REAL-TIME COMMUNICATION SYSTEMPOWERED BY AI FOR SPECIALLY ABLED

PROJECT REPORT

R.M.D Engineering College
B.E Electronics & Communication Engineering
(2019 - 2023)

TEAM ID - PNT2022TMID14851

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CHAPTER-1

INTRODUCTION

1.1 Project Overview

The goal of this project was to build a neural network able to classify which letter ofthe 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 areimmersed in a hearing world . Large barriers that profoundly affect life quality stem from the communication disconnect between the deaf and the hearing. Some examples are information deprivation, limitation of social connections, and difficulty integrating in society

Most research implementations for this task have used depth maps generated bydepth 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. This is in alignment with the motivation as this would make a future implementation of a real time ASL-to-oral/written language translator practical in an everyday situation.

1.2 Purpose

In our society, we have people with disabilities. The technology is developing day byday 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 translationwill be very useful to have a proper conversation between a normal person and an impaired person inany language.

The project aims to develop a system that converts the sign language into a humanhearing 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.

CHAPTER-2

LITERATURE SURVEY

Literature survey:

A literature survey or a literature review in a project report is that section which shows thevarious 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 agoal 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. Communicationsbetween 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 cannotbe used. Voice Conversion System with Hand Gesture Recognition and translation will be very usefulto have a proper conversation between a normal person and an impaired person in any language.

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 enablea person to receive information in the format that suits their needs best. These Various technologymay be available to the deaf.many items, including cochlear implants, loop systems,accessibility,FMtechnology 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.Computersmay be taught to do particular jobs by processing huge quantities of data and detecting trends in thedata. This is accomplished via the use of various technologies.

TITLE:Communication system for deaf and dumb people AUTHOR:
Shraddha R. Ghorpade, Prof. Surendra K. Waghmare2YEAR: 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 usingsign language, which is expressive and natural. So that we can converse with them and comprehendwhat 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 arecombined to create utterances that communicate the meaning of words or statements.

TITLE: Educational Status of Differently Abled Persons and Developed Policies in India
AUTHOR: Chiranjit Majumder
YEAR: 2019 April

One of the socially created phenomenon is basically Disability. The fact is that many children and adults suffered from disabilities excluded from mainstream education benefits. Disabled personsare segregated from education system because of social negligence and absence of support system in the home and inadequacy of sufficient facilities in schools particularly. However, education is the most important medium for social, economic and political transformation. Socialization of children with disabilities (CWD) through education receives an unremarkably important roles in societies suchas India where social exclusion of Physically Challenged Persons (PCPs) is significant. Indisputably,
the literacy level of Physically Challenged Persons (PCPs) is very low in India. Very poor educational outcomes for children with disabilities remain in developing countries specially. Most of disabled persons do not getfx the full benefits of education. However, some policies in India has started to display some concern for Physically Challenged students. Education is utmost significant to lift upthe socioeconomic status of PCPs. But education of disabled persons has not received adequate
intentness and resources that it requires. Physically Challenged Persons (PCPs), few who are enrolledin schools are not given equal opportunity for middle secondary and higher education levels. Many
Disabled persons are educated but they do not get any work for earning in our society.

2.3 Problem Statement Definition

Communication is the only medium by which we can share our thoughts or conveythe 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.

Problem:

Vedha has difficulty in hearing. He uses sign language to communicate with others. But he can't table to communicate with normal people who don't understand sign language.

Solution:

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 signlanguage for the deaf ,the system enhances the user friendly experience.

Problem:

Ram is a dumb by birth. He uses sign language to communicate with others. But he can't able to communicate with normal people who don't understand sign language.

Solution:

To create a app for understanding sign language and convert into Speech signal as output fornormal people.

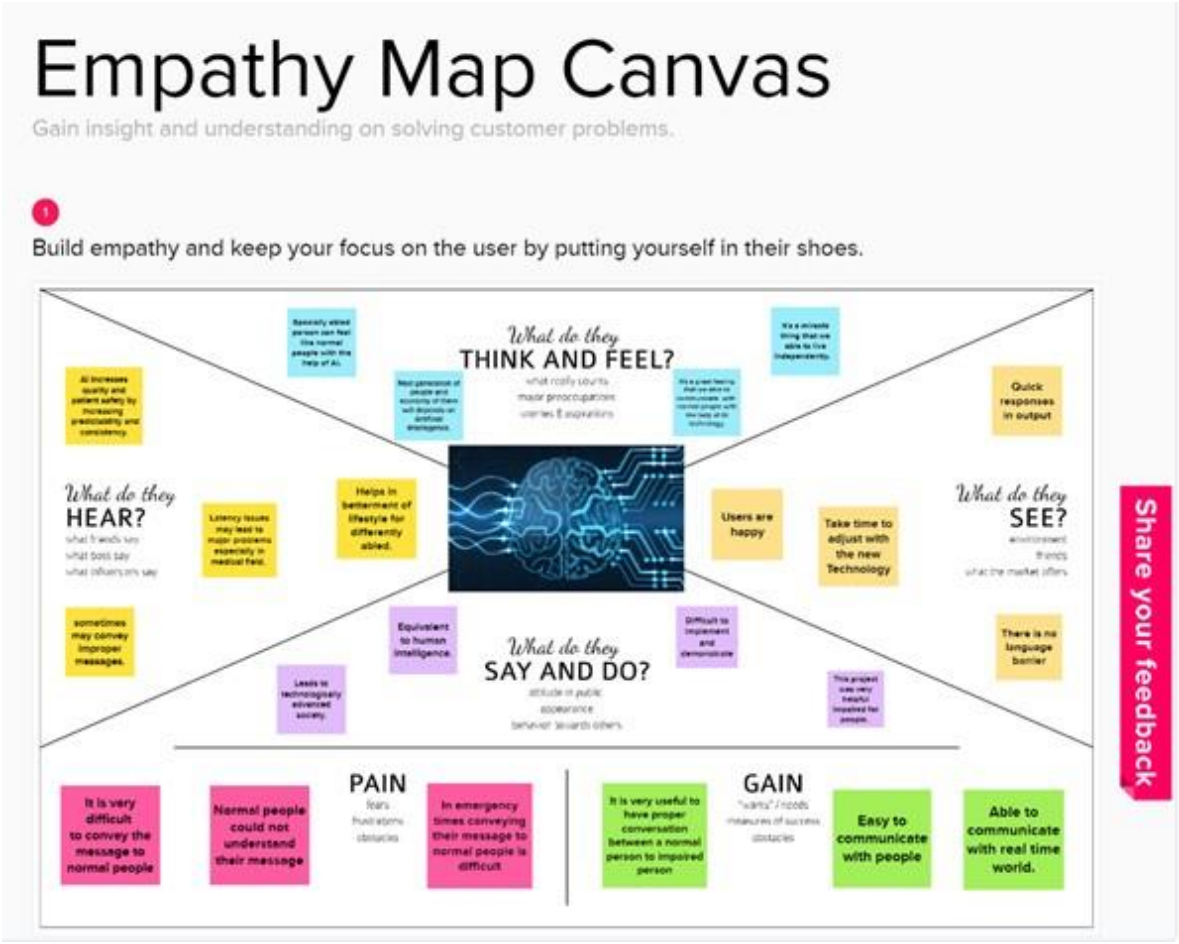
CHAPTER-3

IDEATION AND PROPOSEDSOLUTION

3.1 Empathy Map Canvas:

Definition:

An empathy map canvas is a more in-depth version of the original empathy map, which helpsidentify 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 youcreate empathy map canvases of similar quality.



3.2 Ideation & Brainstorming:

Definition:

Brainstorming provides a free and open environment that encourages everyone within a team toparticipate 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 to communicate with the normalpeople easily.
2.	Idea/Solution description	A real time ML based system is built for the real time sign language detection with a Tensor Flow object detection
3.	Novelty/Uniqueness	This model using SSD ML algorithm recognizing the signsas words insteadof old traditional translators, that arevery slow and take toomuch 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 (Revenue Model)	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 has been used can be replaced with another modelas well. The same systemcan be implemented for different sign 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 andthat the solution you have realized for it actually solves the customer's problem.

CHAPTER- 4

REQUIREMENT ANALYSIS

4.1 Functional Requirements

FR No.	Functional Requirement	Sub Requirements
FR-1	**User Registration**	Registration throughForm Registration through Gmail.
FR-2	**User confirmation**	Confirmation via Email Confirmation via OTP
FR-3	**System**	Desktop with high resolution camera
FR-4	**Authorization Levels**	There are two levelsof authorization namelystandard access level and advanced accesslevel.
FR-5	**External interface**	Ethernet, Wi-Fi,USB to provideinternet facility to access the resources with real timecommunication.
FR-6	**Reporting**	If anyissues found in the application, automatically it will be notified to the developer.

4.2 Non-Functional Requirements

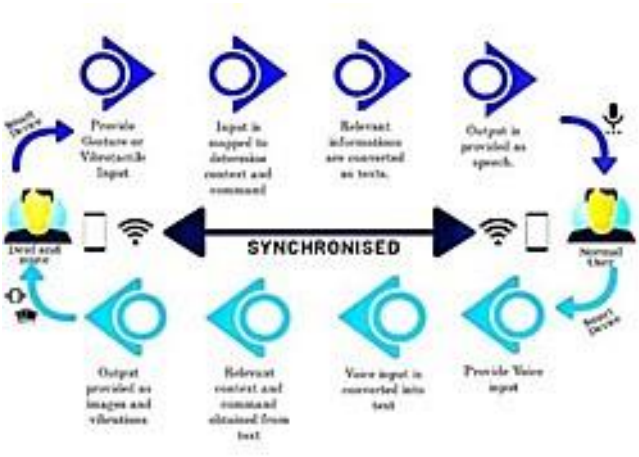
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	To convey a message to normal people,as well as convert speechinto understandable sign language for the deaf and dumb people.
NFR-2	**Security**	Converted information using signs intospeech is accessed only by the user.
NFR-3	**Reliability**	Provides insight into potential issuesfor desktop applications on manageddevices.
NFR-4	**Performance**	The timefor converting signsinto speech shouldbe faster for the real timecommunication.
NFR-5	**Availability**	Provides automatic recovery as muchaspossible.
NFR-6	**Scalability**	This app enables deaf and dumb people to convey theirinformation using signswhich get converted to human-understandable language and speechis given as output.

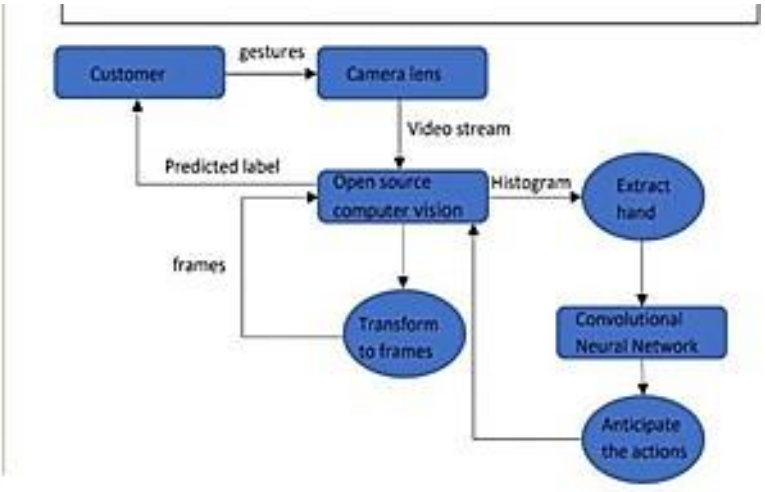
CHAPTER-5

PROJECT DESIGN

5.1 Data Flow Diagram

A Data Flow Diagram (DFD) is a traditional visual representation of the information flowswithin 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.





5.2 Solution & Technical Architecture

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

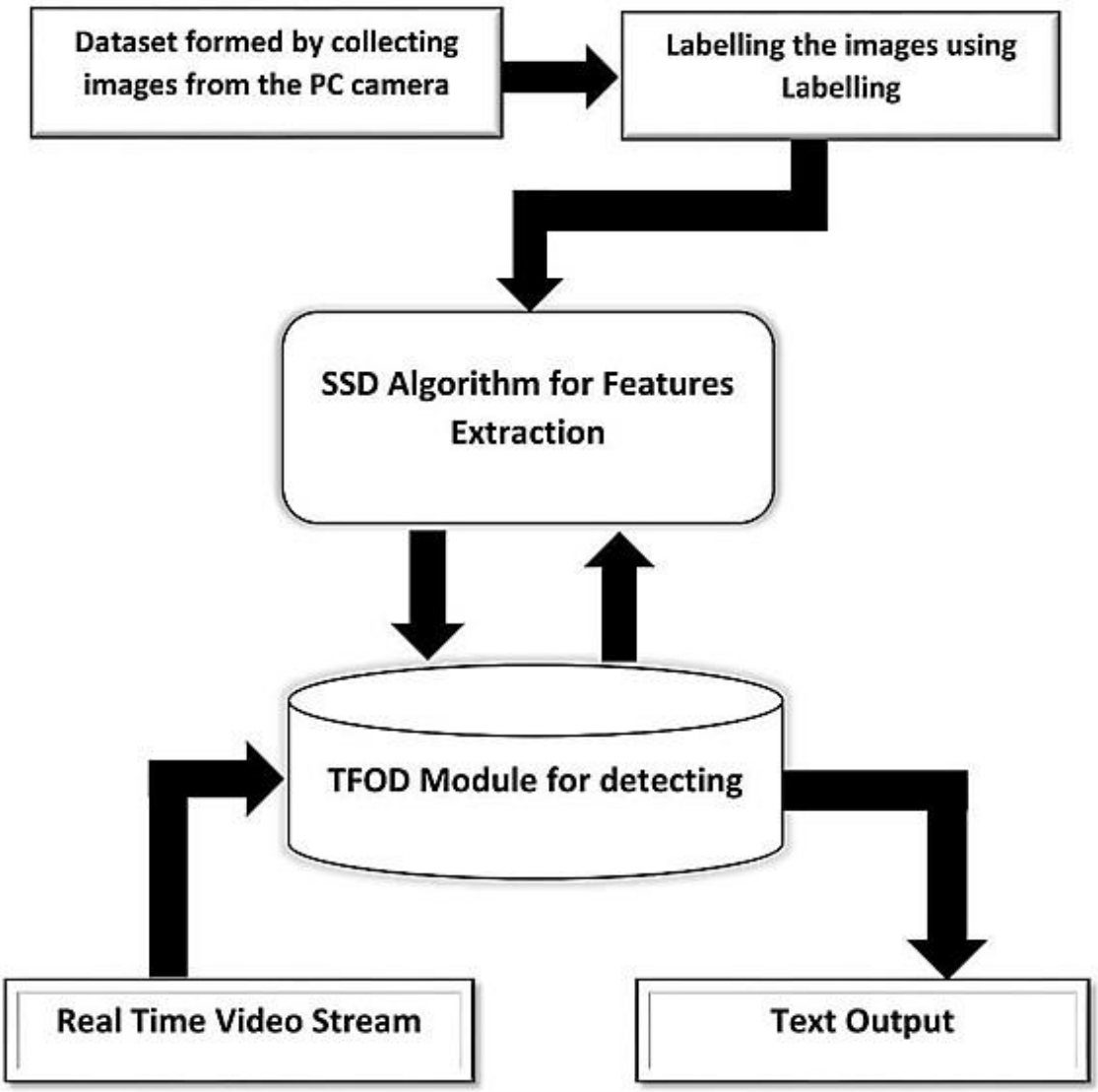
1. Find the best tech solution to solve existing business problems.

2. Describe the structure, characteristics, behaviour, and other aspects of the software to project stakeholders.

3. Define features, development phases, and solution requirements.

4. Provide specifications according to which the solution is defined, managed, and delivered.

Solution Architecture Diagram :



SYSTEM ARCHITECTURE

Technology Stack (Architecture & Stack):

Technical Architecture:

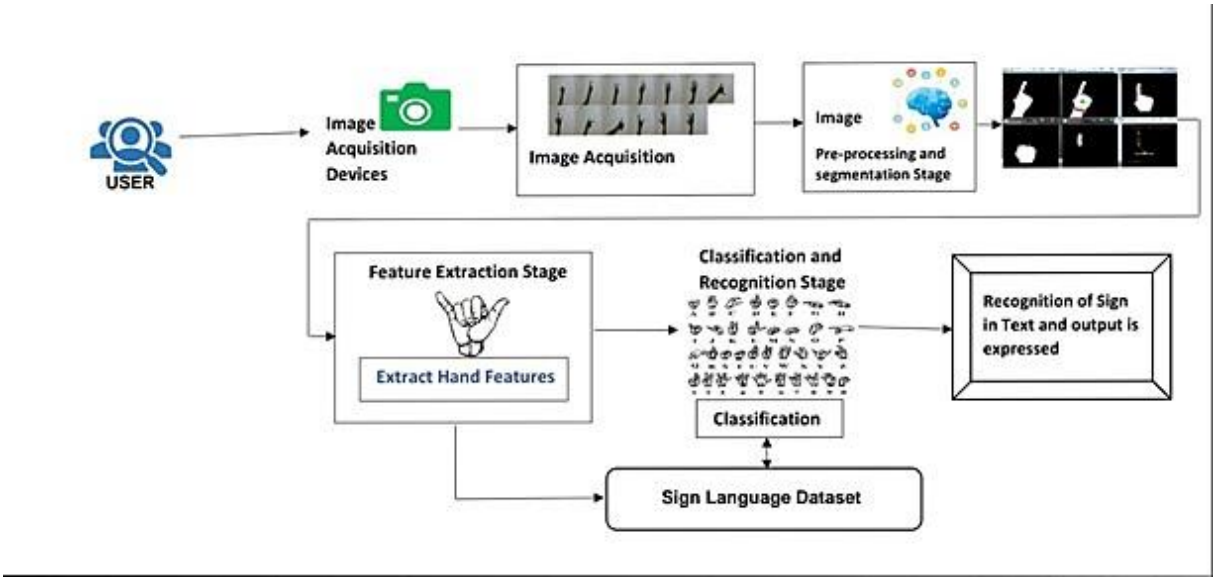


Table-1:

Components and Technologies:

S.NO	Component	Description	Technology
1.	User Interface	Customer have to login through their respectivewebsite 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,feasible answers afterrecognising thehuman gestures.	ANN,CNN
5.	Database	Data couldbenumbers or words.	MySQL, Rational database
6.	Cloud Database	Providing customer to use hostdatabase withoutbuyingadditional hardware..	Deep learning and neural networks
7.	File Storage	File storagecould be fast,reliable and flexible..	Local filesystem
8.	External API-1	Used to access the information in the cloud	Weather API
9.	External API-2	Used to access the information for datadrivendecision making...	Aadhar API
10.	Machine Learning 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 which are 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 will be 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 (Mobileuser)	Registration	USN-1	As customer, I couldable to registerfor 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 the acknowledgement verification emailonce after my registrationhasbeen donefor theapp	I can get verification emailand clickok to confirmit..	High	Sprint 1
		USN-3	As a customer, Icould able to register for application via their official websites and social media.	I could able to registerand access my account by usingtheirwebsite & socialmedia.	Medim	Sprint 2
		USN-4	As a customer, Icould able to register for application through Gmail	via some thirdparties link	Low	Sprint 2
	Login	USN-5	As a customer, I could able to logininto application 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 accessmy dashboard andchange 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
CustomerCare Executive	Service	USN-8	Can avail the serviceby calling customer care or reaching through E-mail.	Can avail the service bycalling customer care or reaching throughE-mail.	Medium	Sprint 1
Administrator		USN-9	Respective personin the companyshould takecare all of this.	All the requirements arethere.	High	Sprint 2
	Sign up	USN-10	Customer have tosign-up to use thesethings andall	Have to enter validcredentials.	High	Sprint 2

User Type	**Functional Requirement (Epic)**	**User Story Number**	**User Story/ Task**	**Acceptance criteria**	**Priority**	**Release**
	Wish list	USN-11	Customer's desired choicesto 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

CHAPTER-6

PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Product Backlog, Sprint Schedule, and Estimation:

Sprint	Functional Requirement(Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data Collection	USN-1	Collect Dataset.	9	High	VARSHINI.H
Sprint-1		USN-2	Image preprocessing	8	Medium	RENUKADEVI.M
Sprint-2	Model Building	USN-3	Import the required libraries, add the necessary layers andcompile the model	10	High	YUVASHREE.S
Sprint-2		USN-4	Training the image classification modelusingCNN	7	Medium	SUSHMITHA.J
Sprint-3	Training andTesting	USN-5	Training the model andtesting the model's performance	9	High	VARSHINI.H
Sprint-4	Implementation ofthe application	USN-6	Converting theinput sign language images into Englishalphabets	8	Medium	SUSHMITHA.J

6.2 Sprint Delivery Schedule

ProjectTracker,Velocity & BurndownChart:

Sprint	Total StoryPoints	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

Velocity:

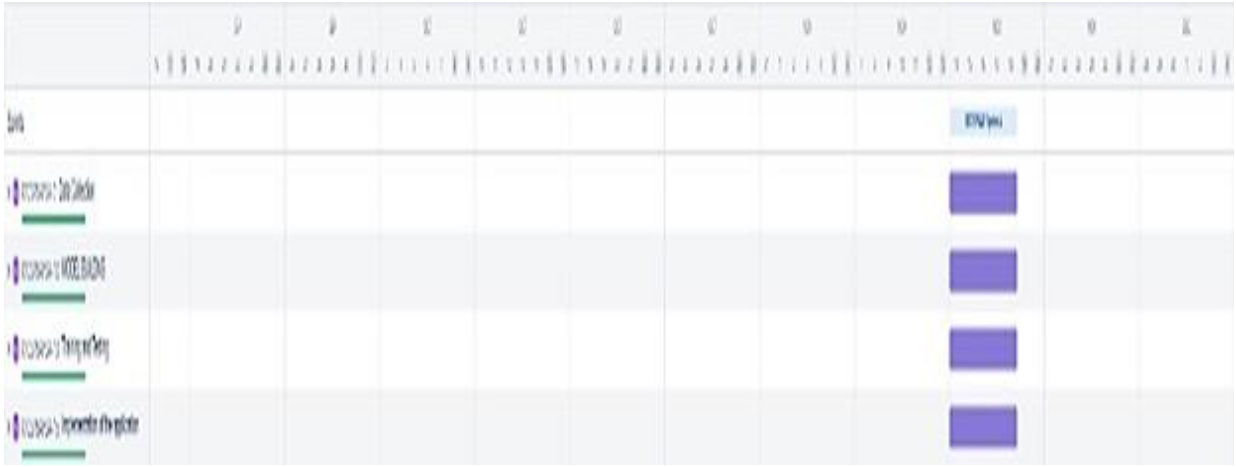
AV = 6/10 = 0.6

Burndown chart:

A burn down chart is a graphical representation of work left to do versus time. It is often used inagile software development methodologies such as Scrum. However, burn down chartscan be applied to any project containing measurable progress over time.

6.3 Reports from JIRA

Jira helps teams plan, assign, track, report, and manage work and brings teams together foreverything from agile software development and customer support to start-ups and 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.



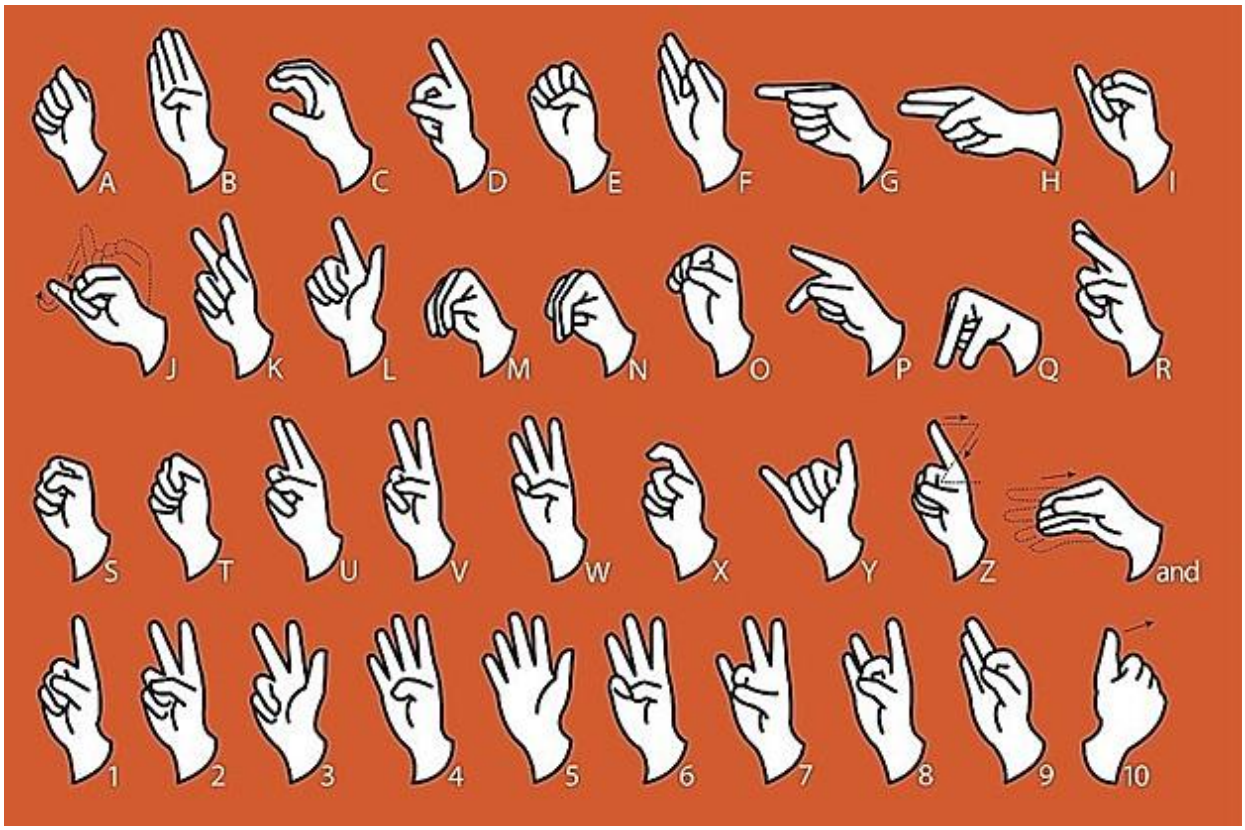
CHAPTER-7

CODING & SOLUTIONING

(Explain the features added in the project along with code)

7.1 Feature 1

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



MODEL BUILDING

```
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 [101]:

```
#Creating the model
model=Sequential()
#Adding the layers
model.add(Convolution2D(32,(3,3), input_shape=(64,64,1), activation =
'relu'))model.add(MaxPooling2D(pool_size=(2,2)))
model.add(Flatten())

#adding hidden layers
model.add(Dense(400,
activation='relu'))
model.add(Dense(200,
activation='relu'))
model.add(Dense(100,
activation='relu'))


#Adding the output layer
model.add(Dense(9, activation='softmax'))
```

In [102]:

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

In [157]:

```
model.fit_generator(x_train, steps_per_epoch=30,
epochs=10,validation_data=x_test,validation_steps=50)
Epoch 1/10
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1: UserWarning:
`Model.fit_generator` is deprecated and will be removed in a future version. Please use
`Model.fit`, which supports generators.
  """Entry point for launching an IPython kernel.
30/30 [==============================] - ETA: 0s - loss: 0.0083 - accuracy: 0.9957
WARNING:tensorflow:Your input ran out of data; interrupting training. Make sure that
yourdataset or generator can generate at least `steps_per_epoch * epochs` batches (in
this case, 50batches). You may need touse the repeat() function when building your
dataset.
30/30 [==============================] - 18s 587ms/step - loss: 0.0083 - accuracy:
0.9957 - val_loss: 0.2910 - val_accuracy:
0.9693Epoch 2/10
30/30 [==============================] - 12s 402ms/step - loss: 0.0081 - accuracy:
0.9980
Epoch 3/10
30/30 [==============================] - 12s 400ms/step - loss: 0.0102 - accuracy:
0.9963
Epoch 4/10
30/30 [==============================] - 12s 402ms/step - loss: 0.0049 - accuracy:
0.9993
Epoch 5/10
30/30 [==============================] - 12s 402ms/step - loss: 0.0030 - accuracy:
0.9997
Epoch 6/10
30/30 [==============================] - 12s 394ms/step - loss: 0.0019 - accuracy:
0.9997
Epoch 7/10
30/30 [==============================] - 12s 401ms/step - loss: 0.0081 - accuracy:
0.9973
```

Epoch 8/10

30/30 [==============================] - 12s 402ms/step - loss: 0.0124 - accuracy: 0.9960

Epoch 9/10

30/30 [==============================] - 12s 401ms/step - loss: 0.0070 - accuracy: 0.9987

Epoch 10/10

30/30 [==============================] - 12s 399ms/step - loss: 0.0089 - accuracy: 0.9973

```
model.save('Real_time.h5')
```

TEST THE MODEL

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

In [105]:

```
model = load_model('/content/Real_time.h5')
```

In [151]:

```
img = image.load_img('/content/Dataset/test_set/H/107.png',target_size = (100,100))img
```

```
from skimage.transform import resize
def detect(frame): img=image.img_to_array(frame)img =
    resize(img,(64,64,1))
    img = np.expand_dims(img,axis=0) pred=np.argmax(model.predict(img))
    op=['A','B','C','D','E','F','G','H','I']
    print("THE PREDICTED LETTER IS ",op[pred])
```

In [150]:

```
img=image.load_img("/content/Dataset/test_set/H/107.png")detect(img)
1/1 [==============================] - 0s 28ms/step
THE PREDICTED LETTER IS H
```

In [155]:

```
img = image.load_img('/content/Dataset/test_set/A/110.png')pred=detect(img)
1/1 [==============================] - 0s 26ms/step
THE PREDICTED LETTER IS A
```

In [158]:

```
img=image.load_img('/content/Dataset/test_set/E/111.png')detect(img)
1/1 [==============================] - 0s 30ms/step
THE PREDICTED LETTER IS E
```

7.2 Feature 2

The communication gap between deaf and dumb people and the general public can bebridged with a mobile application.

Mobile App:

```
from flask import Flask,
fromcamera import Video

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


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

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



if _name_ ==
    '_main_':a
    pp.run()
```

CHAPTER-8

TESTING

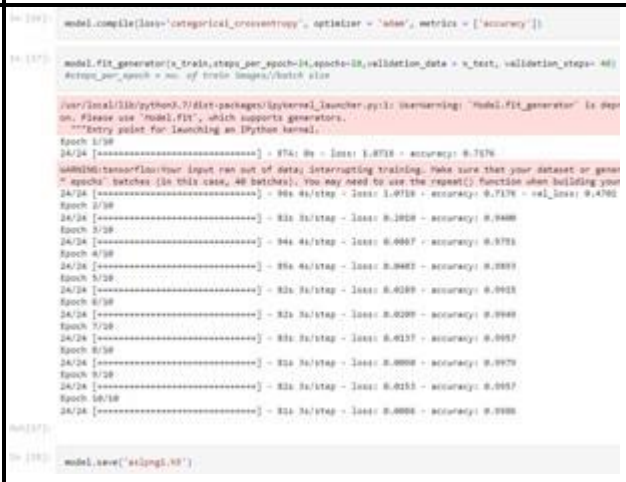
8.1 Test cases

> Our code was tested on 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

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

S.No.	Parameter	Values	Screenshot
1	Model Summary		
2	Accuracy	Training Accuracy –99.6% Validation Accuracy –98.3%	

CHAPTER-9

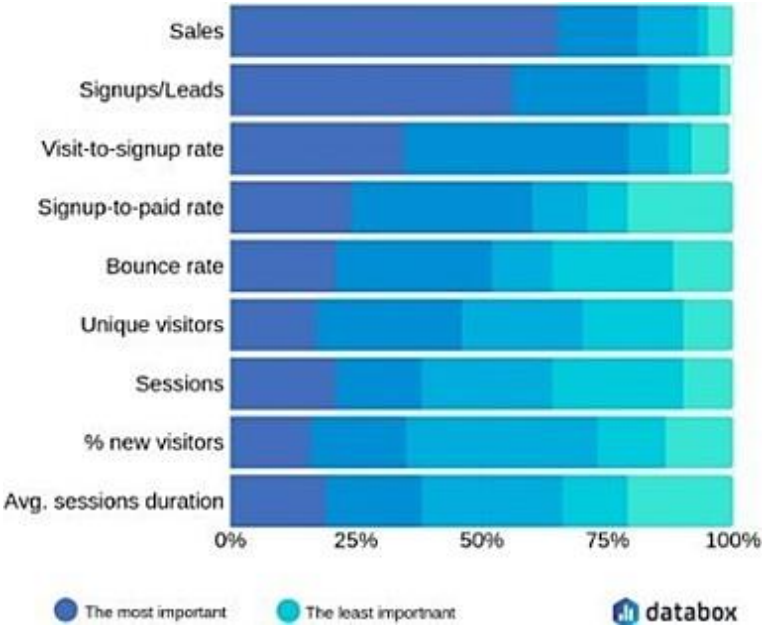
RESULTS

9.1 Performance Metrics

- The proposed procedure was implemented and tested on a set of images.

- The training database consists of 15750 images of Alphabets from "A" to "I", while the testingdatabase consists of 2250 images of Alphabets from "A" to "I".

- Once the gesture is recognized the equivalent alphabet is shown on the screen.



Output:

IBM Project Name: Real-Time Communication System Powered by AI for Specially Abled

TEAM ID: PNT2022TMID25478

TEAM Lead:VARSHINI H

TEAM Member 1:RENUKADEVI

MTEAM Member 2:YUVASHREE

S TEAM Member 3:SUSHMITHA J

FINAL OUTPUT

Import datagenerator to train and test

In [83]:

```
from tensorflow.keras.preprocessing.image import ImageDataGenerator
```

In [84]:

```
train_datagen = ImageDataGenerator(rescale = 1./255,shear_range=0.2,zoom_range=
0.2,horizontal_flip=True,vertical_flip=False)
```

In [85]:

```
test_datagen = ImageDataGenerator(rescale = 1./255)
```

In [82]:

```
import tensorflow as tf
import os
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Conv2D, Flatten, Dropout, MaxPooling2D
from tensorflow.keras.preprocessing.image import ImageDataGenerator
import numpy as np
import matplotlib.pyplot as plt import
IPython.display as displayfrom PIL import Image
import pathlib
```

Apply ImageDataGenerator Functionality To Train And Test set

In [86]:

```
from google.colab import drive
```

In [87]:

```
from tensorflow.keras.preprocessing.image import ImageDataGenerator
print("This dataset has been created and uploaded by IBM-TeamID-IBM-Project-50210-1660899973")
```

```
This dataset has been created and uploaded by IBM-TeamID-IBM-Project-50210-1660899973
```

In [88]:

```
x_train= train_datagen.flow_from_directory(r"/content/drive/MyDrive/dataset/dataset/training_set",ta
rget_size=(64,64),class_mode="categorical",batch_size=48)
```

```
Found 10324 images belonging to 9 classes.
```

In [89]:

```
x_test =
test_datagen.flow_from_directory(r"/content/drive/MyDrive/dataset/dataset/test_set",target_size= (64,64),class_mode=
"categorical",batch_size=48)
```

```
Found 2280 images belonging to 9 classes.
```

In [90]:

```
x_train.class_indices
```

Out[90]:

```
{'A': 0, 'B': 1, 'C': 2, 'D': 3, 'E': 4, 'F': 5, 'G': 6, 'H': 7, 'I': 8}
```

In [51]:

```
x_test.class_indices
```

Out[51]:

```
{'A': 0, 'B': 1, 'C': 2, 'D': 3, 'E': 4, 'F': 5, 'G': 6, 'H': 7, 'I': 8}
```

MODEL BUILDING

In [91]:

```
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 Flattenmodel=Sequential()
```

In [92]:

```
model.add(Convolution2D(32,(3,3), input_shape=(64,64,1), activation = 'relu'))
```

In [93]:

```
model.add(MaxPooling2D(pool_size=(2,2)))
```

In [94]:

```
model.add(Flatten())
```

In [95]:

```
model.add(Dense( units=512, activation='relu'))model.add(Dense(units=9,
```

In [96]:

```
activation='softmax'))
```

In [97]:

In [98]:

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

In [99]:

```
model.save('Realtime.h5')
```

In [ ]:

```
a=len(x_train)
b=len(x_test)
```

Length of training and testing data

In [ ]:

```
print(a)
print(b)
```

```
216
48
```

TEST THE MODEL

In [31]:

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

In [32]:

```
img =
image.load_img('/content/drive/MyDrive/dataset/dataset/test_set/F/107.png',target_size =
(500,500))
img
```

Out[32]:

In [102]:

```
from skimage.transform import resize
def detect(frame): img=image.img_to_array(frame)
        img = resize(img,(64,64,1))
        img = np.expand_dims(img,axis=0)
        pred=np.argmax(model.predict(img))
        op=['A','B','C','D','E','F','G','H','I'] print("THE PREDICTED
        LETTER IS ",op[pred])
```

In [101]:

```
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):
        prediction=model.predict(img) print(prediction)
        prediction=model.predict_classes(img)print(prediction)


arr= image.img_to_array(img)
```

In [39]:

In [34]:

```
frame=cv2.imread('/content/drive/MyDrive/dataset/dataset/test_set/F/107.png')data=detect(frame)
from google.colab.patches import cv2_imshowcv2_imshow(frame)
cv2.waitKey(0) cv2.destroyAllWindows()
```

```
1/1 [==============================] - 0s 285ms/stepTHE
PREDICTED LETTER IS  I
```

In [79]:

```
frame=cv2.imread('/content/drive/MyDrive/dataset/dataset/test_set/C/12.png')data=detect(frame)
from google.colab.patches import cv2_imshowcv2_imshow(frame)
cv2.waitKey(0) cv2.destroyAllWindows()
```

```
1/1 [==============================] - 0s 78ms/stepTHE
PREDICTED LETTER IS  A
```

In [103]:

```
frame=cv2.imread('/content/drive/MyDrive/dataset/dataset/training_set/D/1008.png')data=detect(frame)
from google.colab.patches import cv2_imshowcv2_imshow(frame)
cv2.waitKey(0) cv2.destroyAllWindows()
```

```
1/1 [==============================] - 0s 75ms/stepTHE
PREDICTED LETTER IS  E
```

CHAPTER-10

ADVANTAGES & DISADVANTAES

Advantages:

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

Disadvantages:

- The number of images and pixels for the model to train in the dataset is not high 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.

CHAPTER-11

CONCLUSION

CONCLUSION:

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

CHAPTER-11

CONCLUSION

FUTURE OF SCOPE:

With the introduction of gesture recognition, the web app can easily be expandedto recognize letters beyond 'I', digits, and other symbols plus gesture recognition canalso allow controlling of software/hardware interfaces. Having a technology that cantranslate hand sign language to its corresponding alphabet is a game changer in the field of communication and Ai for specially-abled people such as those deaf or dumb.

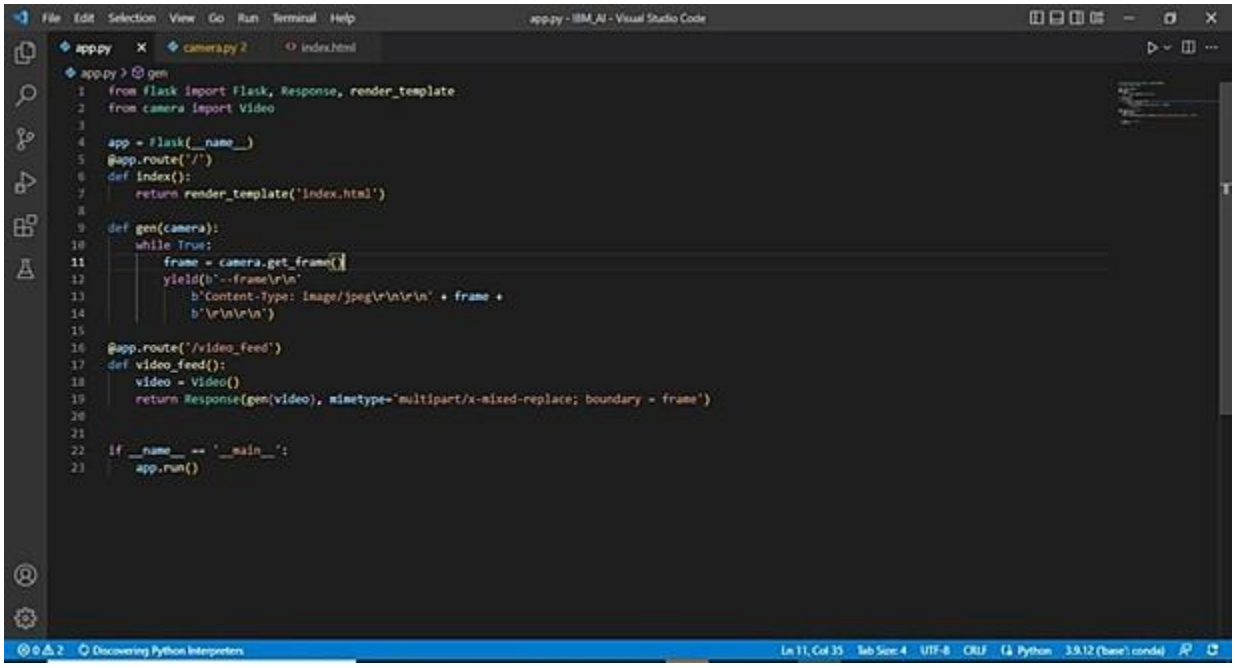
CHAPTER-13

APPENDIX

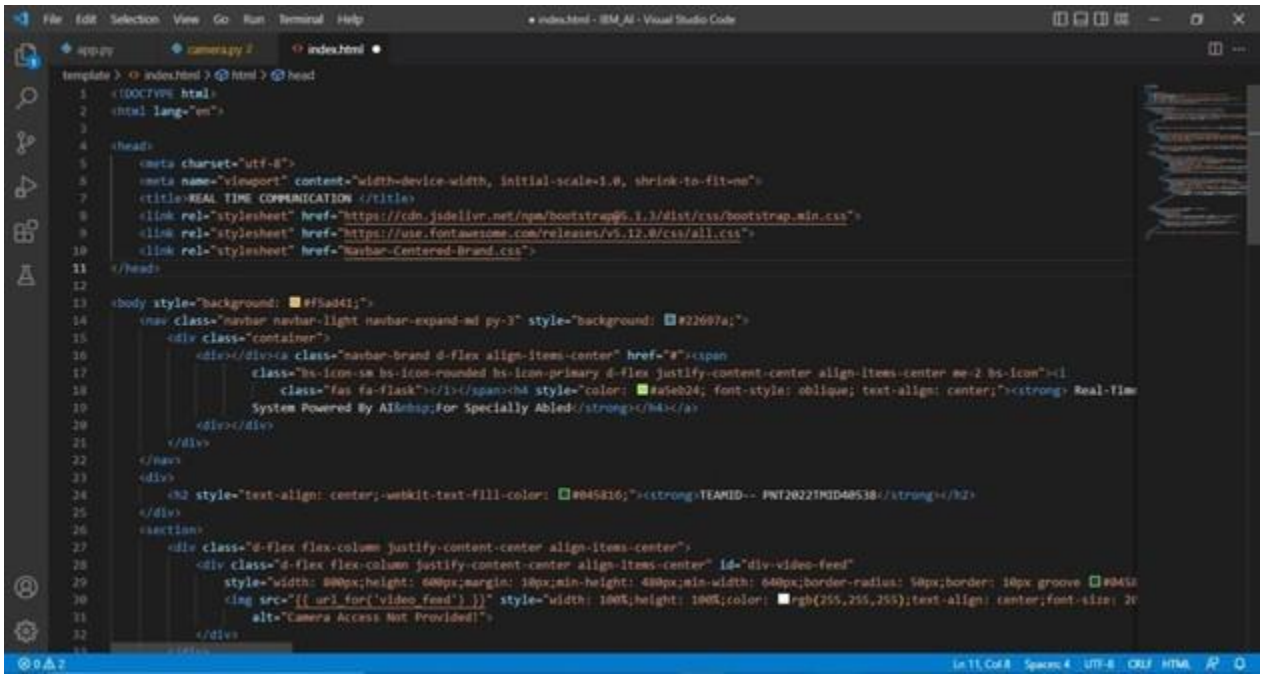
APPENDIX:

Source code:

Flask:



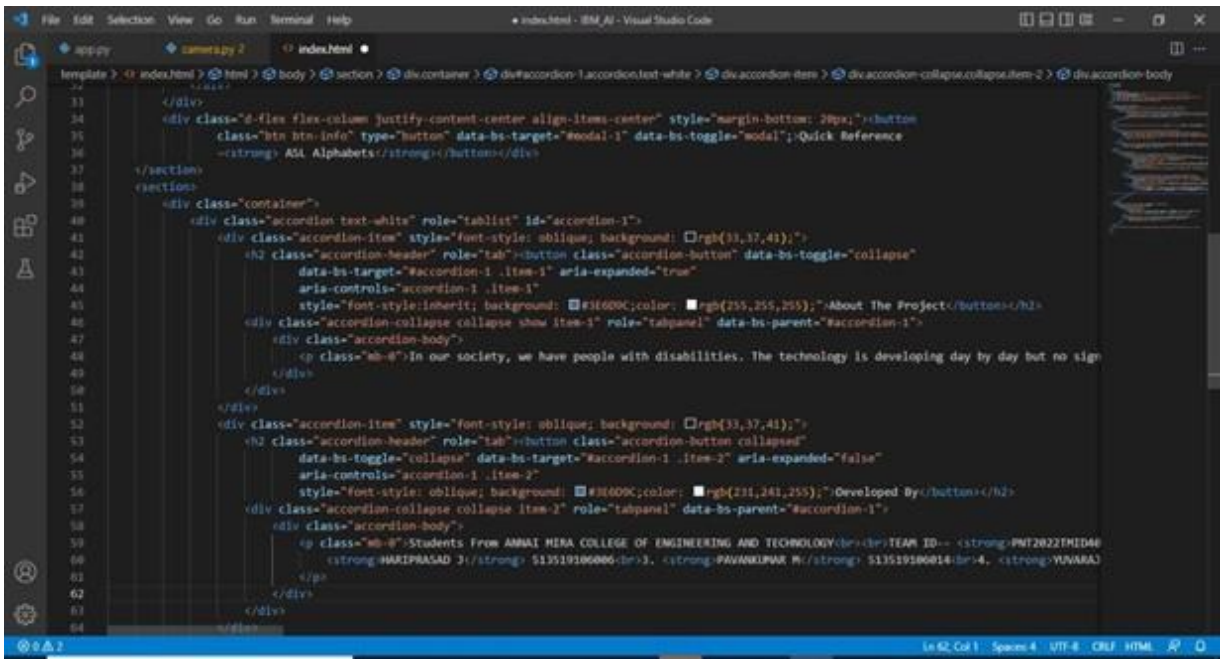
HTML:



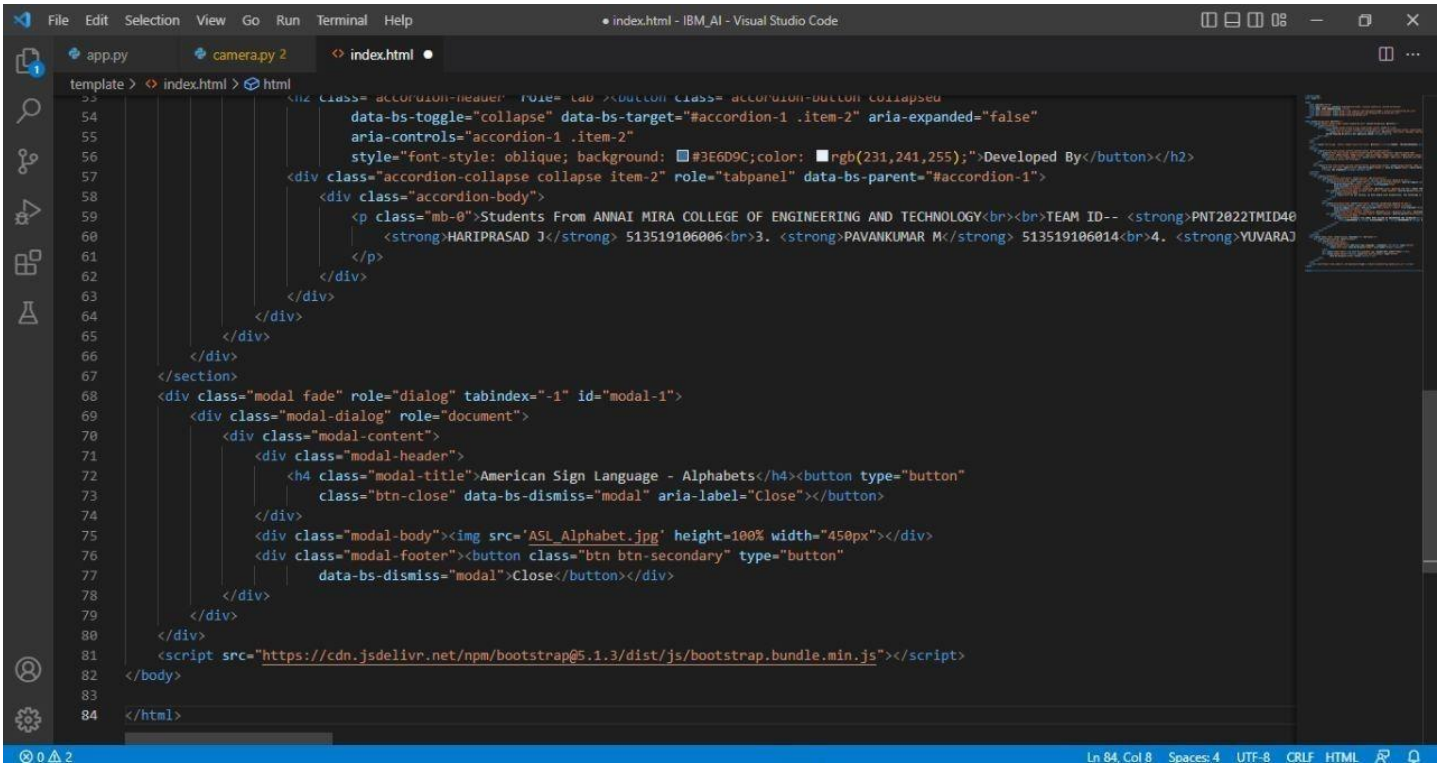
```
<!DOCTYPE html>
<html lang="en">

<head>
    <meta charset="utf-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0, shrink-to-fit=no">
    <title>REAL TIME COMMUNICATION </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="Navbar-Centered-Brand.css">
</head>

<body style="background: #f5ad41;">
    <nav class="navbar navbar-light navbar-expand-md py-3" style="background: #22697a;">
        <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><h4 style="color: #a5eb24; font-style: oblique; text-align: center;"><strong> Real-Time
                    System Powered By AI For Specially Abled</strong></h4></a>
            </div></div>
        </div>
    </nav>
    <div>
        <h2 style="text-align: center;-webkit-text-fill-color: #045816;"><strong>TEAMID-- PNT2022TMID40538</strong></h2>
    </div>
    <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: 800px;height: 600px;margin: 10px;min-height: 480px;min-width: 640px;border-radius: 50px;border: 10px groove #045
                <img src="{{ url_for('video_feed') }}" style="width: 100%;height: 100%;color: rgb(255,255,255);text-align: center;font-size: 2
                    alt="Camera Access Not Provided!">
            </div>
```



```
        </div>
        <div class="d-flex flex-column justify-content-center align-items-center" style="margin-bottom: 20px;"><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="font-style: oblique; 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="font-style:inherit; background: #3E6D9C;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">In our society, we have people with disabilities. The technology is developing day by day but no sig
                        </div>
                    </div>
                </div>
                <div class="accordion-item" style="font-style: oblique; 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="font-style: oblique; background: #3E6D9C;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">Students From ANNAI MIRA COLLEGE OF ENGINEERING AND TECHNOLOGY<br><br>TEAM ID-- <strong>PNT2022TMID40
                                <strong>HARIPRASAD J</strong> 513519106006<br>3. <strong>PAVANKUMAR M</strong> 513519106014<br>4. <strong>YUVARA
                            </p>
                        </div>
                    </div>
```


File Edit Selection View Go Run Terminal Help
• index.html - IBM_AI - Visual Studio Code
app.py
camera.py 2
index.html
template > index.html > html
data-bs-toggle="collapse" data-bs-target="#accordion-1 .item-2" aria-expanded="false"
aria-controls="accordion-1 .item-2"
style="font-style: oblique; background: #3E6D9C;color: rgb(231,241,255);">Developed By</button></h2>

Students From ANNAI MIRA COLLEGE OF ENGINEERING AND TECHNOLOGY

TEAM ID-- PNT2022TMID40
HARIPRASAD J 513519106006
3. PAVANKUMAR M 513519106014
4. YUVARAJ

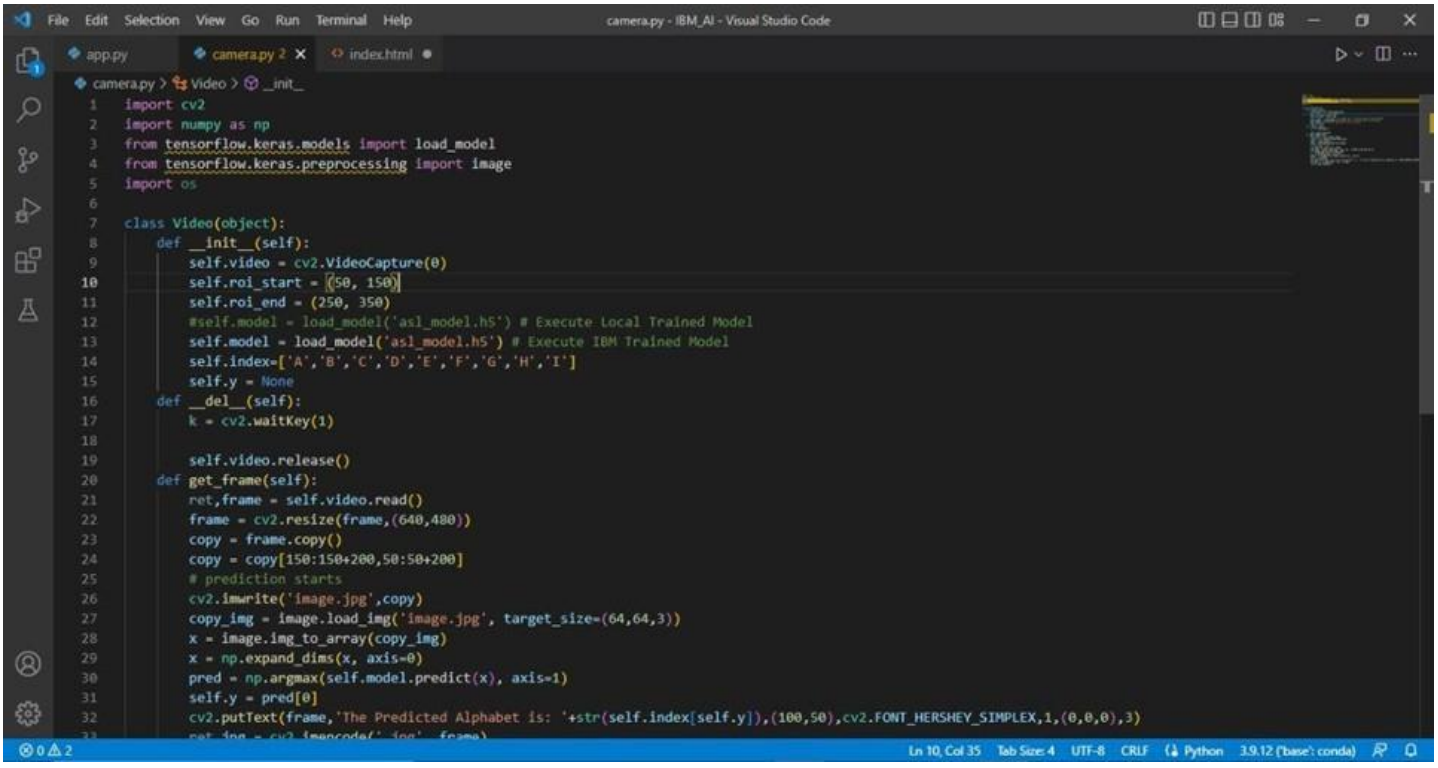
</section>

<h4 class="modal-title">American Sign Language - Alphabets</h4><button type="button"
class="btn-close" data-bs-dismiss="modal" aria-label="Close"></button>

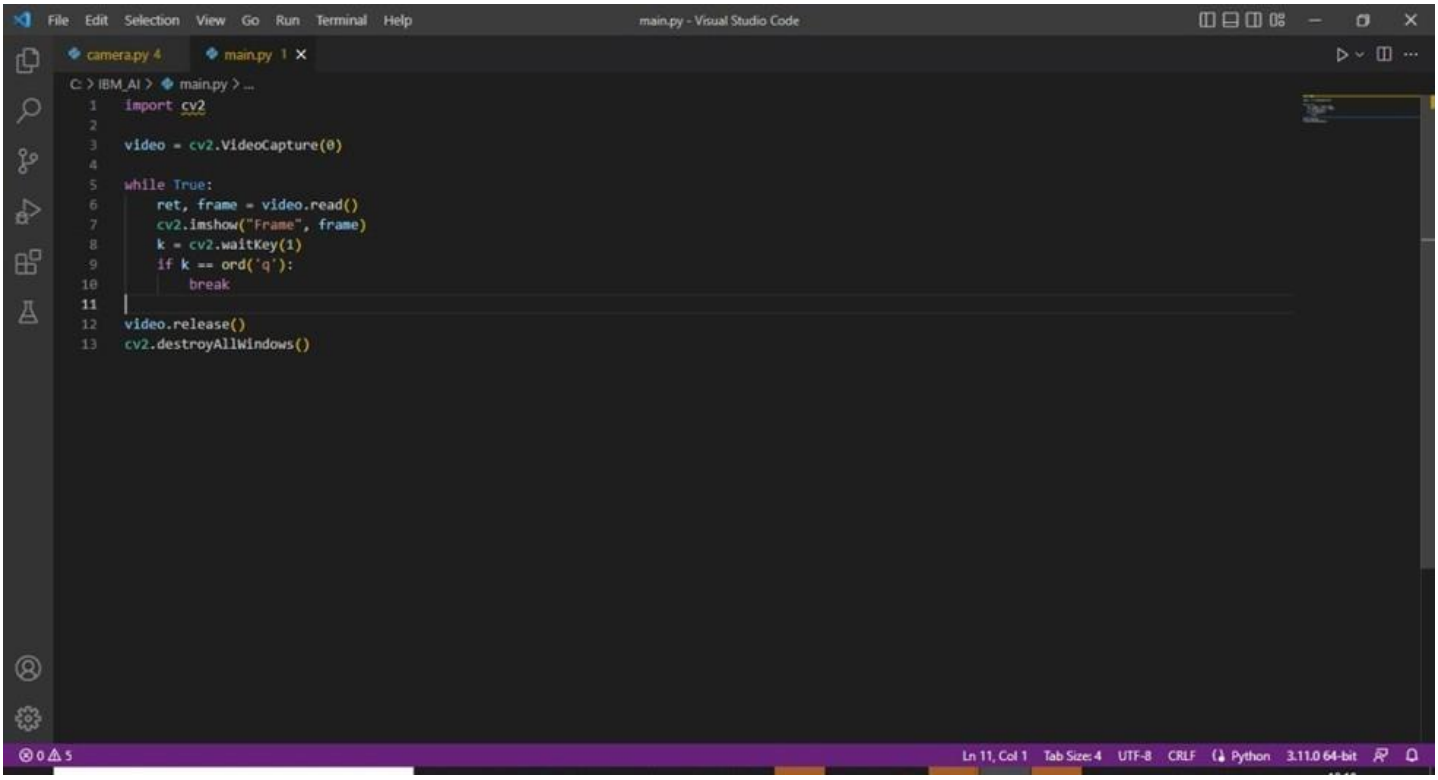
<img src='ASL_Alphabet.jpg' height=100% width="450px">
<button class="btn btn-secondary" type="button"
data-bs-dismiss="modal">Close</button>

<script src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/js/bootstrap.bundle.min.js"></script>
</body>
</html>
Ln 84, Col 8 Spaces: 4 UTF-8 CRLF HTML

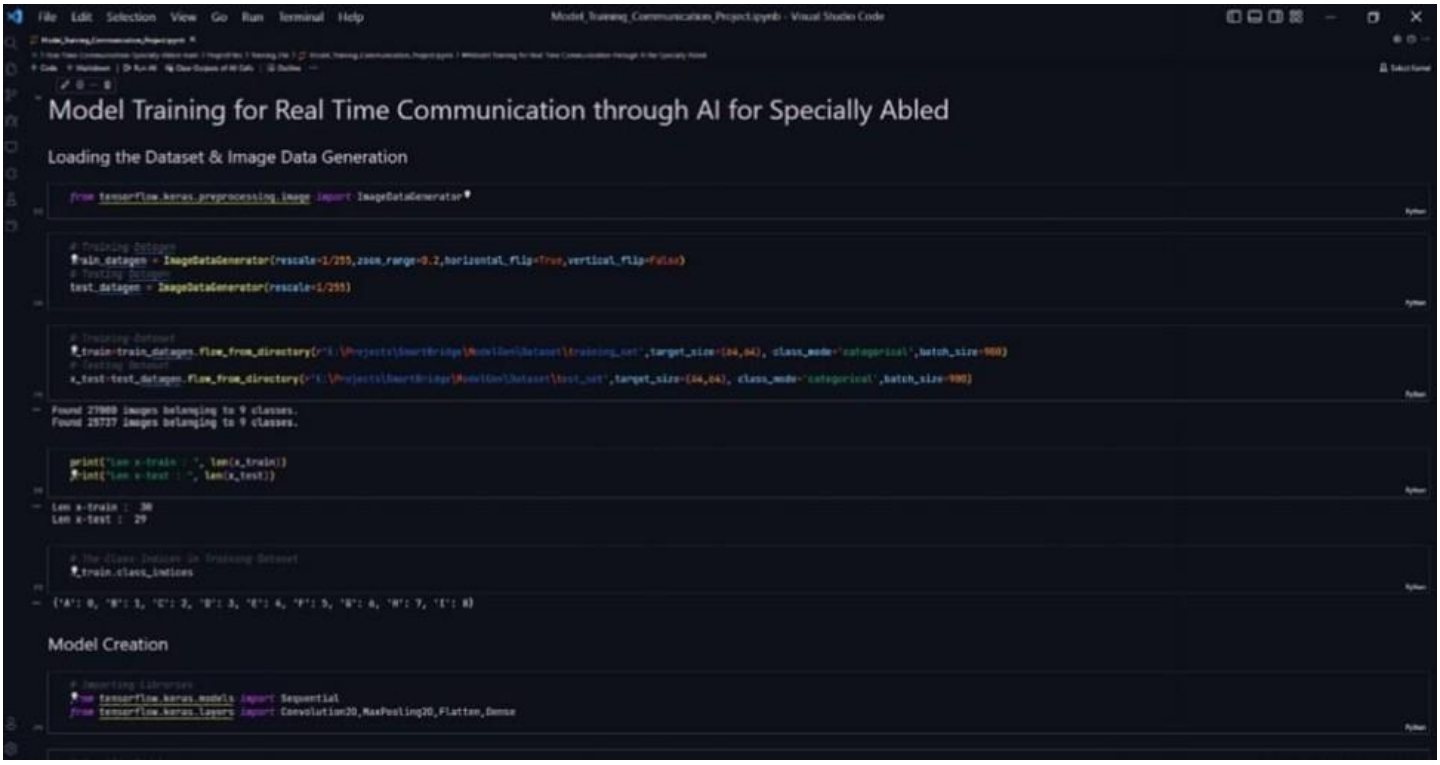
Camera:


File Edit Selection View Go Run Terminal Help
camera.py - IBM_AI - Visual Studio Code
app.py
camera.py 2
index.html
camera.py > Video > __init__
import cv2
import numpy as np
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
import os
class Video(object):
def __init__(self):
self.video = cv2.VideoCapture(0)
self.roi_start = (50, 150)
self.roi_end = (250, 350)
#self.model = load_model('asl_model.h5') # Execute Local Trained Model
self.model = load_model('asl_model.h5') # Execute IBM Trained Model
self.index=['A','B','C','D','E','F','G','H','I']
self.y = None
def __del__(self):
k = cv2.waitKey(1)
self.video.release()
def get_frame(self):
ret,frame = self.video.read()
frame = cv2.resize(frame,(640,480))
copy = frame.copy()
copy = copy[150:150+200,50:50+200]
# prediction starts
cv2.imwrite('image.jpg',copy)
copy_img = image.load_img('image.jpg', target_size=(64,64,3))
x = image.img_to_array(copy_img)
x = np.expand_dims(x, axis=0)
pred = np.argmax(self.model.predict(x), axis=1)
self.y = pred[0]
cv2.putText(frame,'The Predicted Alphabet is: '+str(self.index[self.y]),(100,50),cv2.FONT_HERSHEY_SIMPLEX,1,(0,0,0),3)
Ln 10, Col 35 Tab Size: 4 UTF-8 CRLF Python 3.9.12 ('base': conda)

Main:



Trained Model:



GitHub Repository: https://github.com/IBM-EPBL/IBM-Project-39752-1660497070