy map canvas reduces the preparation time and standardizes the process so you create empathy map canvases of similar quality.

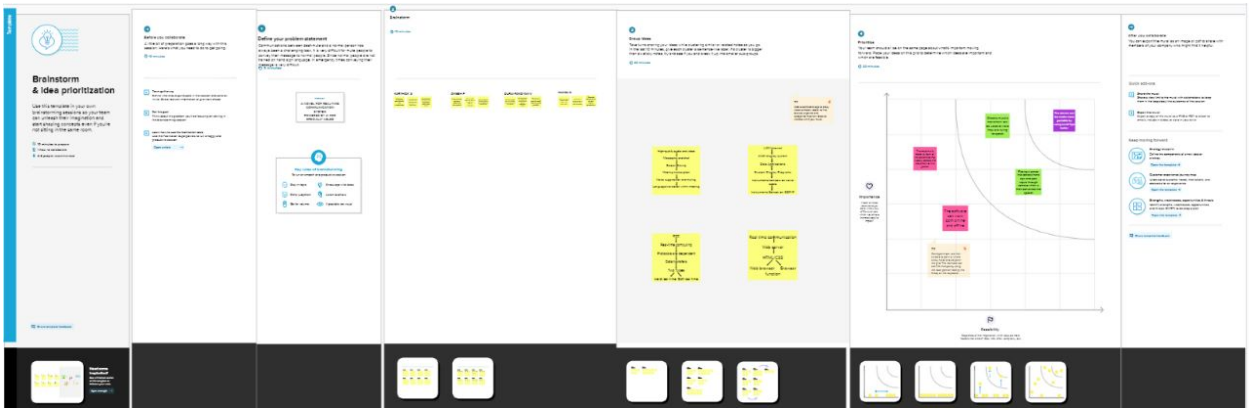
3.1 Empathy Map Canvas

3.2 Idea on & Brainstorming

Definition:

Brainstorming provides a free and open environment that encourages everyone within

a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich number of creative solutions.



3.3 Proposed solution :

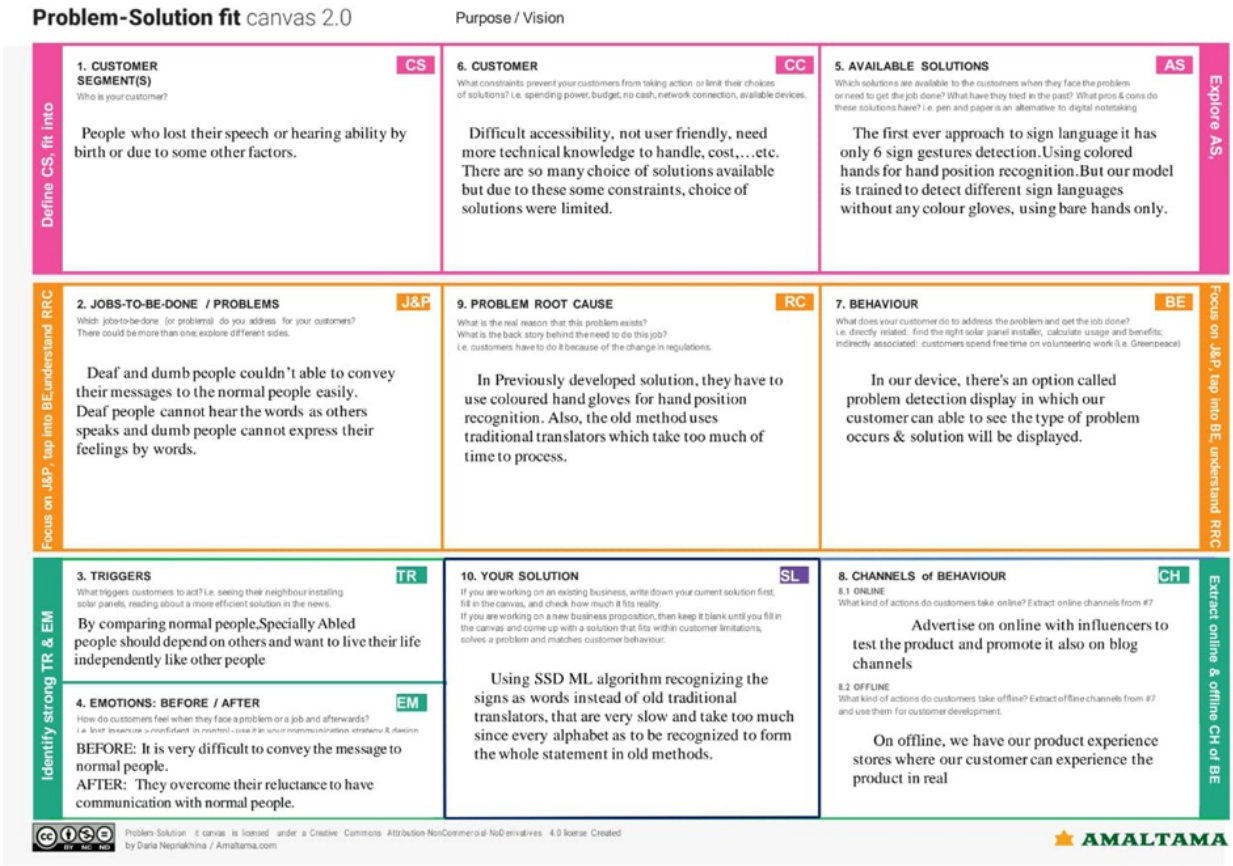
S.No	Parameter	Description
1.	Problem Statement (Problem to be solved)	Deaf and dumbpeople couldn't able tocommunicate with the normalpeople easily.
2.	Idea/Solution description	A real time ML based system is built for the real timesign language detection with a Tensor Flow object detection
3.	Novelty/Uniqueness	This model using SSD ML algorithm recognizing the signs as words insteadof old traditional translators, that arevery slow and taketoomuch since every alphabet as tobe recognized to form the whole statement in old methods.

4.	Social Impact/Customer satisfaction	It drastically reduce communication difference gapbetween normal peopleand specially abledpeople with the help of AI.So they can live their life independently.
5.	Business Model (RevenueModel)	We use freemium business revenue model for making revenue. In our device, we give most of the basic featuresfor free of charge butthey have to pay if they need more advanced features.
6.	Scalability of the Solution	The model which is TensorFlow model that hasbeen used can be replaced with another modelas well. The same system can be implemented for differentsign languages by substituting the dataset.

3.4.Problem solution fit :

Definition :

The Problem-Solution Fit simply means that you have found a problem with your customer and that the solution you have realized for it actually solves the customer's problem.



4.1 Functional requirements :

FR No.	Functional Requirement	Sub Requirements
FR-1	**User Registration**	Registration throughForm Registration through Gmail.
FR-2	**User confirmation**	Confirmationvia Email Confirmation via OTP
FR-3	**System**	Desktop with highresolution camera
FR-4	**Authorization Levels**	There are two levelsof authorization namelystandard access leveland advanced accesslevel.
FR-5	**External interface**	Ethernet, Wi-Fi,USB to provideinternet facility to access the resources withreal timecommunication.

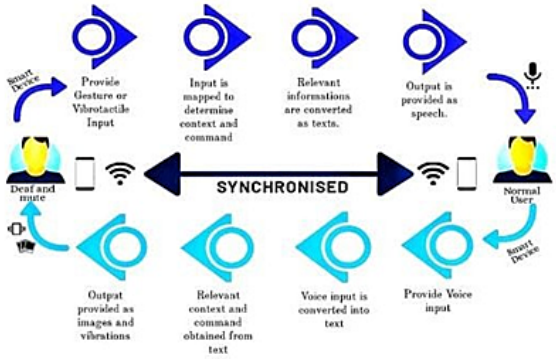
FR-6	**Reporting**	If anyissues foundin the application, automatically it will be notified to the developer.

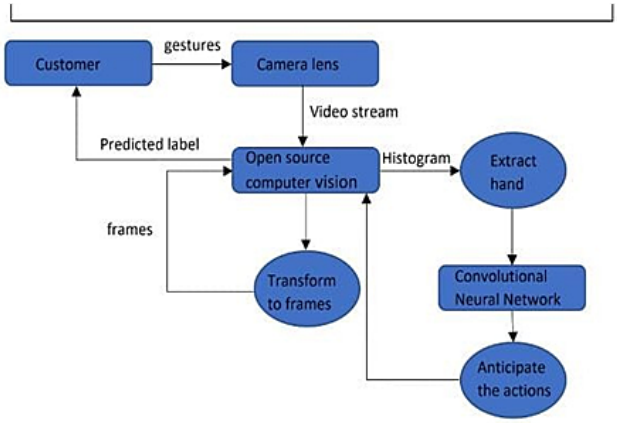
4.2 Non-functional requirements :

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	To conveya message to normal people,as well asconvert speechinto understandable sign language for the deaf and dumbpeople.
NFR-2	**Security**	Converted information usingsigns intospeech is accessed onlyby the user.
NFR-3	**Reliability**	Provides insight into potential issuesfor desktop applications on managed devices.
NFR-4	**Performance**	The timefor converting signsinto speech shouldbe faster forthe real timecommunication.
NFR-5	**Availability**	Provides automatic recovery as muchas possible.
NFR-6	**Scalability**	This app enables deaf and dumb people to convey their information using signs whichget converted tohuman-understandable language and speechis given as output.

5.1 Data flow diagram :

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



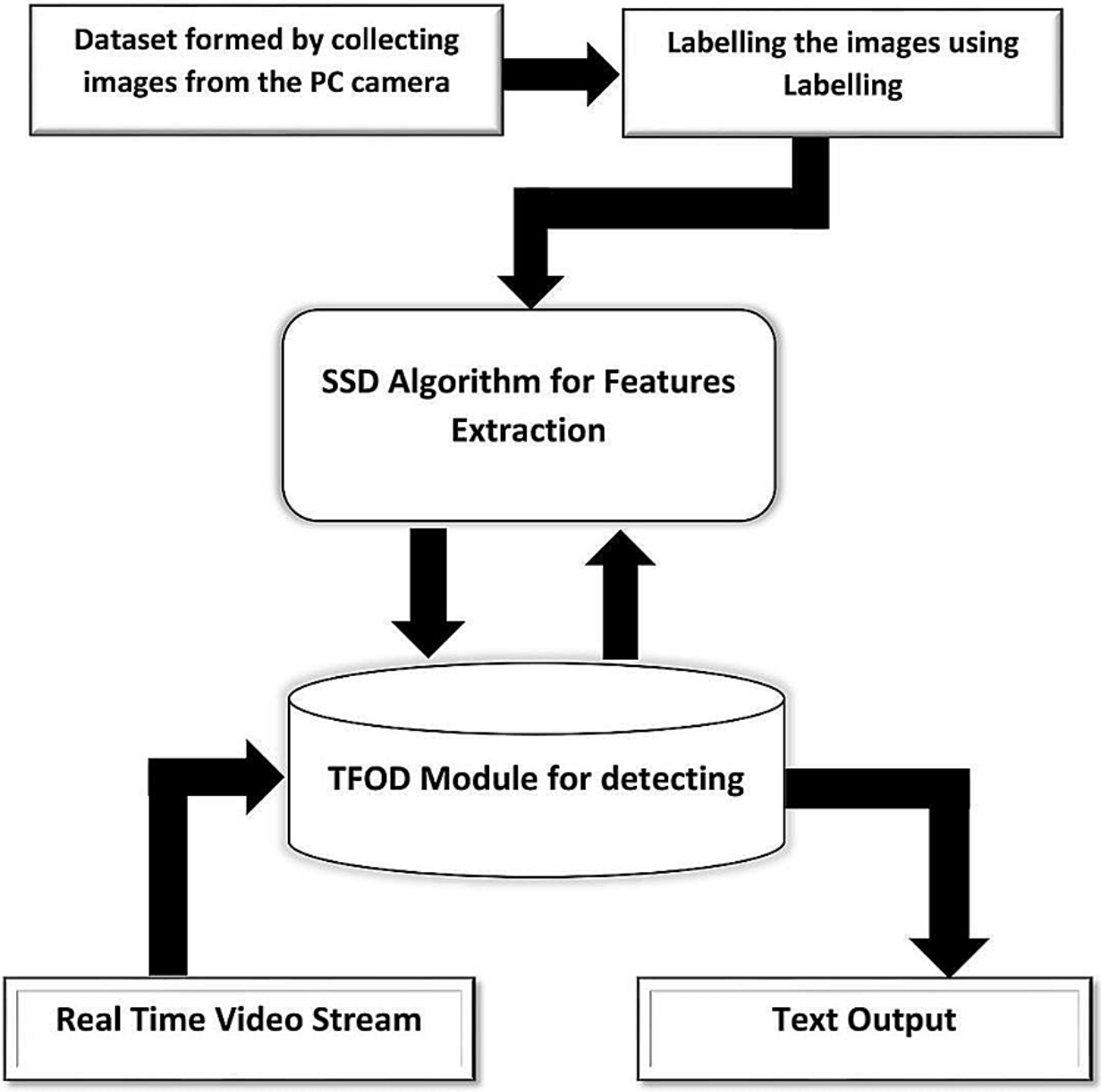


5.2 Solution and techhnical architecture :

Solution architecture is a complex process – with many sub-processes – that bridges the gapbetween businessproblems and technology solutions. Its goals are to:

- Find the best tech solution to solve existing business problems.
- Describe the structure, characteristics, behaviour, and other aspects of the software to project stakeholders.
- Define features, development phases, and solution requirements.
- Provide specifications according to whichthe solution is defined, managed, and delivered.

Solution Architecture Diagram



SYSTEM ARCHITECTURE

Technology Stack (Architecture & Stack):

Technical Architecture:

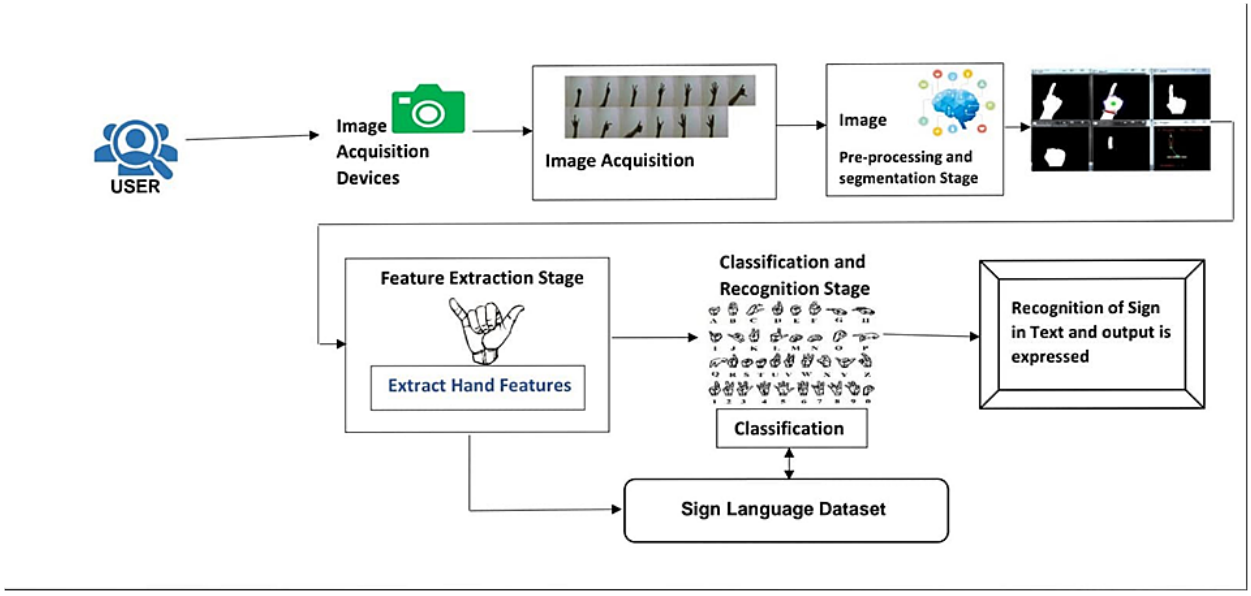


Table-1 Components and Technologies:

S.NO	Component	Description	Technology
1.	User Interface	Customer have to login through theirrespectivewebsite or phonenumber. Then interaction willhappen withthe User interface.	javascript, CSS,HTML
2.	Application Logic-1	It requires various types libraries,frameworks todevelop the project	Java / Python
3.	Application Logic-2	Helps to converting the human gestures/actionsinto written words.	Machine learning
4.	Application Logic-3	Provides helpful,feasibleanswers afterrecognising thehuman gestures.	ANN,CNN
5.	Database	Data couldbe numbers or words.	MySQL, Rational database

6.	Cloud Database	Providing customer to use hostdatabase withoutbuyingadditional hardware..	Deep learning and neuralnetworks
7.	File Storage	File storagecould be fast,reliable and flexible..	Local filesystem
8.	ExternalAPI-1	Used to accessthe information in the cloud	Weather API
9.	ExternalAPI-2	Used to access the information fordata drivendecision making...	Aadhar API
10.	MachineLearning Model	Machine learning interact with variousalgorithmsthat are required for implementation.	Image acquisation
11.	Infrastructure (Server /Cloud)	Application deployment on local system /localcloud serverconfiguration. Install the windowsversion and execute theinstaller..	Local, Cloud Foundry, Kubernetes, etc.

Table-2: Application Characteristics:

S. No	Characteristics	Description	Technology
1.	Open-Source Frameworks	The framework whichare used.	Tensor flow, Theano, RNN, PyTorch
2.	Security Implementations	Security controls which can implemented by usingfirewall..	Firewall and somesecurity related softwares..
3.	Scalable Architecture	The architecture willbe scalable (Micro services).	Data, models, speedand consistency..
4.	Availability	The availablity of application (use of loadbalancers, distributed servers etc)	Image recognition, sign/gestures recognition, text recognition & real time captioning..

5.	Performance	Design aspects for the performance of application (number of requests persecond, use of cacheetc..,	Using Convolutional neural network, maching learning for conversation and improve the sensivity of the performance..

5.3 User Stories :

User Type	Functional Requirement(Epic)	User Story Number	User Story/ Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As customer, I couldable to register for theapp by entering my E-mail and proper password.	I could able to access myregistered account.	High	Sprint 1
		USN-2	As a user, I'll get theacknowledgement verification emailonce after my registrationhasbeen donefor theapp	I can get verification emailand clickok to confirm it..	High	Sprint 1
		USN-3	As a customer, I could able to register for application via their official websites and social media.	I could able to register and access my account by usingtheirwebsite &socialmedia.	Medim	Sprint 2
		USN-4	As a customer, I could able to register for application through Gmail	via some thirdparties link	Low	Sprint 2

	Login	USN-5	As a customer, I could able to login intoapplication by entering alreadyregistered email and password	I can type manually and alsocan used saved logincredentials	High	Sprint 1

	Dashboard	USN- 6	As a customer,I canget all services andhelp in dashboard	I can access my dashboardand change profile	Medium	Sprint 2
Customer (Webuser)	Registration	USN-7	As a customer, I couldable to login throughregistered phone numberby usingotp instead of Gmail	I could able to register & loginvia phone numberto access my account	High	Sprint 2
Customer Care Executive	Service	USN-8	Can avail the serviceby calling customer care or reaching through E-mail.	Can avail the service by calling customer care or reaching throughE-mail.	Medium	Sprint 1
Administrator		USN-9	Respective personinthe companyshould take careall of this.	All the requirements arethere.	High	Sprint 2
	Sign up	USN-10	Customer have tosign-up to use thesethings andall	Have to enter validcreden tials.	High	Sprint 2

User Type	Functional Requirement(Epic)	User Story Number	User Story/ Task	Acceptance criteria	Priority	Release
	Wish list	USN-11	Customer's desiredchoices to availthese services.	As a customer can reviewand choose theirservices ashewant/preferred.	Medium	Sprint 1
	Enrollment	USN-12	Now, customer can avail all services oncehe/she enrolled.	As a customer, it'squiteenchanting	Medium	Sprint 2

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint planning and 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.	5	High	Karthik S Dinesh P Durai Pandiyan V Manoj C
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application.	5	High	Karthik S Dinesh P Durai Pandiyan V Manoj C
Sprint-1		USN-3	As a user, I can register for the application through Gmail.	5	Medium	Karthik S Dinesh P Durai Pandiyan V Manoj C
Sprint-1	Login	USN-4	As a user, I can log into the application by entering email & password.	5	High	Karthik S Dinesh P Durai Pandiyan V Manoj C
Sprint-2	Data Collection	USN-5	Collecting the Required Dataset.	10	High	Karthik S

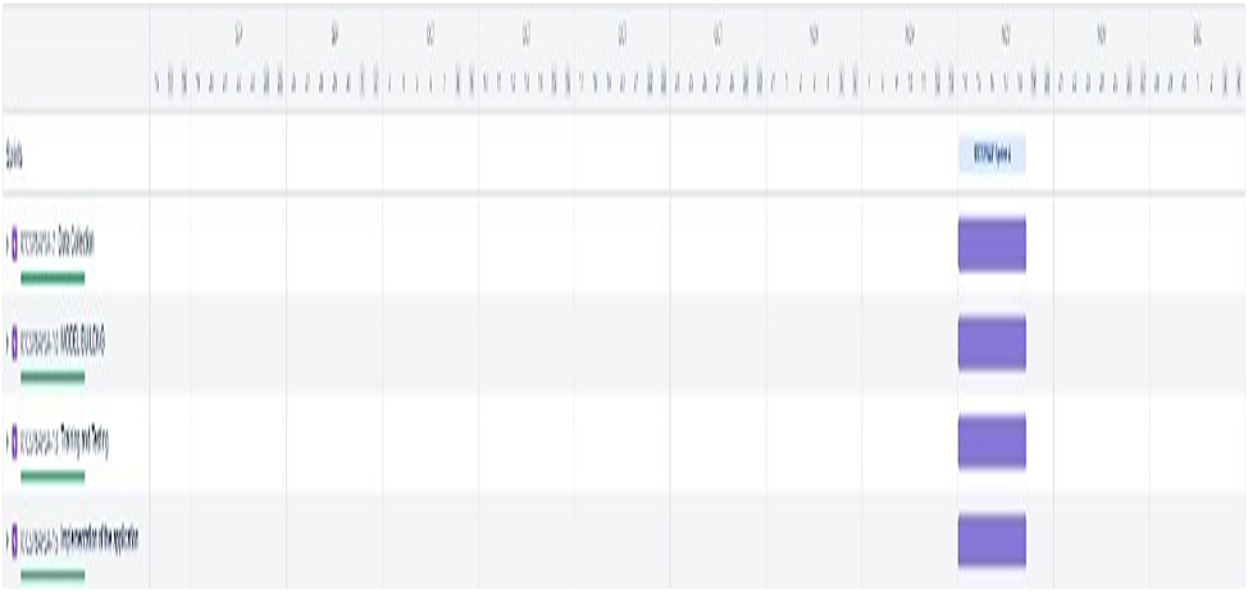
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-2	Data cleaning and Image Preprocessing	USN-6	Perform the image preprocessing techniques on the dataset.	10	High	Karthik S Dinesh P Durai Pandiyan V Manoj C
Sprint-3	Model Building	USN-7	Model Initialization with required layers.	10	High	Karthik S Dinesh P Durai Pandiyan V Manoj C
Sprint-3	Training	USN-8	Training the image classification model using the Neural Network.	10	High	Karthik S Dinesh P Durai Pandiyan V Manoj C
Sprint-4	Testing	USN-9	Testing the Model's Performance.	10	High	Karthik S Dinesh P Durai Pandiyan V Manoj C
Sprint-4	Deployment of model in Web / App	USN-10	Deploying the Tested Model	10	Medium	Karthik S Dinesh P Durai Pandiyan V Manoj C

6.2 Sprint Delivery schedule :

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint EndDate (Planned)	Story Points Completed (ason PlannedEnd Date)	Sprint Release Date(Actual)
Sprint-1	10	6 Days	24 Oct 2022	29 Oct 2022	8	29 Oct 2022
Sprint-2	10	6 Days	31 Oct 2022	04 Nov 2022	5	04 Nov 2022
Sprint-3	10	6 Days	07 Nov 2022	11 Nov 2022	7	11 Nov 2022
Sprint-4	10	6 Days	14 Nov 2022	18 Nov 2022	5	18 Nov 2022

6.3 Reports from JIVA :

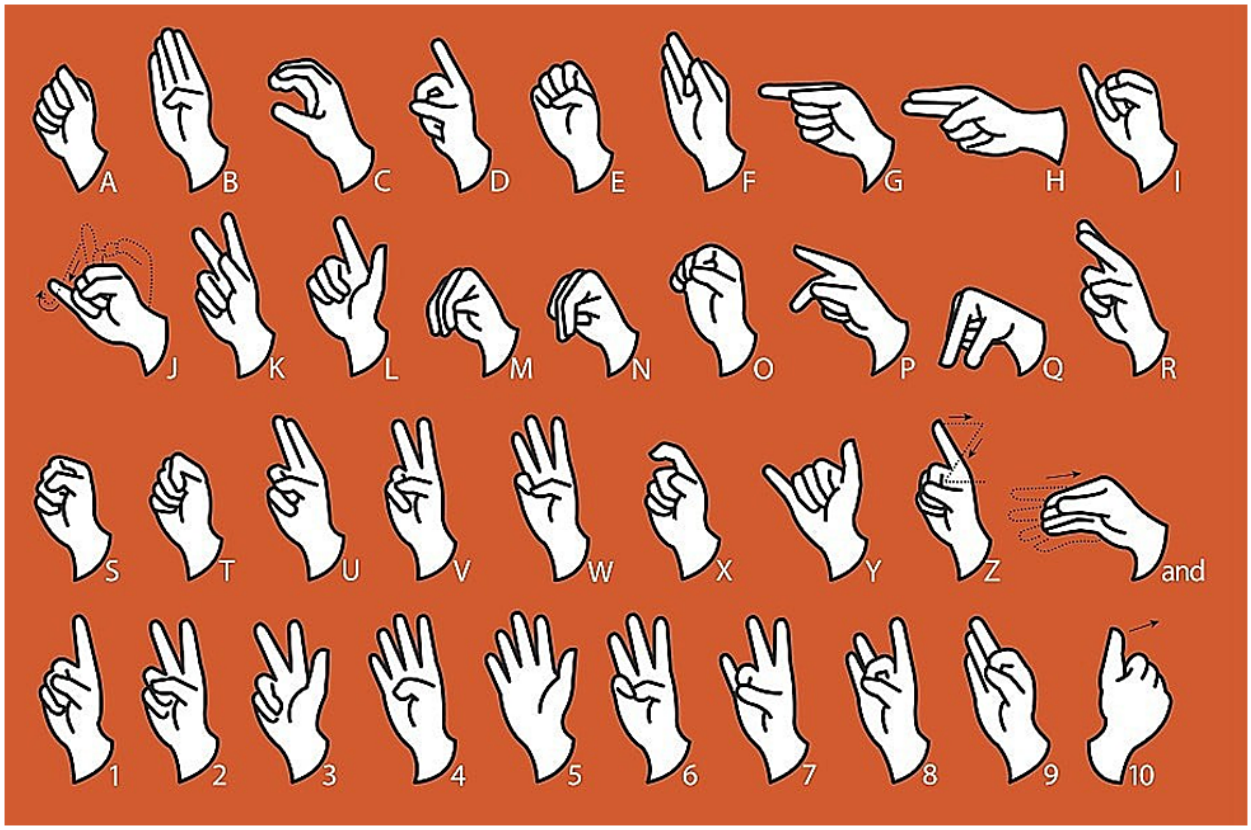
Jira helps teams plan, assign, track, report, and manage work and brings teams together for everything from agile softwaredevelopment and customersupport to start-upsand enterprises. Software teams build better with Jira Software, the #1 tool for agile teams.As a Jira administrator, you can create project categories so your team can view work across related projects in one place. Your team can use categories in advanced search, filters, reports,and more.



7.Coding and Solution :

7.1 FEATURE :

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



MODEL BUILDING

MODEL BUILDING

In [5]:
```
from keras.models import Sequential
from keras.layers import Dense
from keras.layers import Convolution2D
from tensorflow.keras.layers import Conv2D, MaxPooling2D
from keras.layers import Dropout
from keras.layers import Flatten
```

In [6]:
```
model=Sequential()
```

In [7]:
```
model.add(Convolution2D(32,(3,3), input_shape=(64,64,1), activation = 'relu'))
```

In [8]:
```
model.add(MaxPooling2D(pool_size=(2,2)))
```

In [9]:
```
model.add(Flatten())
```

In [14]:
```
model.add(Dense( units=512, activation='relu'))
```

In [15]:
```
model.add(Dense(units=9, activation='softmax'))
```

In [16]:
```
model.compile(loss='categorical_crossentropy', optimizer='adam', metrics=['accuracy'])
```

In [17]:
```
model.fit_generator(x_train, steps_per_epoch=24, epochs=10, validation_data=x_test,validation_steps=40)
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1: UserWarning: `Model.fit_generator` is deprecated and will be removed in a future versi
on. Please use `Model.fit`, which supports generators.
  """Entry point for launching an IPython kernel.
Epoch 1/10
24/24 [==============================] - 17s 666ms/step - loss: 1.9786 - accuracy: 0.5628
Epoch 2/10
24/24 [==============================] - 16s 662ms/step - loss: 1.4525 - accuracy: 0.6621
Epoch 3/10
24/24 [==============================] - 16s 676ms/step - loss: 0.9580 - accuracy: 0.6842
Epoch 4/10
24/24 [==============================] - 16s 675ms/step - loss: 0.7076 - accuracy: 0.7240
Epoch 5/10
24/24 [==============================] - 16s 659ms/step - loss: 0.6103 - accuracy: 0.7488
Epoch 6/10
24/24 [==============================] - 16s 663ms/step - loss: 0.5005 - accuracy: 0.8054
Epoch 7/10
24/24 [==============================] - 17s 679ms/step - loss: 0.4164 - accuracy: 0.8904
Epoch 8/10
24/24 [==============================] - 18s 723ms/step - loss: 0.3408 - accuracy: 0.8994
Epoch 9/10
24/24 [==============================] - 16s 659ms/step - loss: 0.2641 - accuracy: 0.9536
Epoch 10/10
24/24 [==============================] - 16s 664ms/step - loss: 0.1676 - accuracy: 0.9672
```

Out[17]:

In [18]:
```
model.save('RSL.h5')
```

7.2 Test the model :

Test the data :

TRAIN AND TEST THE DATA

In [2]:
```
from keras.preprocessing.image import ImageDataGenerator
train_datagen=ImageDataGenerator(rescale = 1./255, shear_range=0.2, zoom_range=0.2,horizontal_flip=True)
test_datagen = ImageDataGenerator(rescale=1./255)
```

In [3]:
```
x_train = train_datagen.flow_from_directory("/content/Dataset/training_set", target_size=(64,64),batch_size=300,
                                            class_mode='categorical', color_mode ="grayscale")
```

```
Found 15750 images belonging to 9 classes.
```

In [4]:
```
x_test = test_datagen.flow_from_directory("/content/Dataset/test_set", target_size=(64,64),batch_size=300,
                                          class_mode='categorical', color_mode ="grayscale")
```

```
Found 2250 images belonging to 9 classes.
```

8. TESTING

8.1 Test cases :

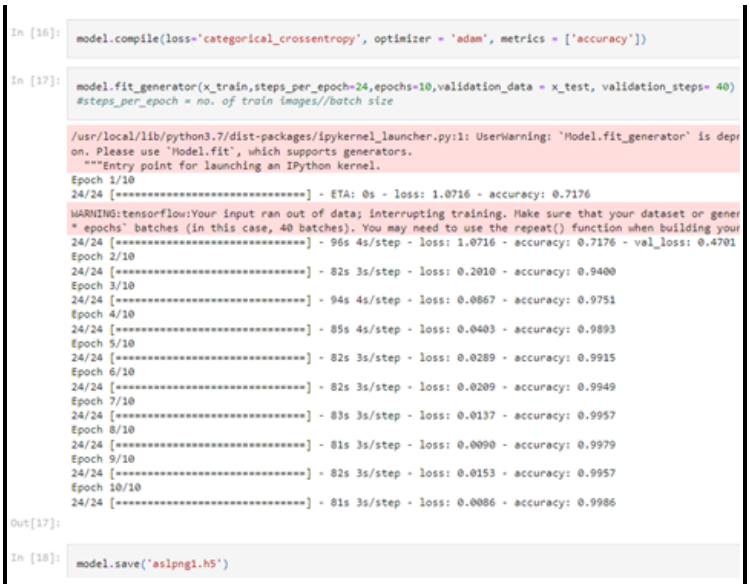
- Our code was testedon various angle to check whether it gives the correct output.
- To satisfy the customer's expectations we tested it fully

8.2 User Acceptance Testing (UAR) :

Our projectwas tested by an end user to verify that it has working correctly.

S.No.	Parameter	Values	Screenshot
1	Model Summary		

```
In [5]: x_test = test_datagen.flow_from_directory('/content/Dataset/test_set',target_size=(64,64),batch_size=300,class_mode='categorical',color_mode="grayscal

Found 2250 images belonging to 9 classes.

In [6]: from keras.models import Sequential
        from keras.layers import Dense
        from keras.layers import Convolution2D
        from keras.layers import MaxPooling2D
        from keras.layers import Dropout
        from keras.layers import Flatten

In [9]: model = Sequential()

In [11]: model.add(Convolution2D(32,(3,3),input_shape=(64,64,1), activation='relu'))
         #no. of feature detectors, size of feature detector, image size, activation function

In [12]: model.add(MaxPooling2D(pool_size=(2,2)))

In [13]: model.add(Flatten())

In [14]: model.add(Dense(units=512, activation = 'relu'))

In [15]: model.add(Dense(units=9,  activation = 'softmax'))

In [16]: model.compile(loss='categorical_crossentropy', optimizer = 'adam', metrics = ['accuracy'])
```

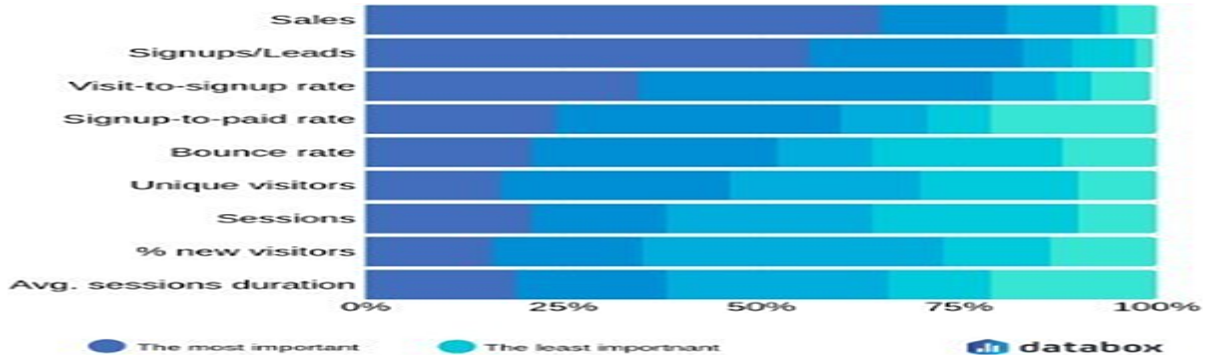
2	Accuracy	Training Accuracy –99.6% Validation Accuracy –98.3%	

```
In [16]: model.compile(loss='categorical_crossentropy', optimizer = 'adam', metrics = ['accuracy'])

In [17]: 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

/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1: UserWarning: `Model.fit_generator` is depr
on. Please use `Model.fit`, which supports generators.
  """Entry point for launching an IPython kernel.
Epoch 1/10
24/24 [==============================] - ETA: 0s - loss: 1.0716 - accuracy: 0.7176
WARNING:tensorflow:Your input ran out of data; interrupting training. Make sure that your dataset or gener
* epochs` batches (in this case, 40 batches). You may need to use the repeat() function when building your
24/24 [==============================] - 96s 4s/step - loss: 1.0716 - accuracy: 0.7176 - val_loss: 0.4701
Epoch 2/10
24/24 [==============================] - 82s 3s/step - loss: 0.2010 - accuracy: 0.9400
Epoch 3/10
24/24 [==============================] - 94s 4s/step - loss: 0.0867 - accuracy: 0.9751
Epoch 4/10
24/24 [==============================] - 85s 4s/step - loss: 0.0403 - accuracy: 0.9893
Epoch 5/10
24/24 [==============================] - 82s 3s/step - loss: 0.0289 - accuracy: 0.9915
Epoch 6/10
24/24 [==============================] - 82s 3s/step - loss: 0.0209 - accuracy: 0.9949
Epoch 7/10
24/24 [==============================] - 83s 3s/step - loss: 0.0137 - accuracy: 0.9957
Epoch 8/10
24/24 [==============================] - 81s 3s/step - loss: 0.0090 - accuracy: 0.9979
Epoch 9/10
24/24 [==============================] - 82s 3s/step - loss: 0.0153 - accuracy: 0.9957
Epoch 10/10
24/24 [==============================] - 81s 3s/step - loss: 0.0086 - accuracy: 0.9986
Out[17]:

In [18]: model.save('aslpng1.h5')
```

9. Results :

9.1 Performance metrics :

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



10. ADVANTAGES & DISADVANTAGES :

Advantages :

- The speech is converted to sign language very quick to provide greater and fasterunderstanding to specially-abled people.

- The user interface is convenient and simple for both people.

Disadvantages :

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

11. CONCLUSION :

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

12. Future Scope :

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. Having a technology that can translate hand sign language to its corresponding alphabet is a game changerin the field of communication and Ai for specially-abled peoplesuch as thosedeafor dumb.

13. APPENDIX :

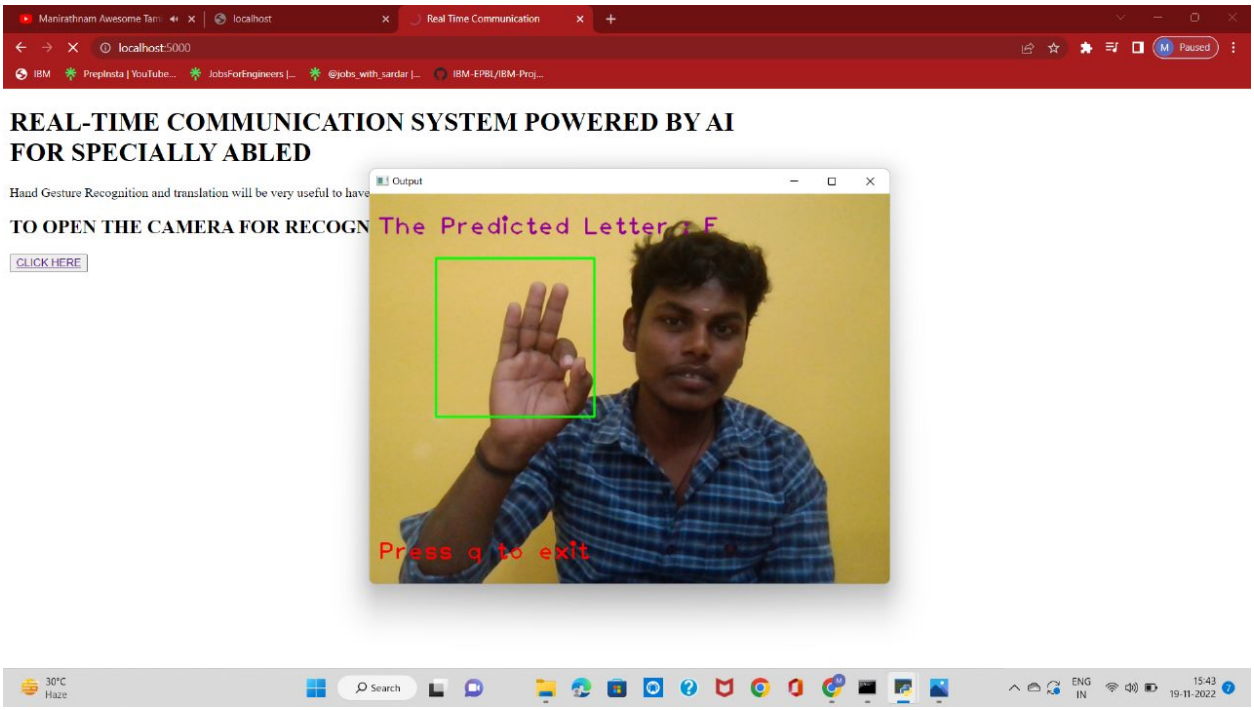
Source code :

```
from flask import Flask,render_template,request
import cv2
from keras.models import load_model
import numpy as np
from gtts import gTTS
import os
from keras.preprocessing import image
from skimage.transform import resize
app = Flask(_name_)

model=load_model("model.h5")

vals = ['A', 'B','C','D','E','F','G','H','I']
```

```
@app.route('/', methods=['GET'])
def index():
	return render_template('index.html')
@app.route('/index', methods=['GET'])
def home():
	return render_template('index.html')
@app.route('/predict', methods=['GET', 'POST'])
def predict():
print("[INFO] starting video stream...")
vs = cv2.VideoCapture(0)

		(W, H) = (None, None)

		while True:
			(grabbed, frame) = vs.read()

			if not grabbed:
				break

			if W is None or H is None:
				(H, W) = frame.shape[:2]
			output = frame.copy()
			r = cv2.selectROI("Select", output)
			print(r)
			cv2.rectangle(output, (81, 79), (276,274), (0,255,0), 2)
			frame = frame[81:276, 79:274]
			frame = cv2.cvtColor(frame, cv2.COLOR_RGB2GRAY)
			_, frame = cv2.threshold(frame, 95, 255,
cv2.THRESH_BINARY_INV)
```

```
                        frame = cv2.cvtColor(frame, cv2.COLOR_GRAY2RGB)
                        img = resize(frame,(64,64,3))
                        img = np.expand_dims(img,axis=0)
if(np.max(img)>1):
                        img = img/255.0
                        result = np.argmax(model.predict(img))
                        index=['A', 'B','C','D','E','F','G','H','I']
                        result=str(index[result])



                        cv2.putText(output, "The Predicted Letter :
{}".format(result), (10, 50), cv2.FONT_HERSHEY_PLAIN,2, (150,0,150), 2)
                        cv2.putText(output, "Press q to exit", (10,450),
cv2.FONT_HERSHEY_PLAIN, 2, (0,0,255), 2)
                        speech = gTTS(text = result, lang = 'en', slow = False)
                        cv2.imshow("Output", output)
                        key = cv2.waitKey(1) & 0xFF
                        if key == ord("q"):
break
                 print("[INFO] cleaning up...")
                vs.release()
                cv2.destroyAllWindows()
                return render_template("index.html")
if _name_ == '_main_':
        app.run(debug=True)
```

OUTPUT :



Github link :

https://github.com/IBM-EPBL/IBM-Project-529-1658305355