REAL TIME COMMUNICATION SYSTEM POWERED BY AI FOR SPECIALLY ABLED

TEAM ID -PNT2022TMID37224

S.No.	TEAM MEMBERS	REGISTER NUMBER
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Project Report Format

1. **INTRODUCTION**
   - 1.1 Project Overview
   - 1.2 Purpose
2. **LITERATURE SURVEY**
   - 2.1 Existing problem
   - 2.2 References
   - 2.3 Problem Statement Definition
3. **IDEATION & PROPOSED SOLUTION**
   - 3.1 Empathy Map Canvas
   - 3.2 Ideation & Brainstorming
   - 3.3 Proposed Solution
   - 3.4 Problem Solution fit
4. **REQUIREMENT ANALYSIS**
   - 4.1 Functional requirement
   - 4.2 Non-Functional requirements
5. **PROJECT DESIGN**
   - 5.1 Data Flow Diagrams
   - 5.2 Solution & Technical Architecture
   - 5.3 User Stories
6. **PROJECT PLANNING & SCHEDULING**
   - 6.1 Sprint Planning & Estimation
   - 6.2 Sprint Delivery Schedule
   - 6.3 Reports from JIRA
7. **CODING & SOLUTIONING (Explain the features added in the project along with code)**
   - 7.1 Feature 1
   - 7.2 Feature 2
   - 7.3 Database Schema (if Applicable)
8. **TESTING**
   - 8.1 Test Cases
   - 8.2 User Acceptance Testing
9. **RESULTS**
   - 9.1 Performance Metrics
10. **ADVANTAGES & DISADVANTAGES**
11. **CONCLUSION**
12. **FUTURE SCOPE**
13. **APPENDIX**
    - Source Code
    - GitHub & Project Demo Link

CHAPTER-1

INTRODUCTION

1.1 Project Overview

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 . 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 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. 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 by day but no significant developments are undertaken for the betterment of these people. Communications between deaf-mute and a normal person has always been a challenging task. It is very difficult for mute people to convey their message to normal people. Since normal people are not trained on hand sign language. In emergency times conveying their message is very difficult. The human hand has remained a popular choice to convey information in situations where other forms like speech cannot be used. Voice Conversion System with Hand Gesture Recognition and translation will be very useful to have a proper conversation between a normal person and an impaired person in any language.

The project aims to develop a system that converts the sign language into a human hearing voice in the desired language to convey a message to normal people, as well as convert speech into understandable sign language for the deaf and dumb. We are making use of a convolution neural network to create a model that is trained on different hand gestures. An app is built which uses this model. This app enables deaf and dumb people to convey their information using signs which get converted to human-understandable language and speech is given as output.

CHAPTER-2

LITERATURE SURVEY

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.

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 fromexisting 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

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 deafindividuals 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 isconveyed 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.

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 persons are 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 such as 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 up the socio-

economic 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 enrolled in 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 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.

Problem:

Vedha has difficulty in hearing. 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 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 ,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 for normal people.

CHAPTER-3

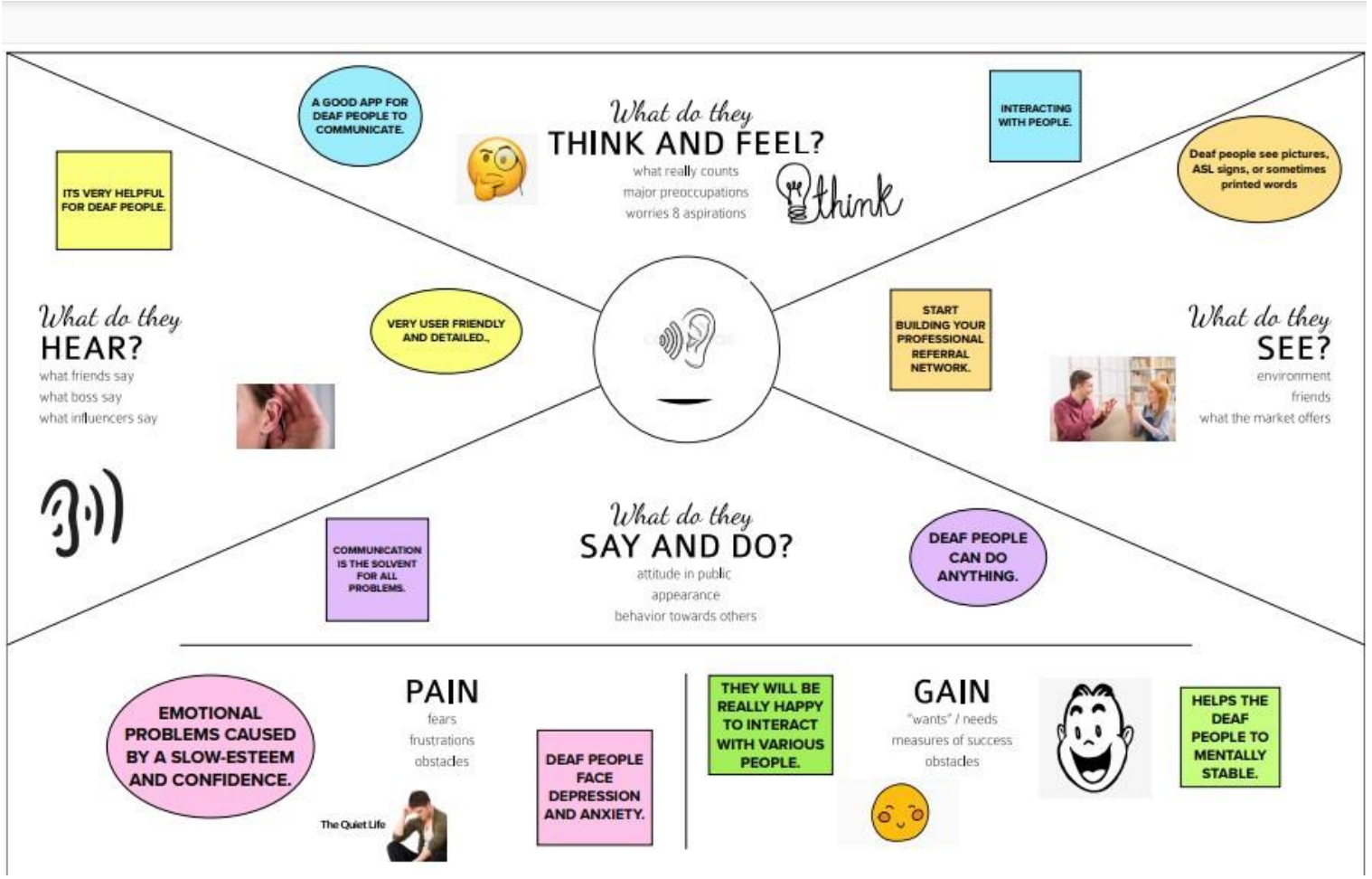
IDEATION AND PROPOSED SOLUTION

3.1 Empathy Map Canvas

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.

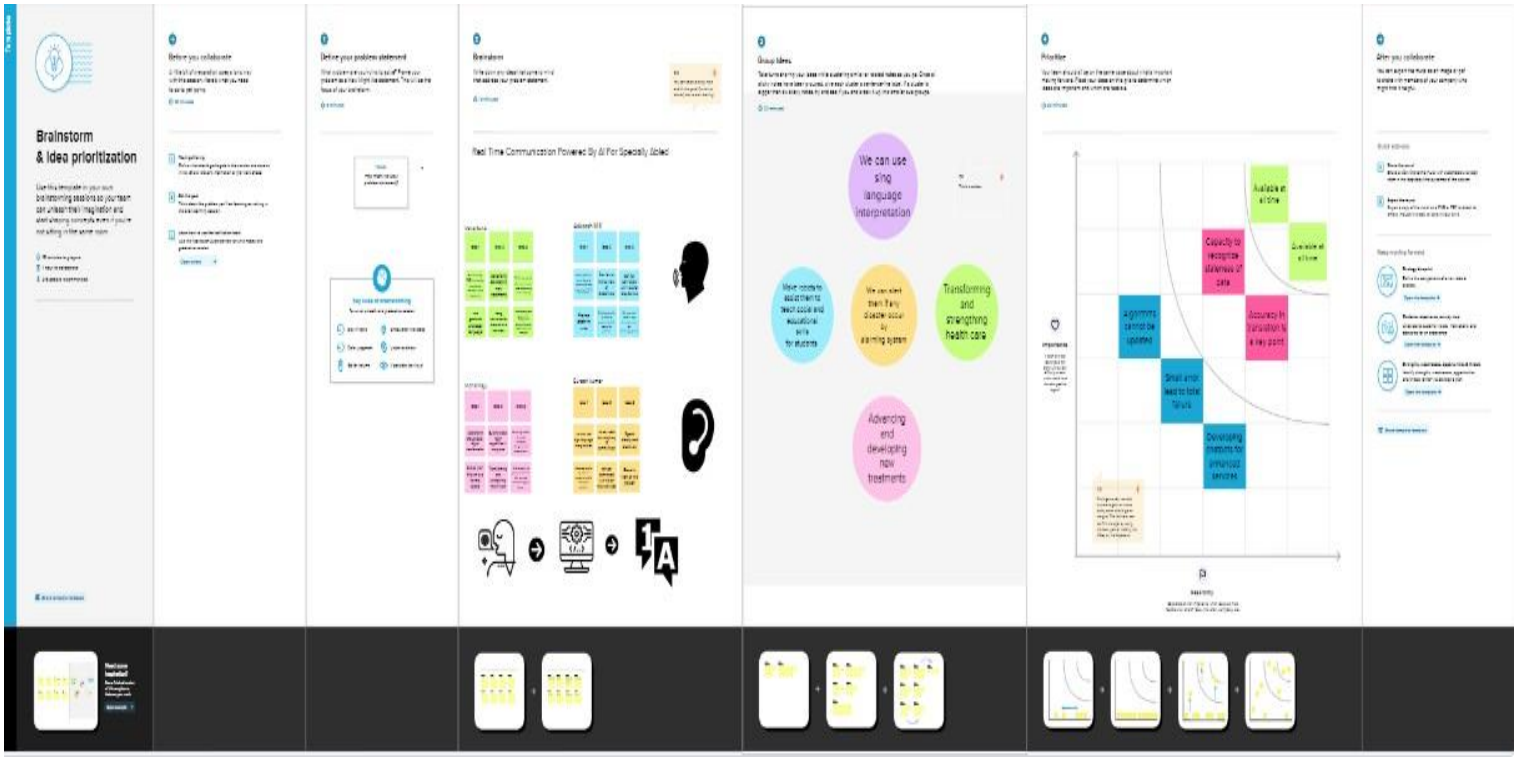
An empathy map canvas helps brands provide a better experience for users by helping teams understand the perspectives and mindset of their customers. Using a template to create an empathy map canvas reduces the preparation time and standardizes the process so you create empathy map canvases of similar quality.



3.2 Ideation & 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

Project Design Phase-I
Proposed Solution

Date	19 September 2022
Team ID	PNT2022TMID37224
Project Name	Real-Time Communication System Powered by AI for Specially Able.
Maximum Marks	2 Marks

Proposed Solution Template:

Project team shall fill the following information in proposed solution template.

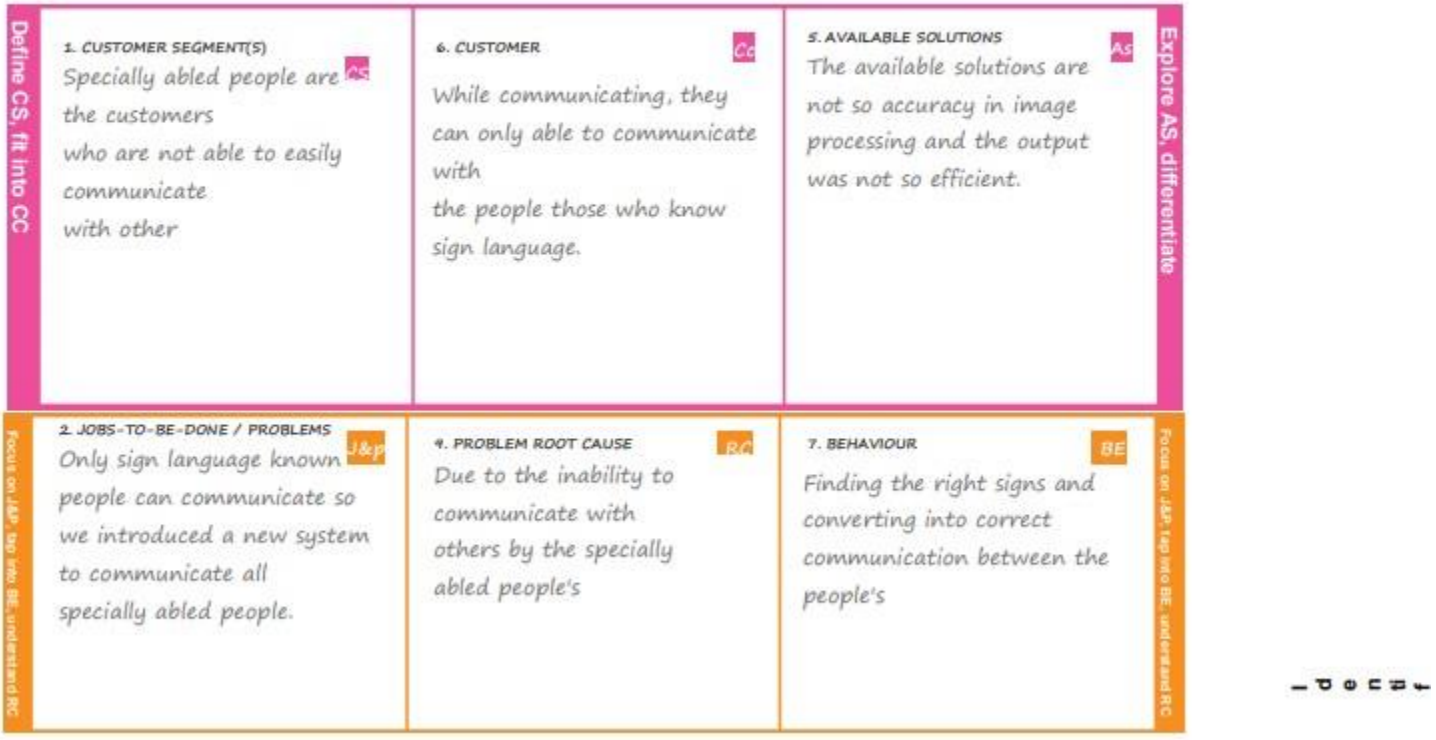
S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Differently able like dump and mute people can communicate only through the sign language, normal people those who do not know the sign language feels difficult to communicate with them.
2.	Idea / Solution description	To overcome this problem we have an idea that an application is created to communicate with the normal people.
3.	Novelty / Uniqueness	This process the image of the person who is using sign language and convert it into the voice by analyzing the sign used.
4.	Social Impact / Customer Satisfaction	Differently able people feel free to communicate and it bring a huge difference comparing to past.
5.	Business Model (Revenue Model)	There are many people in the world who is differently able, this application will become more popular among them and it will be installed by all and it will be used, and so it will produce more money.
6.	Scalability of the Solution	Thus this would bring a new evolution in Real Time Communication System Powered by AI for Specially Able with less time and safe enough resources.

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.

Project Title:Real time communication powered by Ai for Specially Abled **Project Design Phase-I - Solution Fit Template** **Team ID:** PNT2022TMID37224



Identify strong TR & EM

3. TRIGGERS TR

Some of the triggers are introducing in all hospitals, medical trusts and also in advertisements.

4. EMOTIONS: BEFORE / AFTER EM

specially abled people hesitate to communicate with others but know using this system they can easily communicate with others.

10. YOUR SOLUTION SL

Created an application using AI , that will able to convert the sign language by image processing of the specially abled people.

8. CHANNELS of BEHAVIOUR CH

8.1 ONLINE

We can update our application and use it in a very efficient way.

8.1 OFFLINE

In offline mode we use it but not so efficient we can use it with a recently updated application.

CHAPTER- 4

REQUIREMENT ANALYSIS

4.1 Functional Requirements

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	User Input Customization	Via Hand Gesture
FR-4	User Output	Text or Audio Output

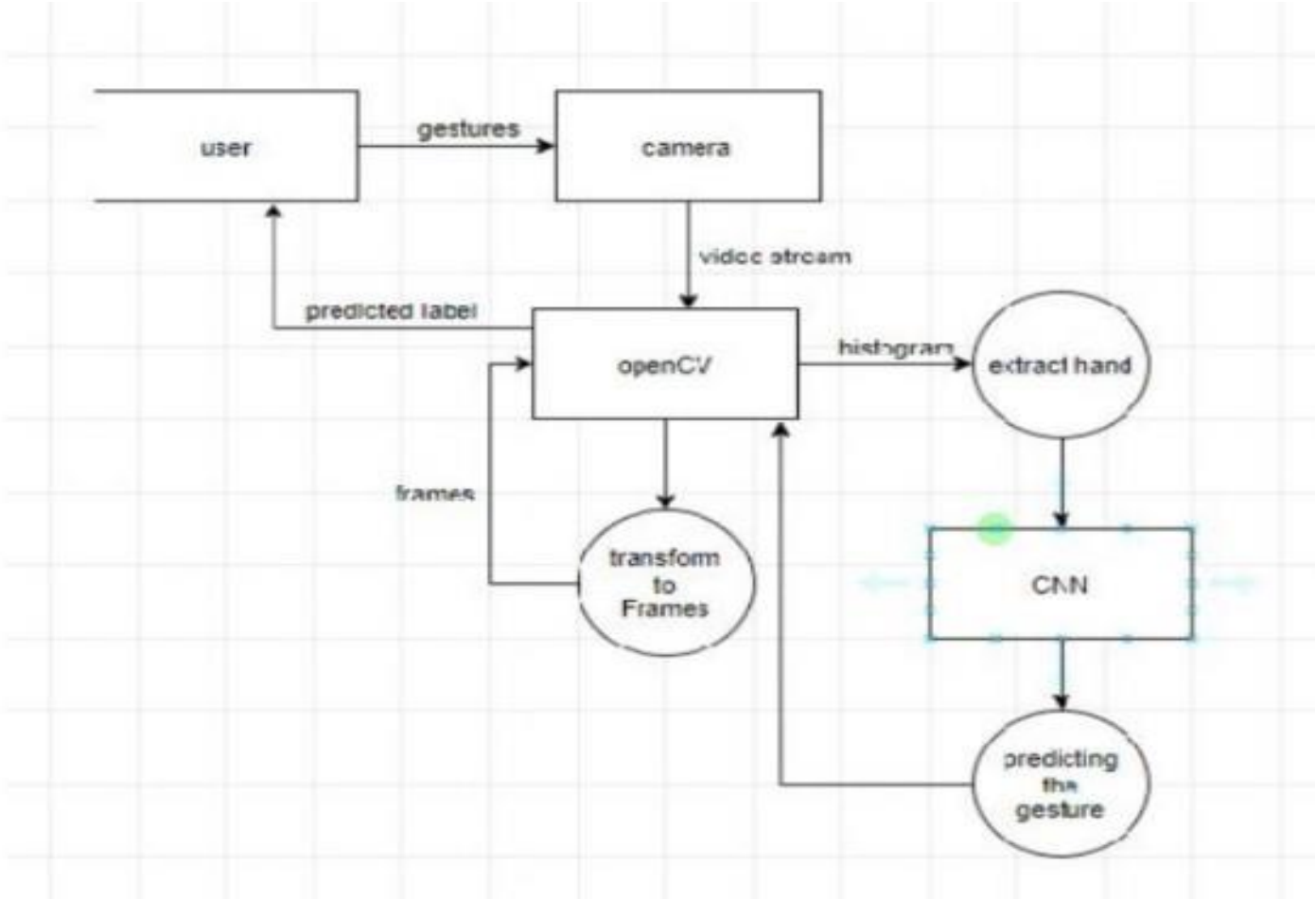
4.2 Non-Functional Requirements

CHAPTER-5

PROJECT DESIGN

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 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 gap between business problems and technology solutions. Its goals are to:

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

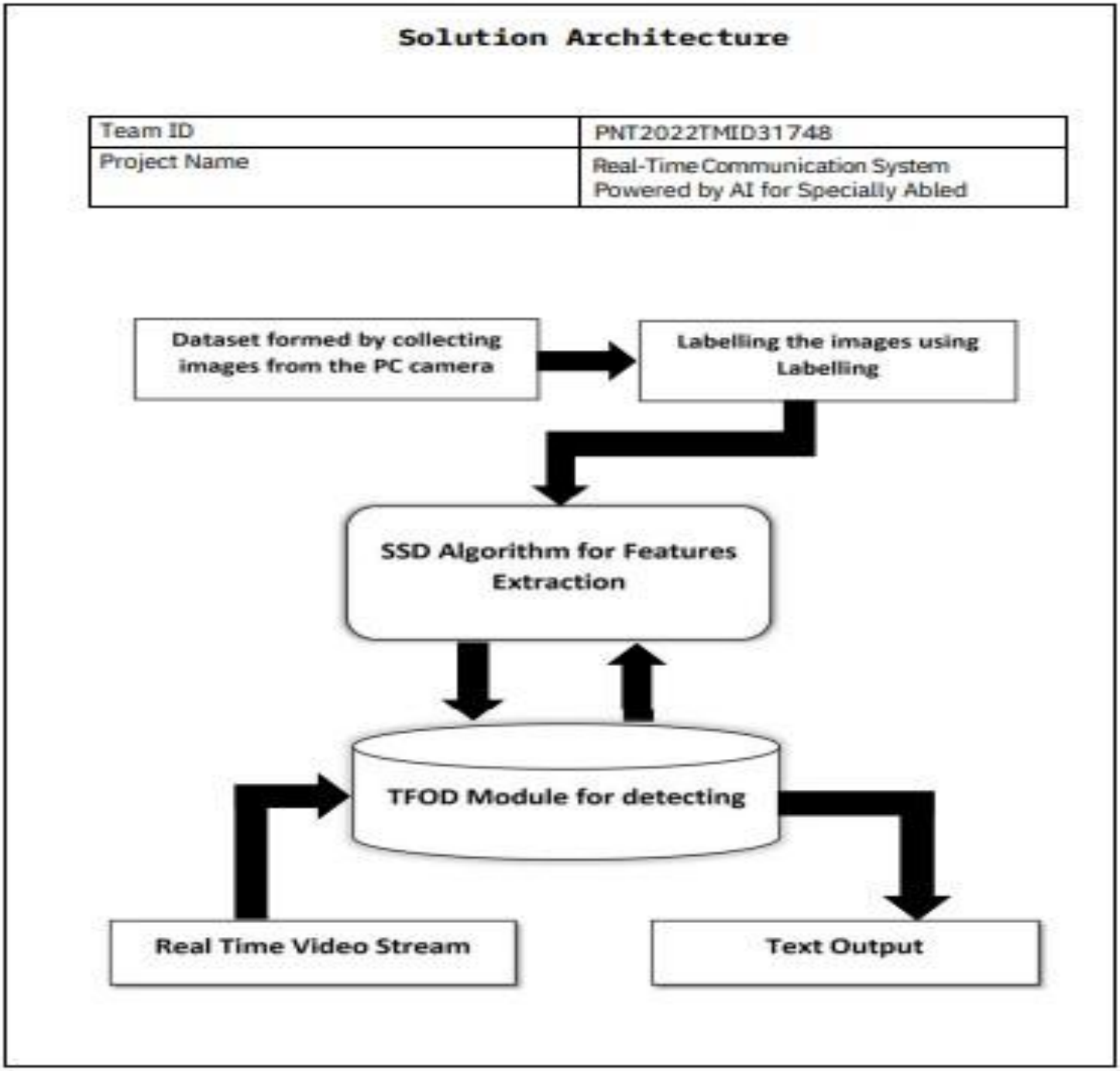
2. Describe the structure, characteristics, behaviour, and other aspects of the

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 :



Technology Stack (Architecture & Stack):

Technical Architecture:

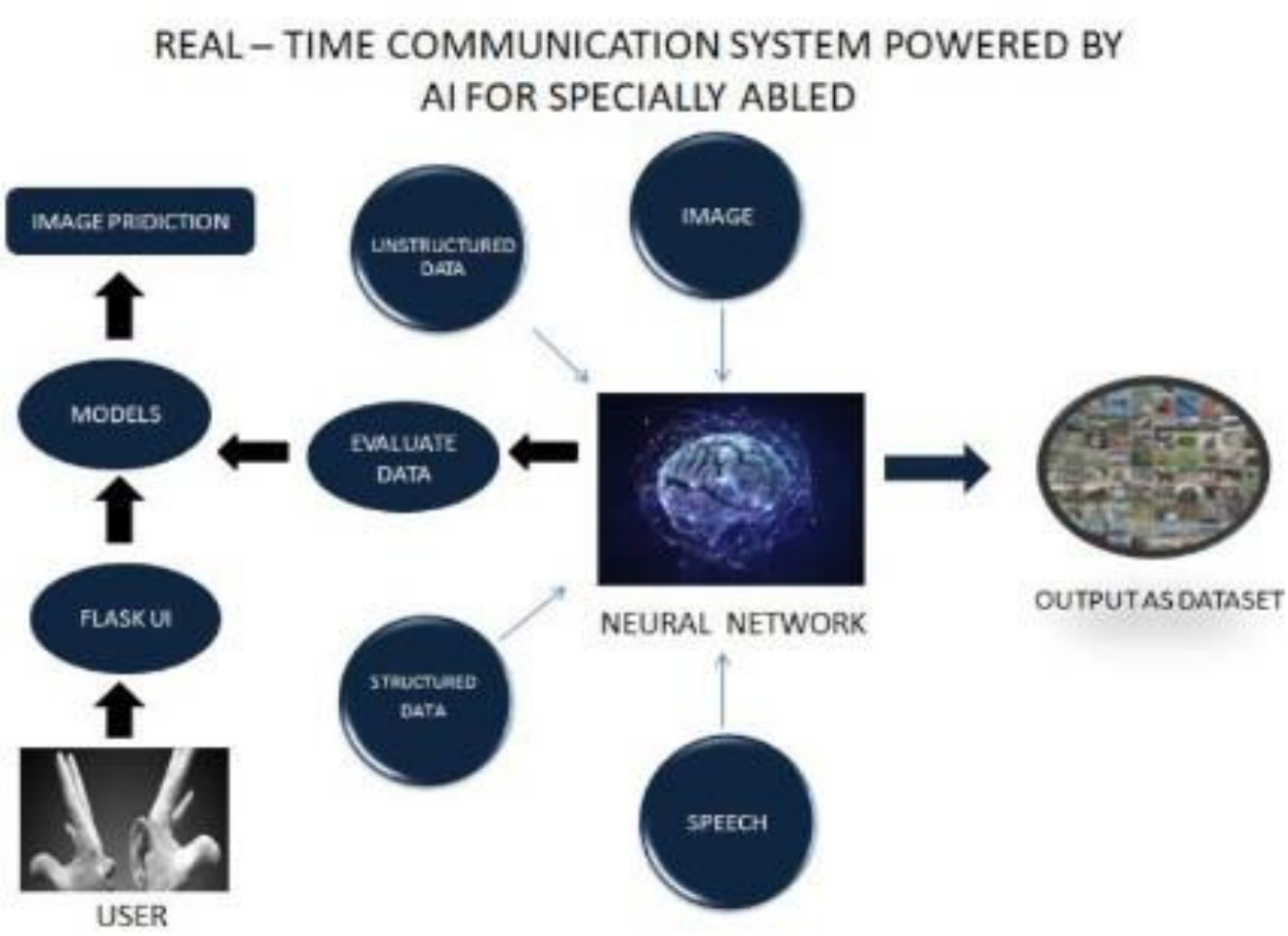


Table-1 Components and Technologies:

S.No	Component	Description	Technology
1.	User	Communication barriers of deaf or hearing-impaired people with other communities, contributing significantly to their social inclusion	AI technology
2.	Flash UI	Flash's user interface components let you interact with the users that use your site and gather information.	Using the cloud it can be executed
3.	Models	Support Vector Machine (SVM) is subsequently applied to classify our gesture image dataset.	Machine Learning
4.	Image Prediction	Gesture can be completely observable and viewing a gesture from another perspective makes the prediction.	ANN,CNN
5.	Image	Image processing is used to made the image into signs by the neural network	ANN, CNN, Open CV
6.	Speech	Speech translates the voice into image and sensitive neural play.	AI and machine learning methods like deep learning and neural networks
7.	Evaluate data	Aims to estimate the generalization accuracy of a model on future (unseen/out-of-sample) data.	
8.	Unstructured data	P unstructured data is a conglomeration of many varied types of data that are stored in their native formats	Natural Language Processing (NLP)
9.	Structured data	Typically categorized as quantitative data — is highly organized and easily decipherable by machine learning algorithms	Machine language and artificial intelligence tools
10.	Neural network	The same convolutional neural network architecture was used for both, the top view and the bottom view models, the only difference is the number of output units	AI technology
11.	Dataset	First prototype of this system is was used a dataset of 24 static signs from the Panamanian Manual Alphabet.	AI technology

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Robots and other tools provide home-based care and other assistance, allowing people with disabilities to live independently	Artificial Intelligence like robots and software systems
2.	Security Implementations	Set the inclusion and exclusion criteria , Report the results in the survey	Artificial Intelligence
3.	Scalable Architecture	The improvement in the specially abled persons interaction with the environments	Artificial Intelligence
4.	Availability	Technology solutions that mimic humans and use logic from playing chess to solving equations and Machine learning is one of the technologies	Artificial Intelligence
5.	Performance	Enables people with disabilities to step into a world where their difficulties are understood and taken into account	Artificial Intelligence

5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Desktopuser)	Registration	USN-1	Not Required	I can access my account / dashboard	High	Sprint-1
	Login	USN-2	Not Required		High	Sprint-1
	Dashboard	USN-3	Not Required			
Customer (Desktopuser)	Main page	USN-4	As a User, I can enter the web page once clicked, which provides be the Guidelines to use the app	I can enter the web page once clicked	Medium	Sprint-1
Customer (Desktopuser)	Guidelines	USN-5	As a User , I can give a read through the guidelines to understand the functioning of the app.	I can give a read through the guidelines.	Medium	Sprint-1
Customer (Desktopuser)	Convert Sign	USN-6	As a User, I can click the button Convert sign , which directs me towards the Main screen	I can click the button Convert sign and directedme to main screen.	Medium	Sprint-2
Customer (Desktopuser)	Camera(Hand movement detection)	USN-7	As a User, I can show my hand sign towards the camera which converts theminto text manner.	I can show my hand sign towards the camera accurately.	High	Sprint-2
Customer (Desktopuser)	Voice mode	USN-8	Once the text is obtained, As a User I can click on the voice mode which provides the text in the form of speech.	I can click on the voice mode which provides the text in the form of speech.	High	Sprint-2
Customer Care Executive	Provide the necessary functionalities requiredto use the app.		As an Executive, I can provide the Specifications of Camera required, andother factors that are required for smooth functioning of the app.	I can provide the Specifications of Camerarequired, and other factors	Low	Sprint-1
Customer Care Executive	Check the performanceof the app		As an Executive, I can check the usage andqueries obtained from the end users.	I can check the usage and queries obtained from the end users.	Medium	Sprint-1
Administrator	Receive queries basedon the usage		As an admin, I can take the queries from the customer care and perform the testing phase again. Loading the other signs in the dataset,in order to make the customers to use the app effictively	I can take the queries fromthe customer care and perform necessary phases again.	High	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	Mohanraju G
Sprint-1		USN-2	Image preprocessing	8	Medium	Mohanraju G
Sprint-2	Model Building	USN-3	Import the required libraries, add the necessary layers and compile the model	10	High	Aakash M K
Sprint-2		USN-4	Training the image classification model using CNN	7	Medium	Aakash M K
Sprint-3	Training and Testing	USN-5	Training the model and testing the model's performance	9	High	Manoj Kumar M
Sprint-4	Implementation of the application	USN-6	Converting the input sign language images into English alphabets	8	Medium	Suresh Kumar D

6.2 Sprint Delivery Schedule

Project Tracker,Velocity & BurndownChart:

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	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:

$$AV = \frac{sprint\ duration}{velocity}$$

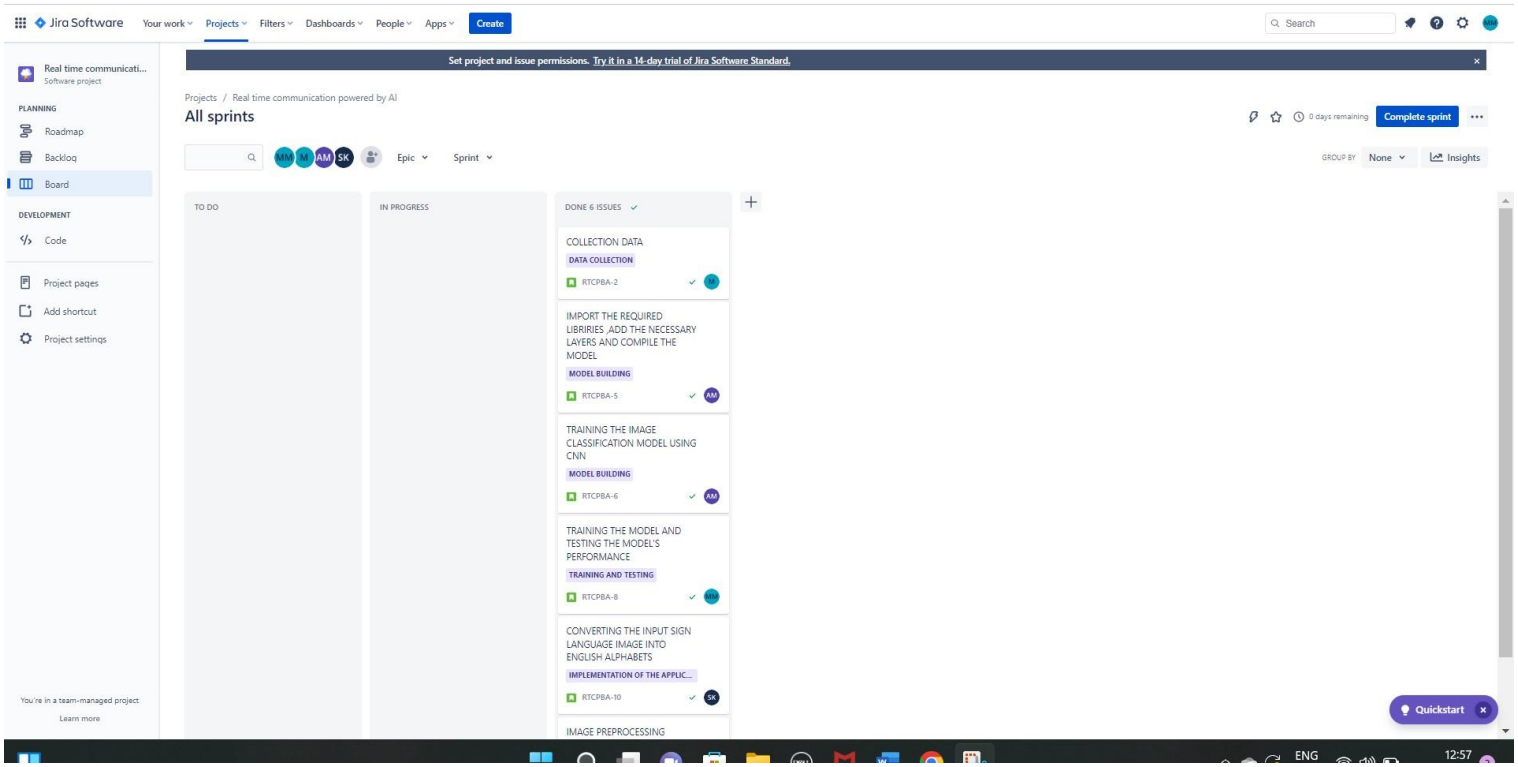
AV = 7/10 = 0.7

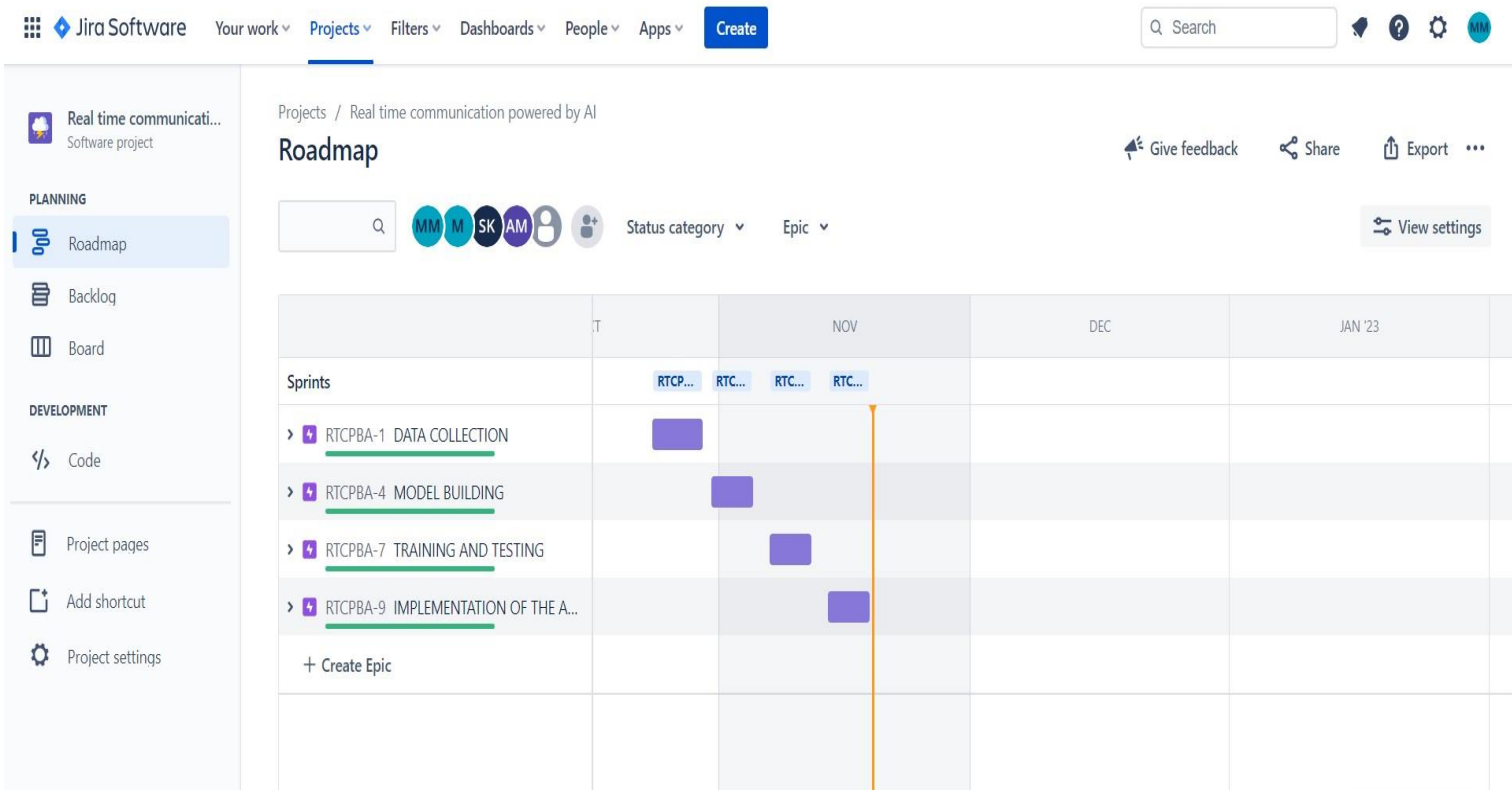
Burndown chart:

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologiessuch 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 for everything 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.




Jira Software
Your work
Projects
Filters
Dashboards
People
Apps
Create
Search
Real time communicati...
Software project
PLANNING
Roadmap
Backlog
Board
DEVELOPMENT
Code
Project pages
Add shortcut
Project settings
Projects / Real time communication powered by AI
Roadmap
Give feedback
Share
Export
MM
M
SK
AM
Status category
Epic
View settings
NOV
DEC
JAN '23
Sprints
RTCP...
RTC...
RTC...
RTC...
RTCPBA-1 DATA COLLECTION
RTCPBA-4 MODEL BUILDING
RTCPBA-7 TRAINING AND TESTING
RTCPBA-9 IMPLEMENTATION OF THE A...
Create Epic

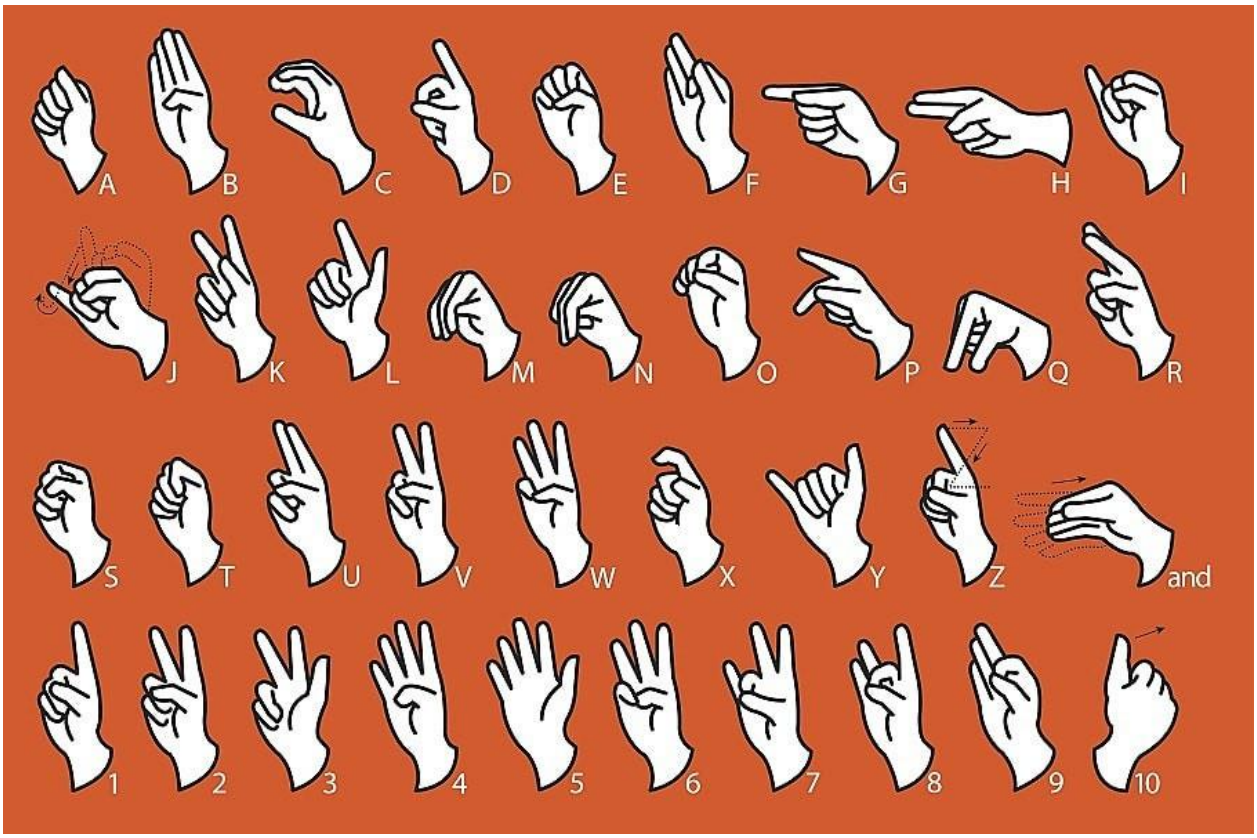
CHAPTER-7

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 sign language standards that exist.



MODEL BUILDING

IMPORT LIBRARIES

In [1]:
```
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 cv2
```

DATA AUGMENTATION

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,vertical_flip=False)
test_datagen = ImageDataGenerator(rescale=1./255)
```

In [3]:
```
x_train = train_datagen.flow_from_directory(r"C:\Users\manoj\Downloads\conversation engine for deaf and dumb\Dataset\training_set
                                            class_mode='categorical', color_mode = "grayscale")
```

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

In [4]:
```
x_test = test_datagen.flow_from_directory(r"C:\Users\manoj\Downloads\conversation engine for deaf and dumb\Dataset\test_set",targ
                                          class_mode='categorical', color_mode = "grayscale")
```

```
Found 2248 images belonging to 9 classes.
```

In [5]:
```
len(x_train)
```

Out[5]:
```
53
```

In [6]:
```
len(x_test)
```

Out[6]:
```
8
```

In [7]:
```
x_train.class_indices
```

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

In [8]:
```
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 [9]:
```
#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 [10]:
```
model.compile(loss='categorical_crossentropy', optimizer='adam', metrics=['accuracy'])
model.fit_generator(x_train, steps_per_epoch=30, epochs=10, validation_data=x_test,validation_steps=50)
```

```
C:\Users\manoj\AppData\Local\Temp\ipykernel_13516\2466348400.py:2: UserWarning: `Model.fit_generator` is deprecated and will be removed in a future version. Please use `Model.fit`, which supports generators.
  model.fit_generator(x_train, steps_per_epoch=30, epochs=10, validation_data=x_test,validation_steps=50)
Epoch 1/10
30/30 [==============================] - ETA: 0s - loss: 0.7062 - accuracy: 0.7498WARNING:tensorflow:Your input ran out of dat
a; interrupting training. Make sure that your dataset or generator can generate at least `steps_per_epoch * epochs` batches (in
this case, 50 batches). You may need to use the repeat() function when building your dataset.
30/30 [==============================] - 31s 864ms/step - loss: 0.7062 - accuracy: 0.7498 - val_loss: 0.2977 - val_accuracy: 0.
9204
Epoch 2/10
30/30 [==============================] - 19s 631ms/step - loss: 0.1214 - accuracy: 0.9653
Epoch 3/10
30/30 [==============================] - 18s 602ms/step - loss: 0.0637 - accuracy: 0.9802
Epoch 4/10
30/30 [==============================] - 18s 583ms/step - loss: 0.0532 - accuracy: 0.9844
Epoch 5/10
30/30 [==============================] - 17s 568ms/step - loss: 0.0317 - accuracy: 0.9905
Epoch 6/10
30/30 [==============================] - 17s 556ms/step - loss: 0.0223 - accuracy: 0.9942
Epoch 7/10
30/30 [==============================] - 15s 510ms/step - loss: 0.0160 - accuracy: 0.9963
Epoch 8/10
30/30 [==============================] - 15s 514ms/step - loss: 0.0081 - accuracy: 0.9977
Epoch 9/10
30/30 [==============================] - 16s 517ms/step - loss: 0.0063 - accuracy: 0.9981
Epoch 10/10
30/30 [==============================] - 16s 545ms/step - loss: 0.0071 - accuracy: 0.9987
```

Out[10]:
```
<keras.callbacks.History at 0x27f93577f70>
```

In [11]:
```
model.save('Real_time.h5')
```

TEST THE MODEL

In [12]:
```
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
import numpy as np
import cv2
```

In [13]:
```
model = load_model('Real_time.h5')
```

In [16]:
```
img = image.load_img('1.png',target_size = (100,100))
img
```

Out[16]:

In [17]:
```
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 [18]:
```
img=image.load_img("10.png")
detect(img)
```

```
1/1 [==============================] - 4s 4s/step
THE PREDICTED LETTER IS  I
```

In [ ]:

7.2 Feature 2

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

Mobile App:

```
from flask import Flask, Response, render_template
from camera 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_':
        app.run()
```

CHAPTER-8

TESTING

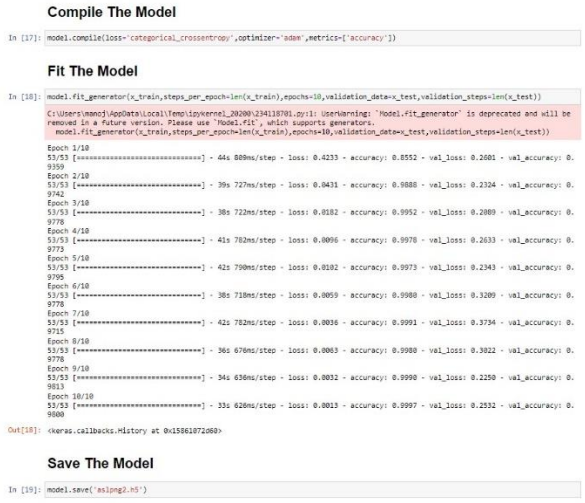
8.1 Test cases

➤ 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%	

```
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'])
```

Compile The Model

```
In [17]: model.compile(loss='categorical_crossentropy',optimizer='adam',metrics=['accuracy'])
```

Fit The Model

```
In [18]: model.fit_generator(x_train,steps_per_epoch=len(x_train),epochs=10,validation_data=x_test,validation_steps=len(x_test))

C:\Users\manoj\AppData\Local\Temp\ipykernel_20200\234118701.py:1: UserWarning: `Model.fit_generator` is deprecated and will be
removed in a future version. Please use `Model.fit`, which supports generators.
  model.fit_generator(x_train,steps_per_epoch=len(x_train),epochs=10,validation_data=x_test,validation_steps=len(x_test))

Epoch 1/10
53/53 [==============================] - 44s 809ms/step - loss: 0.4233 - accuracy: 0.8552 - val_loss: 0.2601 - val_accuracy: 0.
9359
Epoch 2/10
53/53 [==============================] - 39s 727ms/step - loss: 0.0431 - accuracy: 0.9888 - val_loss: 0.2324 - val_accuracy: 0.
9742
Epoch 3/10
53/53 [==============================] - 38s 722ms/step - loss: 0.0182 - accuracy: 0.9952 - val_loss: 0.2089 - val_accuracy: 0.
9778
Epoch 4/10
53/53 [==============================] - 41s 782ms/step - loss: 0.0096 - accuracy: 0.9978 - val_loss: 0.2633 - val_accuracy: 0.
9773
Epoch 5/10
53/53 [==============================] - 42s 790ms/step - loss: 0.0102 - accuracy: 0.9973 - val_loss: 0.2343 - val_accuracy: 0.
9795
Epoch 6/10
53/53 [==============================] - 38s 718ms/step - loss: 0.0059 - accuracy: 0.9980 - val_loss: 0.3209 - val_accuracy: 0.
9778
Epoch 7/10
53/53 [==============================] - 42s 782ms/step - loss: 0.0036 - accuracy: 0.9991 - val_loss: 0.3734 - val_accuracy: 0.
9715
Epoch 8/10
53/53 [==============================] - 36s 676ms/step - loss: 0.0063 - accuracy: 0.9980 - val_loss: 0.3022 - val_accuracy: 0.
9778
Epoch 9/10
53/53 [==============================] - 34s 636ms/step - loss: 0.0032 - accuracy: 0.9990 - val_loss: 0.2250 - val_accuracy: 0.
9813
Epoch 10/10
53/53 [==============================] - 33s 628ms/step - loss: 0.0013 - accuracy: 0.9997 - val_loss: 0.2532 - val_accuracy: 0.
9800

Out[18]: <keras.callbacks.History at 0x1586107d60>
```

Save The Model

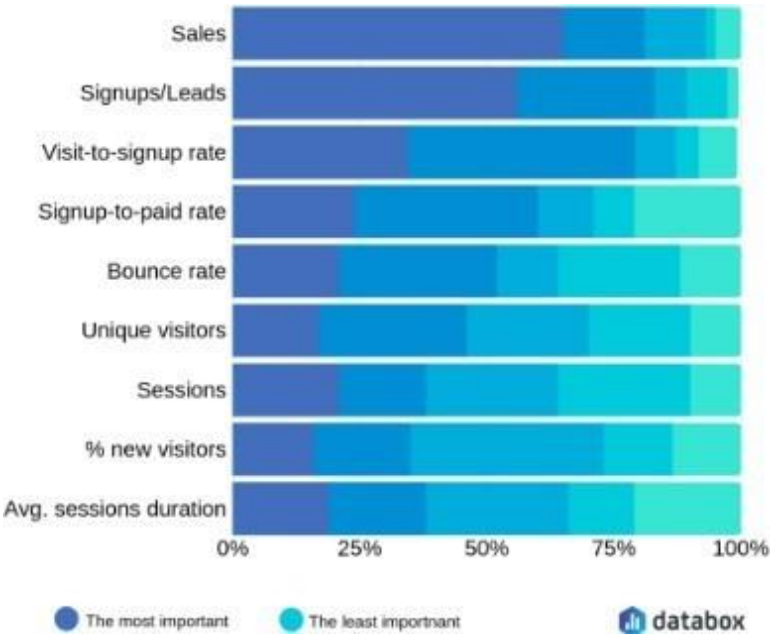
```
In [19]: model.save('aslpng2.h5')
```

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 testing database consists of 2250 images of Alphabets from "A" to "I".**
- **Once the gesture is recognized the equivalent alphabet is shown on the screen.**



output:

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 so accuracy is moderate level.
- It will be improved by changing the dataset.
- Currently, we have deployed a dataset in the model for the alphabets A to I only.

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 alphabets that are understandable to humans. This system sends hand gestures to the model, who recognizes them and displays the equivalent.

CHAPTER-12

FUTURE SCOPE

FUTURE OF 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 changer in the field of communication and Ai for specially-abled people such as thosedeaf or dumb.

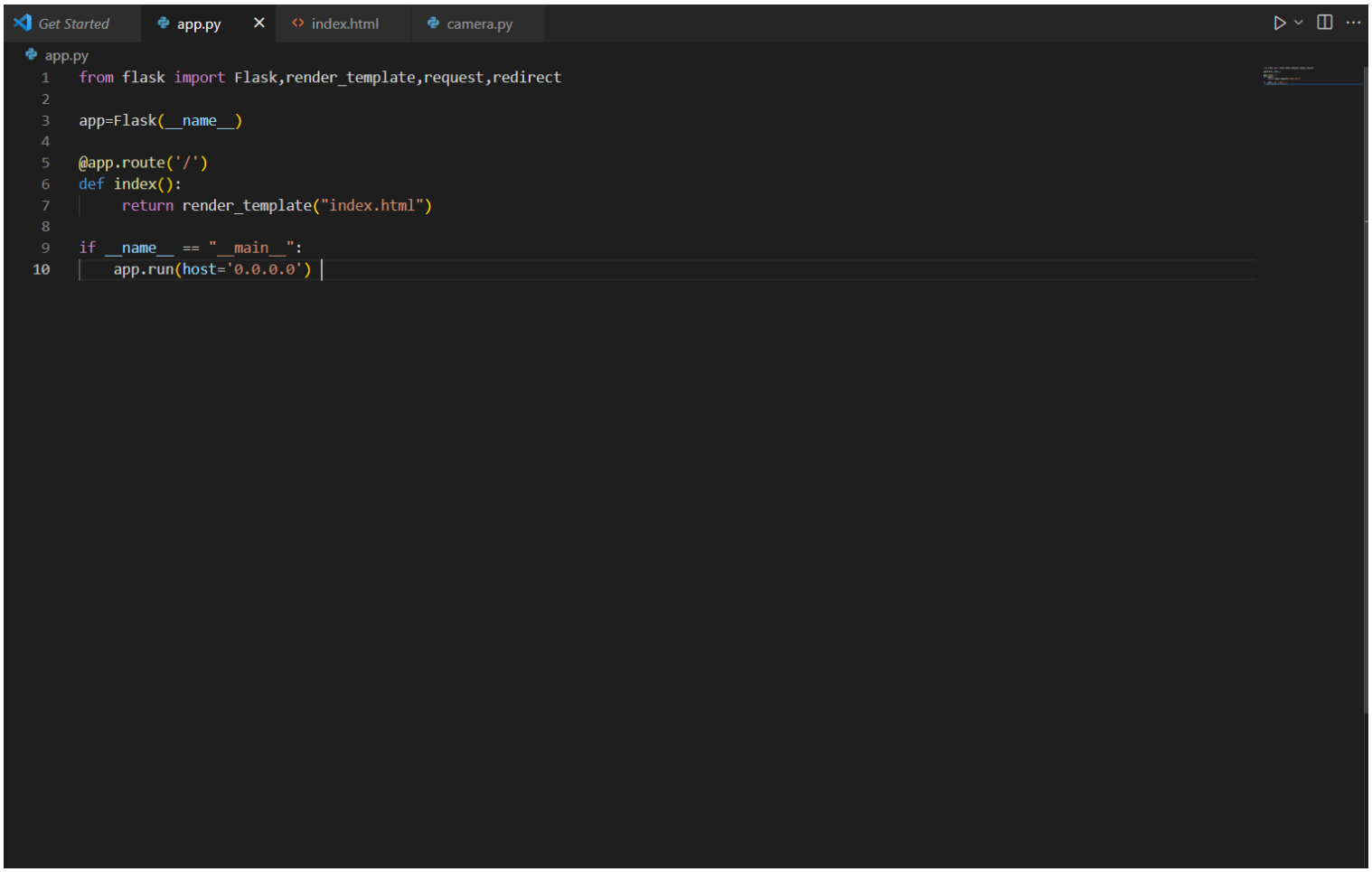
CHAPTER-13

APPENDIX

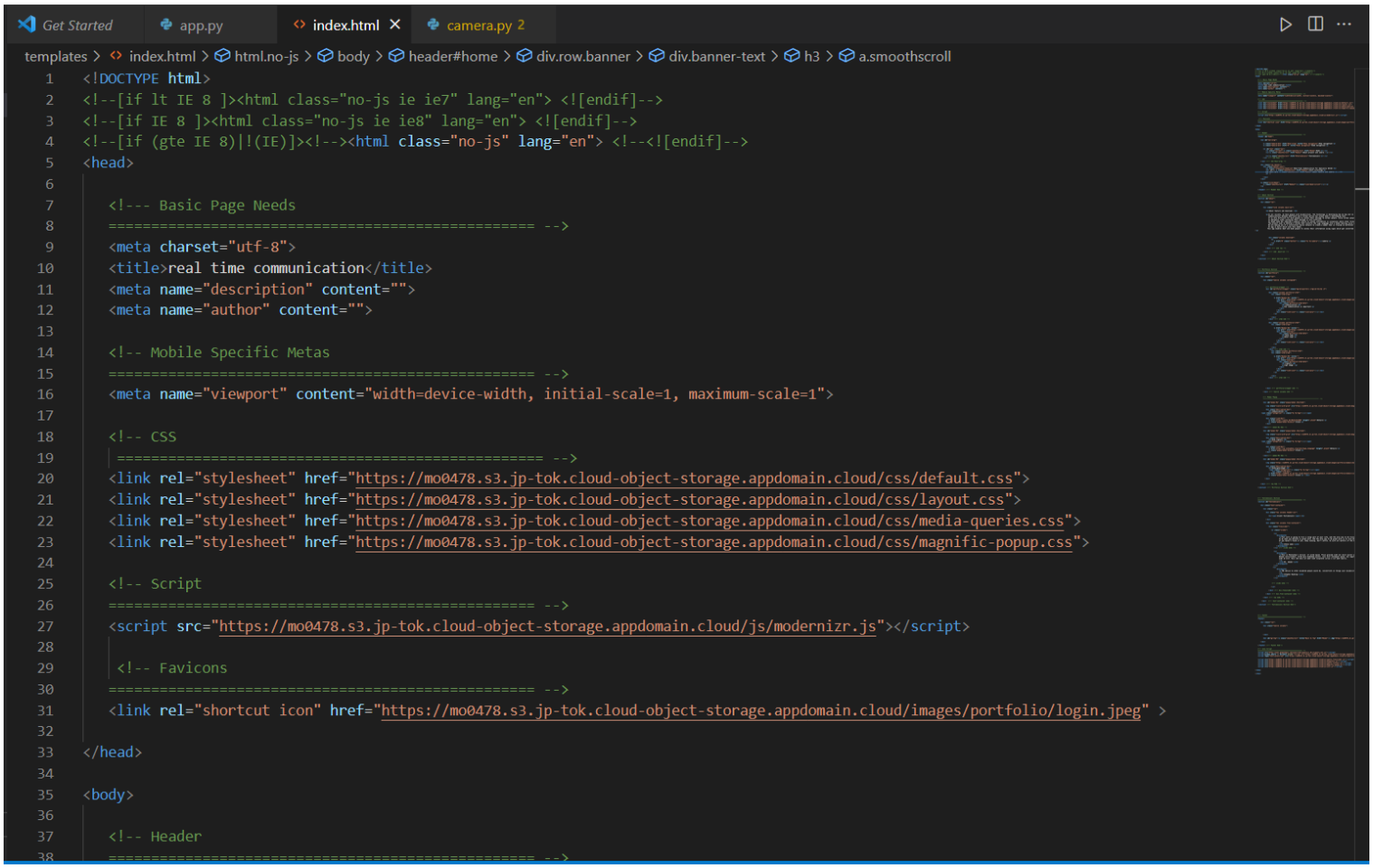
APPENDIX:

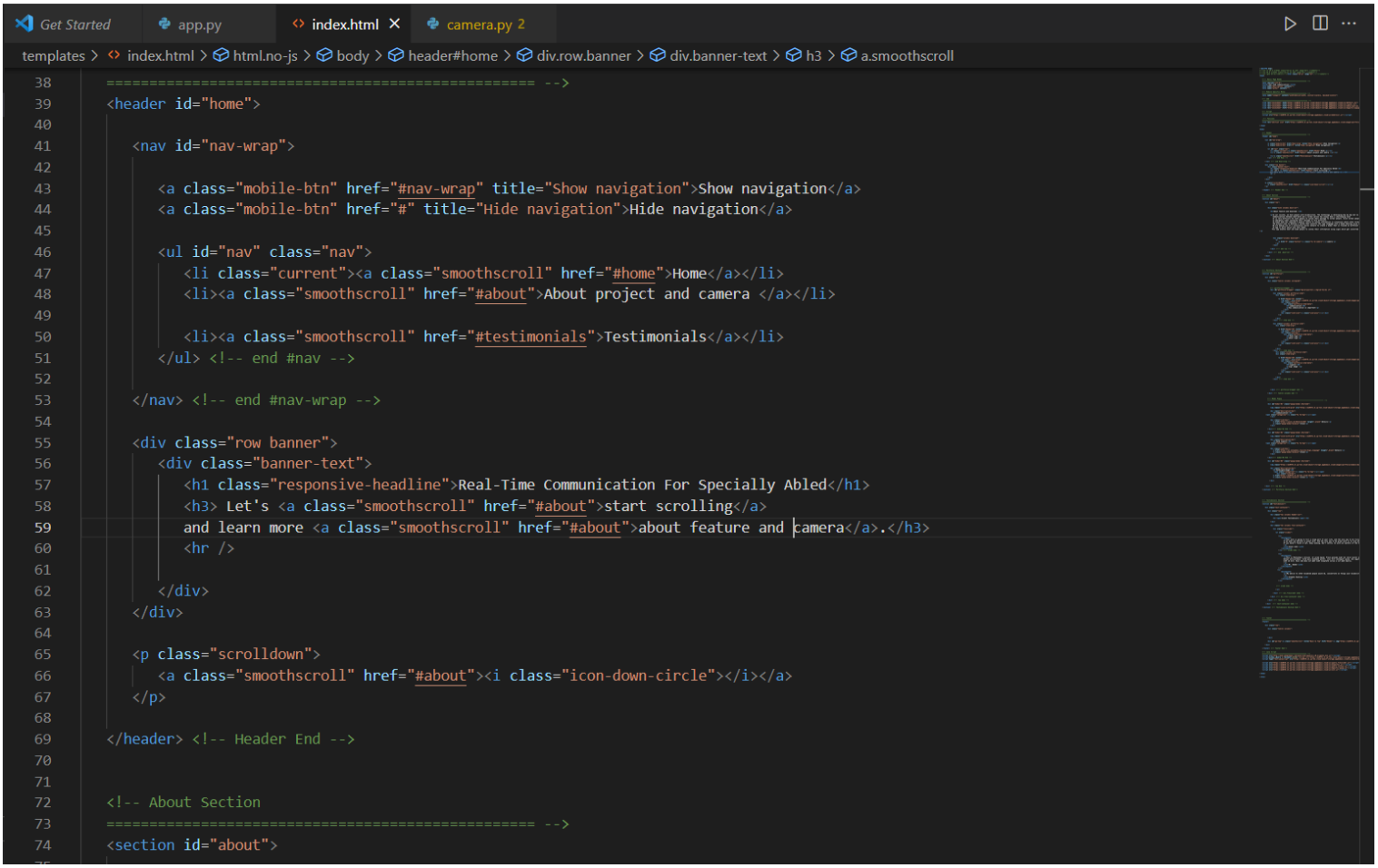
Source code:

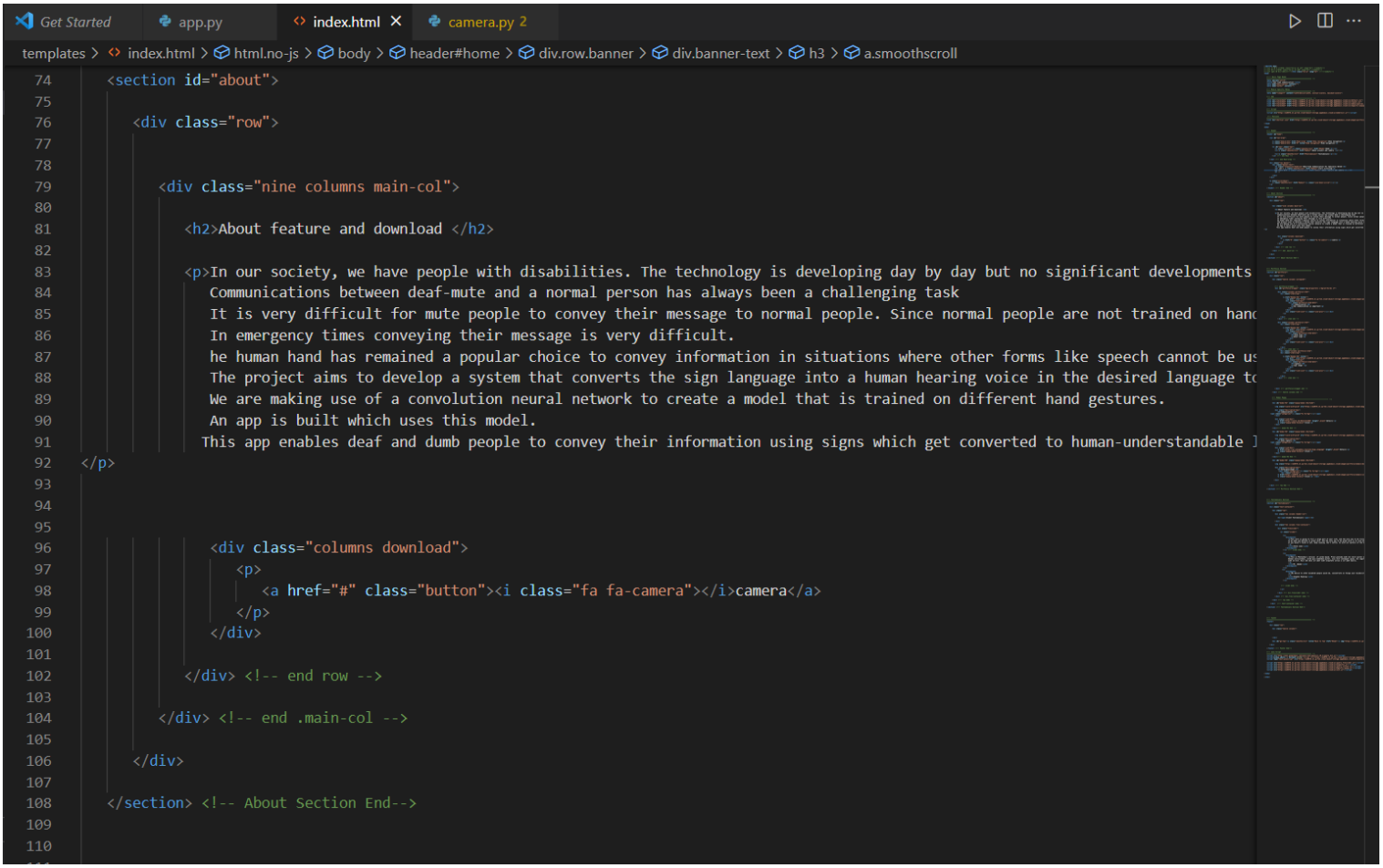
Flask:

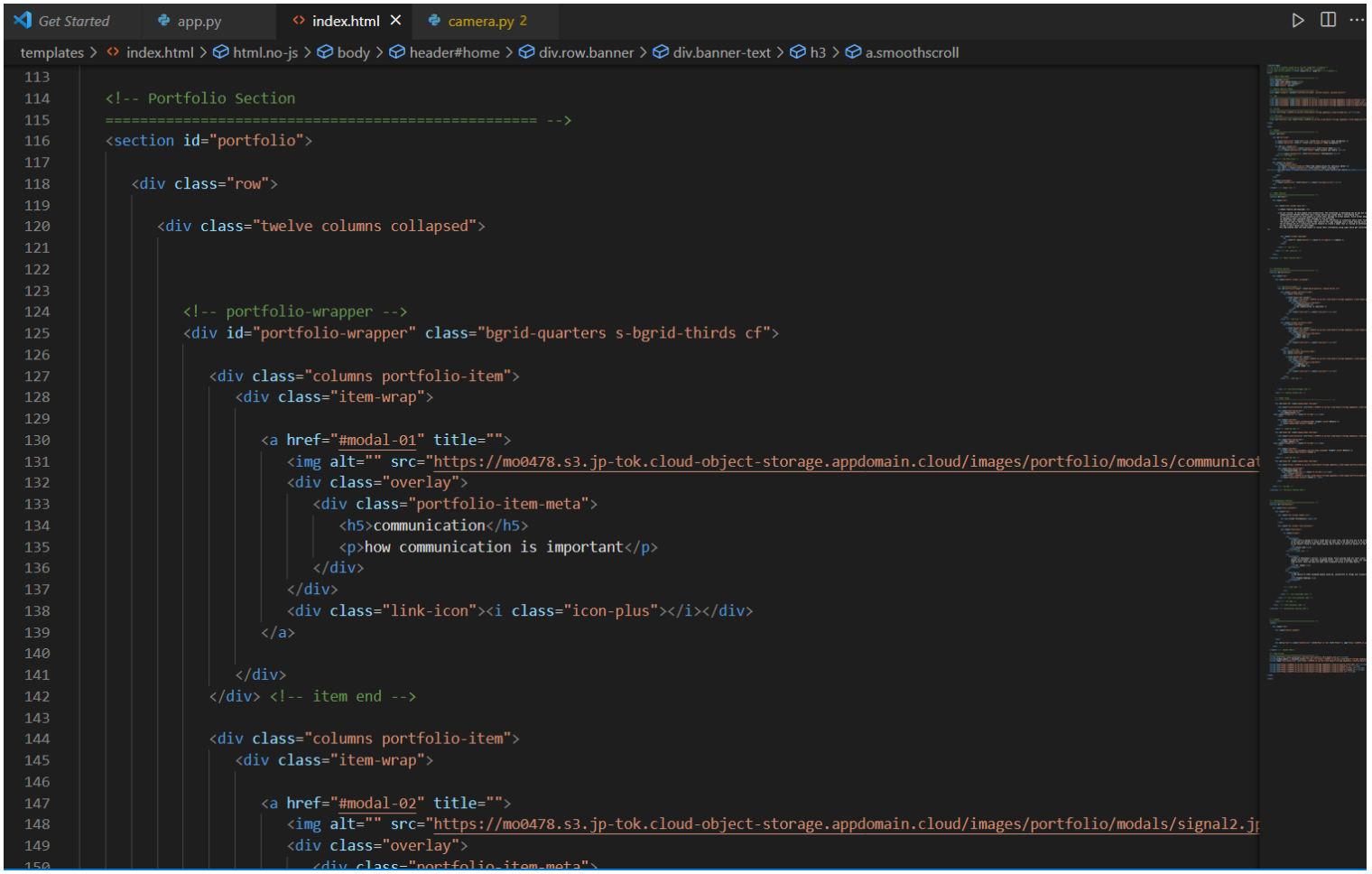


HTML:


Get Started
app.py
index.html
camera.py 2
templates > index.html > html.no-js > body > header#home > div.row.banner > div.banner-text > h3 > a.smoothscroll
<!DOCTYPE html>
<!--[if lt IE 8]><html class="no-js ie ie7" lang="en"> <![endif]-->
<!--[if IE 8]><html class="no-js ie ie8" lang="en"> <![endif]-->
<!--[if (gte IE 8)|!(IE)]><!--><html class="no-js" lang="en"> <!--<![endif]-->
<head>
<!--- Basic Page Needs
<meta charset="utf-8">
<title>real time communication</title>
<meta name="description" content="">
<meta name="author" content="">
<!-- Mobile Specific Metas
<meta name="viewport" content="width=device-width, initial-scale=1, maximum-scale=1">
<!-- CSS
<link rel="stylesheet" href="https://mo0478.s3.jp-tok.cloud-object-storage.appdomain.cloud/css/default.css">
<link rel="stylesheet" href="https://mo0478.s3.jp-tok.cloud-object-storage.appdomain.cloud/css/layout.css">
<link rel="stylesheet" href="https://mo0478.s3.jp-tok.cloud-object-storage.appdomain.cloud/css/media-queries.css">
<link rel="stylesheet" href="https://mo0478.s3.jp-tok.cloud-object-storage.appdomain.cloud/css/magnific-popup.css">
<!-- Script
<script src="https://mo0478.s3.jp-tok.cloud-object-storage.appdomain.cloud/js/modernizr.js"></script>
<!-- Favicons
<link rel="shortcut icon" href="https://mo0478.s3.jp-tok.cloud-object-storage.appdomain.cloud/images/portfolio/login.jpeg" >
</head>
<body>
<!-- Header


Get Started
app.py
index.html
camera.py 2
templates > index.html > html.no-js > body > header#home > div.row.banner > div.banner-text > h3 > a.smoothscroll
38 == -->
39 <header id="home">
40
41 <nav id="nav-wrap">
42
43 Show navigation
44 Hide navigation
45
46 <ul id="nav" class="nav">
47 <li class="current">Home
48 About project and camera
49
50 Testimonials
51 <!-- end #nav -->
52
53 </nav> <!-- end #nav-wrap -->
54
55
56
57 <h1 class="responsive-headline">Real-Time Communication For Specially Abled</h1>
58 <h3> Let's start scrolling
59 and learn more about feature and camera.</h3>
60 <hr />
61
62
63
64
65
66
67
68
69 </header> <!-- Header End -->
70
71
72 <!-- About Section
73 == -->
74 <section id="about">


Get Started
app.py
index.html
camera.py 2
templates > index.html > html.no-js > body > header#home > div.row.banner > div.banner-text > h3 > a.smoothscroll
74 <section id="about">
75
76
77
78
79
80
81 <h2>About feature and download </h2>
82
83 In our society, we have people with disabilities. The technology is developing day by day but no significant developments
84 Communications between deaf-mute and a normal person has always been a challenging task
85 It is very difficult for mute people to convey their message to normal people. Since normal people are not trained on hanc
86 In emergency times conveying their message is very difficult.
87 he human hand has remained a popular choice to convey information in situations where other forms like speech cannot be us
88 The project aims to develop a system that converts the sign language into a human hearing voice in the desired language tc
89 We are making use of a convolution neural network to create a model that is trained on different hand gestures.
90 An app is built which uses this model.
91 This app enables deaf and dumb people to convey their information using signs which get converted to human-understandable]
92
93
94
95
96
97
98 camera
99
100
101
102 <!-- end row -->
103
104 <!-- end .main-col -->
105
106
107
108 </section> <!-- About Section End-->
109
110


Get Started
app.py
index.html
camera.py 2
templates > index.html > html.no-js > body > header#home > div.row.banner > div.banner-text > h3 > a.smoothscroll
<!-- Portfolio Section
<section id="portfolio">

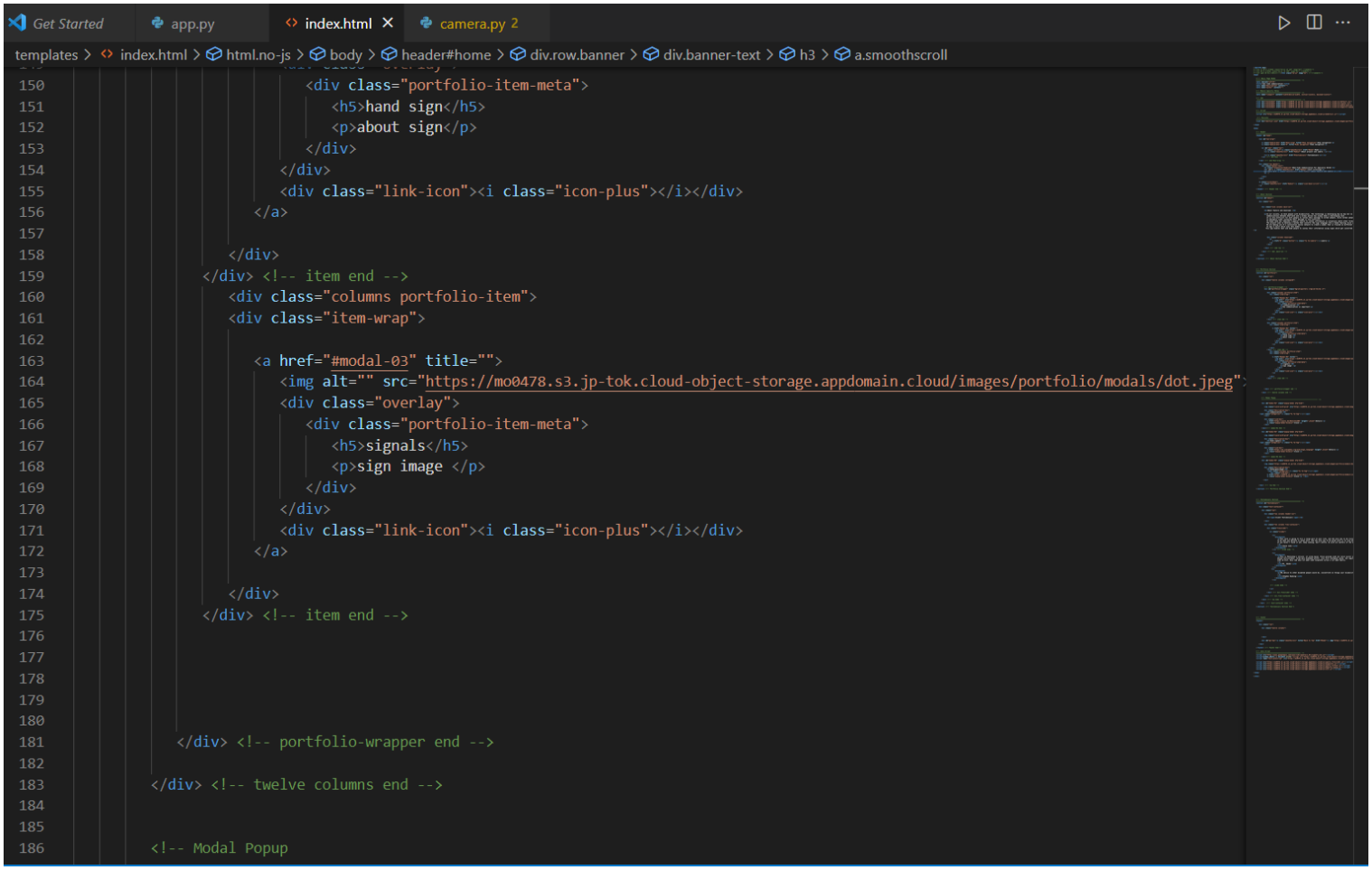
<!-- portfolio-wrapper -->

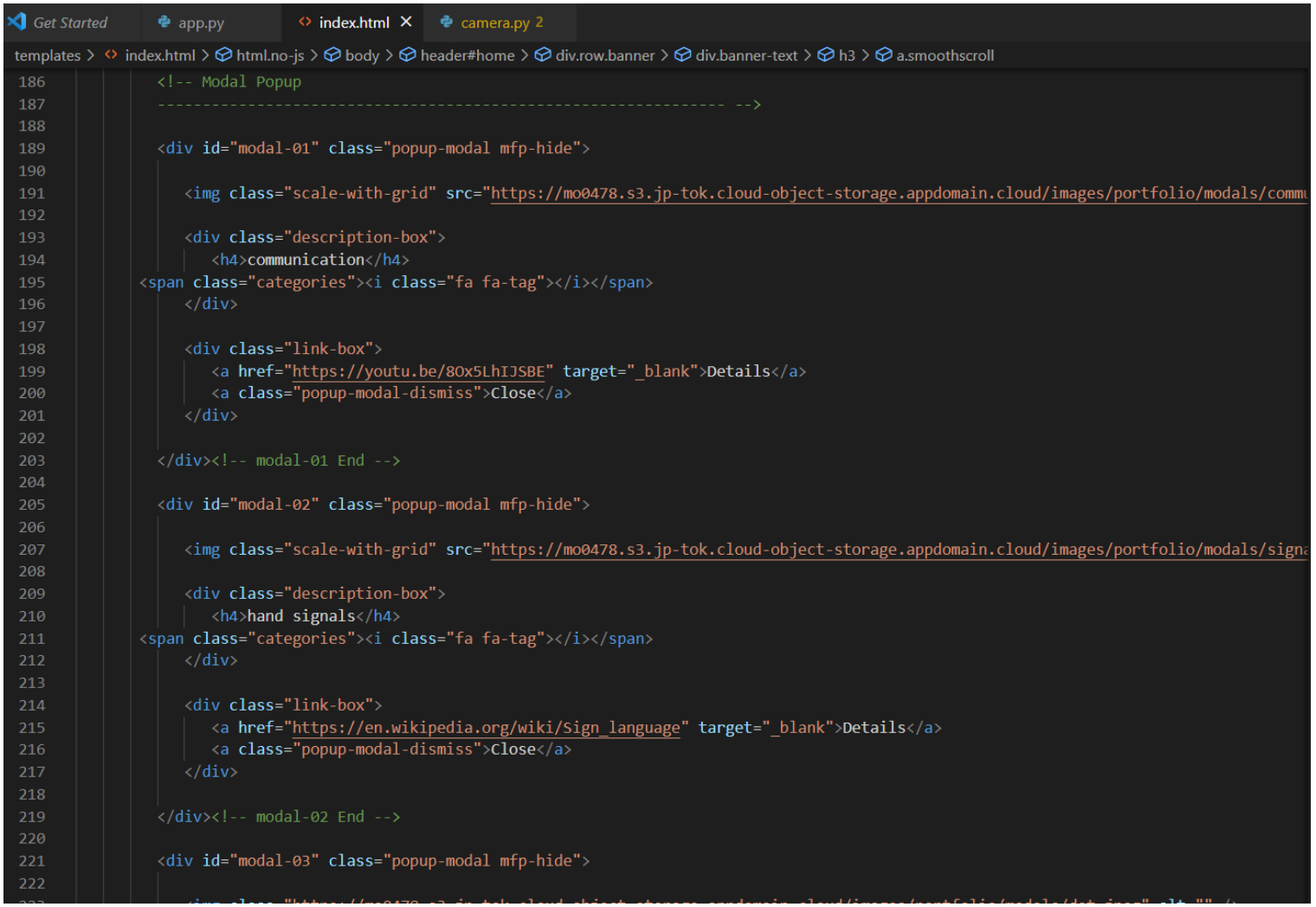
<img alt="" src="https://mo0478.s3.jp-tok.cloud-object-storage.appdomain.cloud/images/portfolio/modals/communicat

<h5>communication</h5>
how communication is important

 <!-- item end -->

<img alt="" src="https://mo0478.s3.jp-tok.cloud-object-storage.appdomain.cloud/images/portfolio/modals/signal2.jp


Get Started
app.py
index.html
camera.py 2
templates > index.html > html.no-js > body > header#home > div.row.banner > div.banner-text > h3 > a.smoothscroll
150
151 <h5>hand sign</h5>
152 about sign
153
154
155
156
157
158
159 <!-- item end -->
160
161
162
163
164 <img alt="" src="https://mo0478.s3.jp-tok.cloud-object-storage.appdomain.cloud/images/portfolio/modals/dot.jpeg">
165
166
167 <h5>signals</h5>
168 sign image
169
170
171
172
173
174
175 <!-- item end -->
176
177
178
179
180
181 <!-- portfolio-wrapper end -->
182
183 <!-- twelve columns end -->
184
185
186 <!-- Modal Popup


Get Started
app.py
index.html
camera.py 2
templates > index.html > html.no-js > body > header#home > div.row.banner > div.banner-text > h3 > a.smoothscroll
<!-- Modal Popup
---------- -->

<img class="scale-with-grid" src="https://mo0478.s3.jp-tok.cloud-object-storage.appdomain.cloud/images/portfolio/modals/commu

<h4>communication</h4>

Details
Close

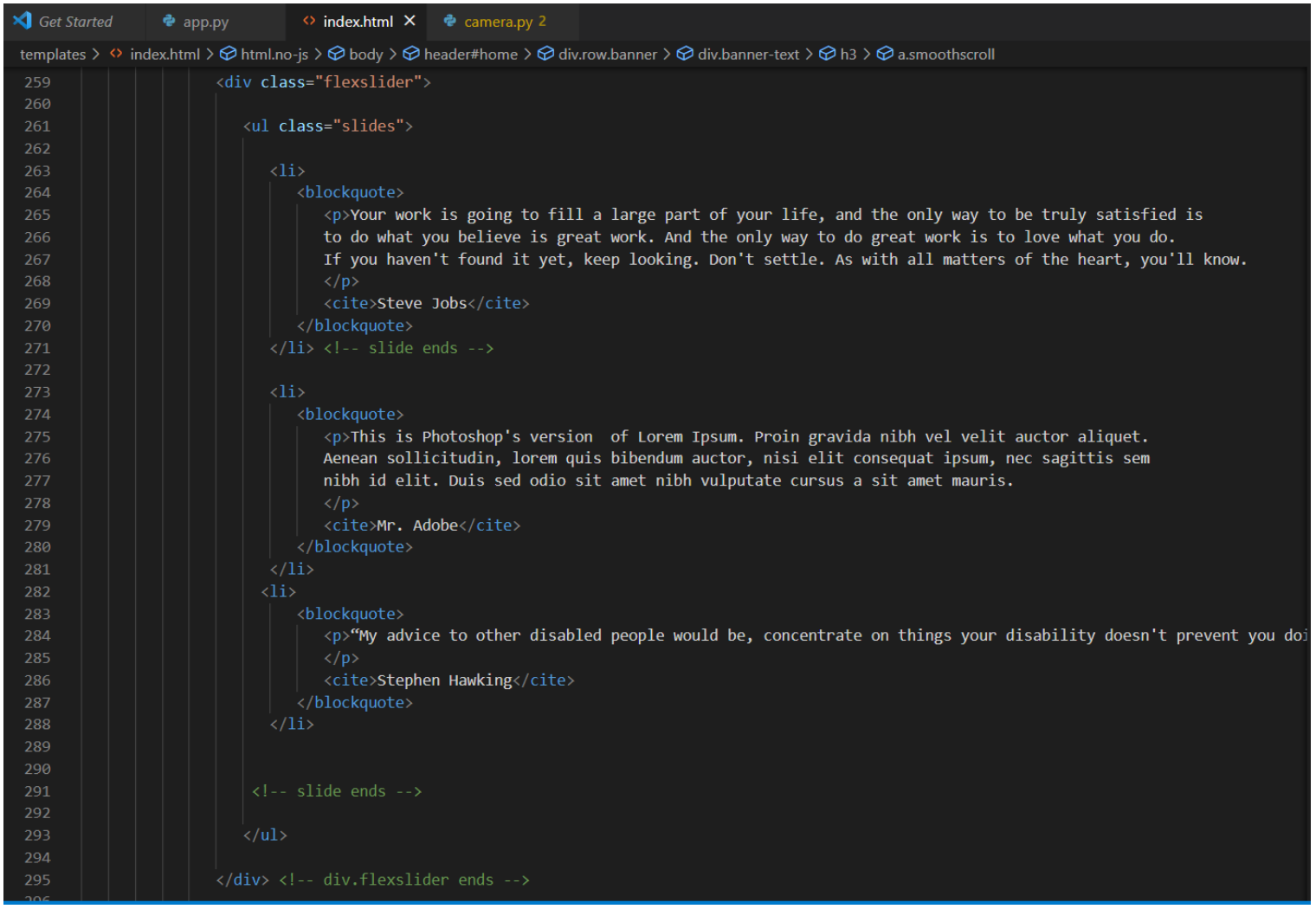
<!-- modal-01 End -->

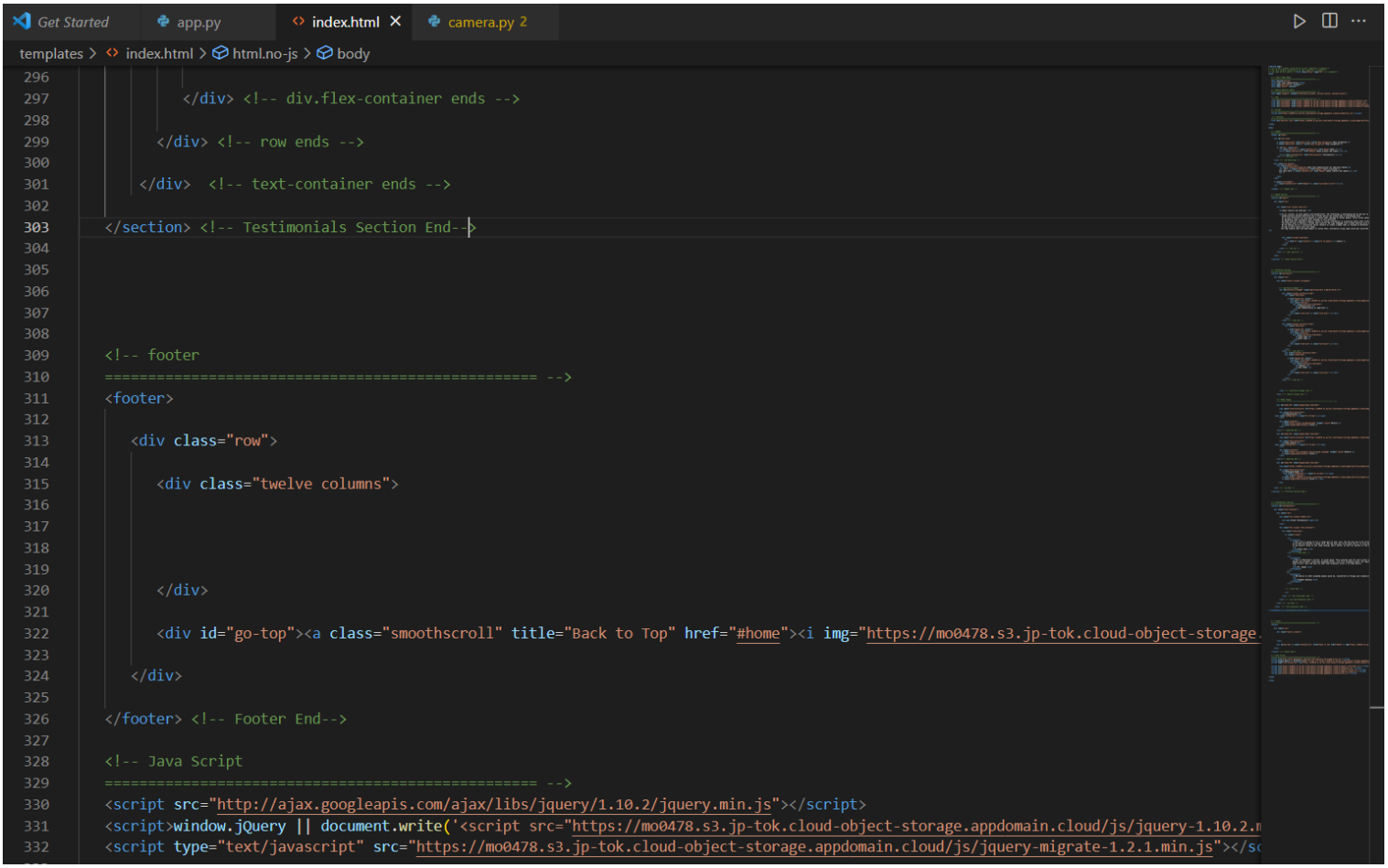
<img class="scale-with-grid" src="https://mo0478.s3.jp-tok.cloud-object-storage.appdomain.cloud/images/portfolio/modals/signa

<h4>hand signals</h4>

Details
Close

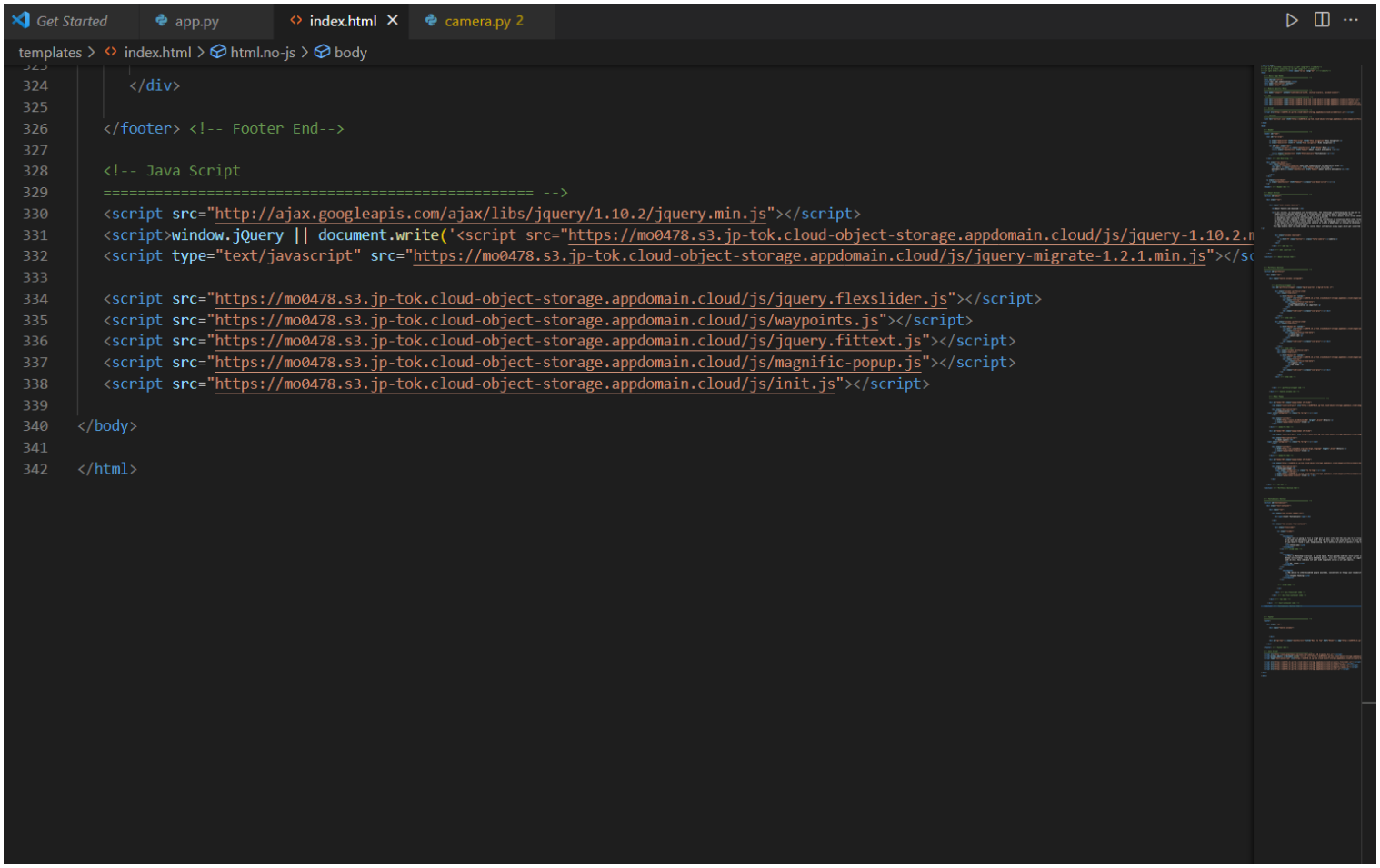
<!-- modal-02 End -->


Get Started
app.py
index.html
camera.py 2
templates > index.html > html.no-js > body > header#home > div.row.banner > div.banner-text > h3 > a.smoothscroll
259
260
261 <ul class="slides">
262
263
264 <blockquote>
265 Your work is going to fill a large part of your life, and the only way to be truly satisfied is
266 to do what you believe is great work. And the only way to do great work is to love what you do.
267 If you haven't found it yet, keep looking. Don't settle. As with all matters of the heart, you'll know.
268
269 <cite>Steve Jobs</cite>
270 </blockquote>
271 <!-- slide ends -->
272
273
274 <blockquote>
275 This is Photoshop's version of Lorem Ipsum. Proin gravida nibh vel velit auctor aliquet.
276 Aenean sollicitudin, lorem quis bibendum auctor, nisi elit consequat ipsum, nec sagittis sem
277 nibh id elit. Duis sed odio sit amet nibh vulputate cursus a sit amet mauris.
278
279 <cite>Mr. Adobe</cite>
280 </blockquote>
281
282
283 <blockquote>
284 “My advice to other disabled people would be, concentrate on things your disability doesn't prevent you doi
285
286 <cite>Stephen Hawking</cite>
287 </blockquote>
288
289
290
291 <!-- slide ends -->
292
293
294
295 <!-- div.flexslider ends -->


Get Started
app.py
index.html
camera.py 2
templates > index.html > html.no-js > body
 <!-- div.flex-container ends -->
 <!-- row ends -->
 <!-- text-container ends -->
</section> <!-- Testimonials Section End-->
<!-- footer
== -->
<footer>

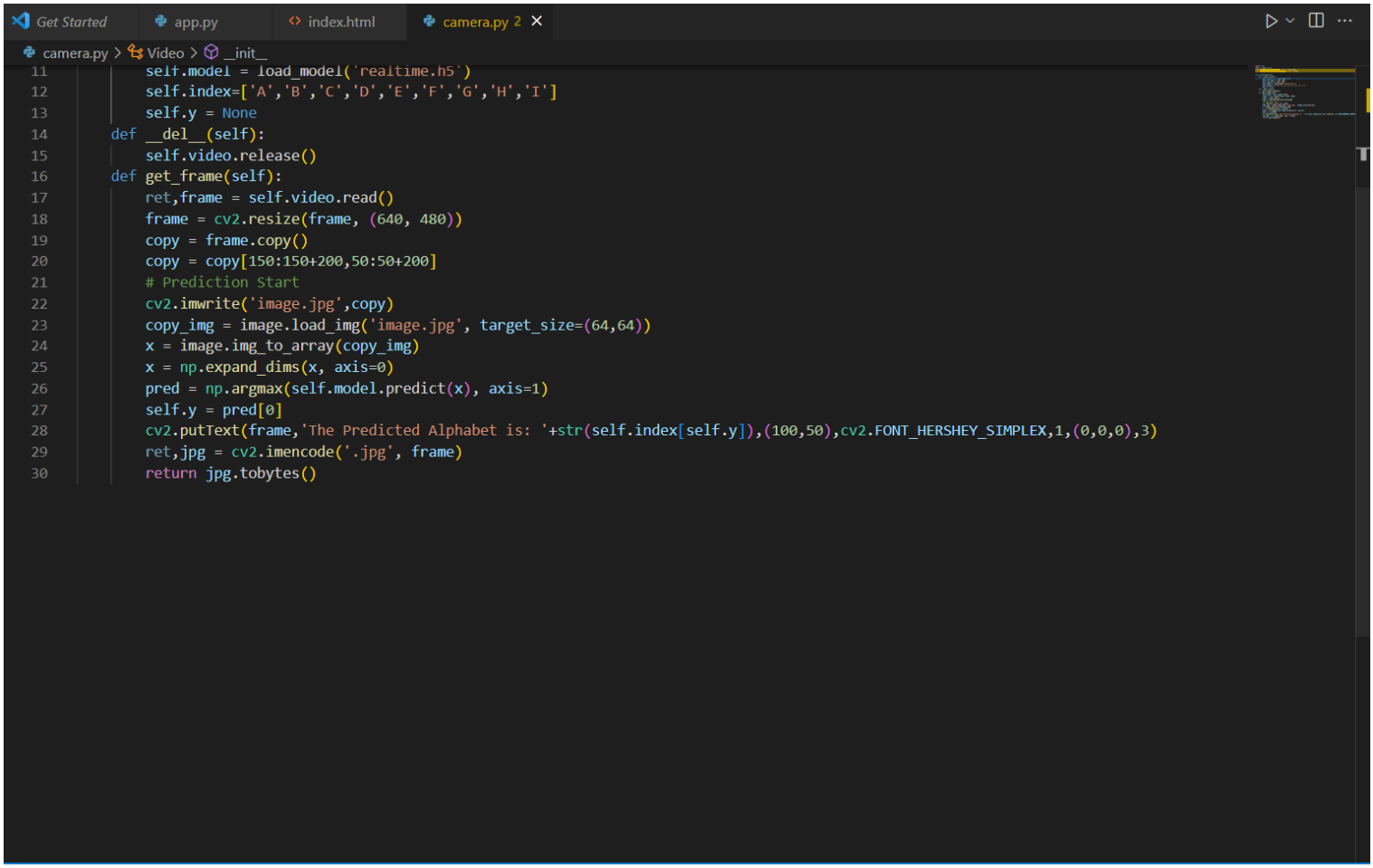
<a class="smoothscroll" title="Back to Top" href="#home"><i img="https://mo0478.s3.jp-tok.cloud-object-storage.

</footer> <!-- Footer End-->
<!-- Java Script
== -->
<script src="http://ajax.googleapis.com/ajax/libs/jquery/1.10.2/jquery.min.js"></script>
<script>window.jQuery || document.write('<script src="https://mo0478.s3.jp-tok.cloud-object-storage.appdomain.cloud/js/jquery-1.10.2.
<script type="text/javascript" src="https://mo0478.s3.jp-tok.cloud-object-storage.appdomain.cloud/js/jquery-migrate-1.2.1.min.js"></sc

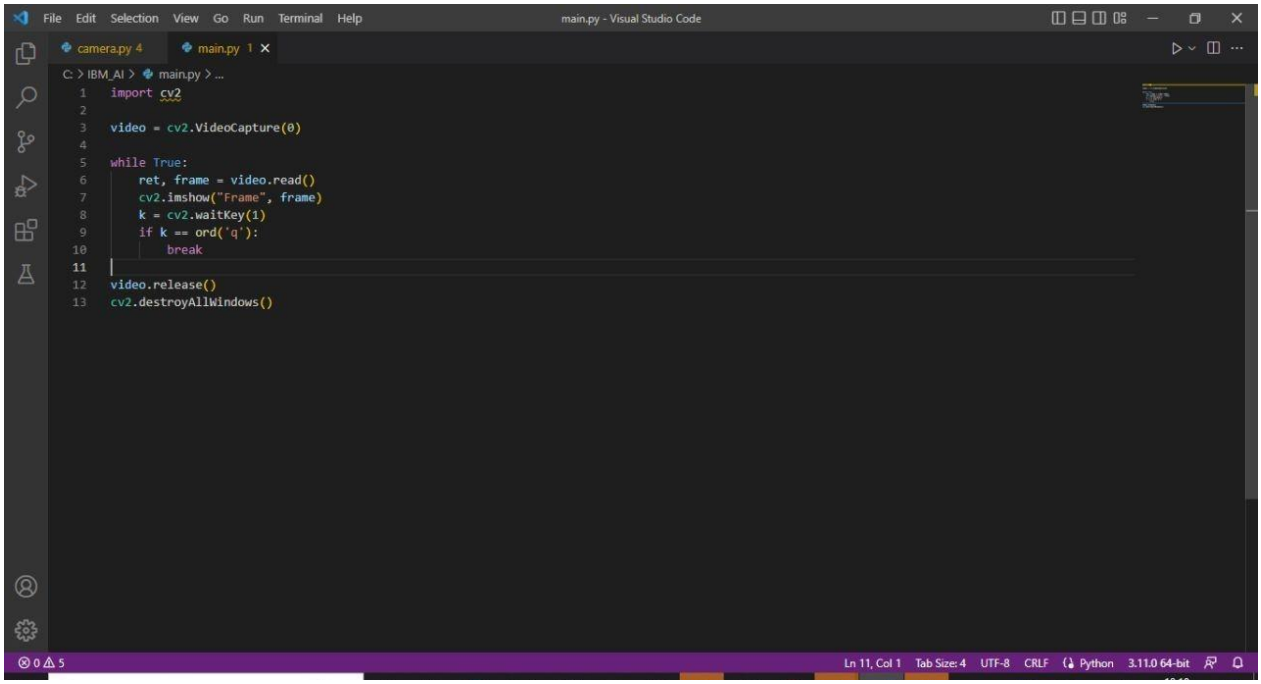

Get Started
app.py
index.html
camera.py 2
templates > index.html > html.no-js > body

</footer> <!-- Footer End-->
<!-- Java Script
========== -->
<script src="http://ajax.googleapis.com/ajax/libs/jquery/1.10.2/jquery.min.js"></script>
<script>window.jQuery || document.write('<script src="https://mo0478.s3.jp-tok.cloud-object-storage.appdomain.cloud/js/jquery-1.10.2.
<script type="text/javascript" src="https://mo0478.s3.jp-tok.cloud-object-storage.appdomain.cloud/js/jquery-migrate-1.2.1.min.js"></sc
<script src="https://mo0478.s3.jp-tok.cloud-object-storage.appdomain.cloud/js/jquery.flexslider.js"></script>
<script src="https://mo0478.s3.jp-tok.cloud-object-storage.appdomain.cloud/js/waypoints.js"></script>
<script src="https://mo0478.s3.jp-tok.cloud-object-storage.appdomain.cloud/js/jquery.fittext.js"></script>
<script src="https://mo0478.s3.jp-tok.cloud-object-storage.appdomain.cloud/js/magnific-popup.js"></script>
<script src="https://mo0478.s3.jp-tok.cloud-object-storage.appdomain.cloud/js/init.js"></script>
</body>
</html>

Camera:


Get Started
app.py
index.html
camera.py 2
camera.py > Video > __init__
self.model = load_model('realtime.h5')
self.index=['A','B','C','D','E','F','G','H','I']
self.y = None
def __del__(self):
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 Start
cv2.imwrite('image.jpg',copy)
copy_img = image.load_img('image.jpg', target_size=(64,64))
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)
ret,jpg = cv2.imencode('.jpg', frame)
return jpg.tobytes()

Main:


File Edit Selection View Go Run Terminal Help
main.py - Visual Studio Code
camera.py 4
main.py 1
C: > IBM_AI > main.py > ...
1 import cv2
2
3 video = cv2.VideoCapture(0)
4
5 while True:
6 ret, frame = video.read()
7 cv2.imshow("Frame", frame)
8 k = cv2.waitKey(1)
9 if k == ord('q'):
10 break
11
12 video.release()
13 cv2.destroyAllWindows()
Ln 11, Col 1 Tab Size: 4 UTF-8 CRLF Python 3.11.0 64-bit

GitHub Repository: https://github.com/IBM-EPBL/IBM-Project-18706-1659688741

**Demo Link : **https://youtu.be/t8FrC5huXzE