REAL-TIME COMMUNICATION SYSTEM POWERED BY AI FOR SPECIALLY ABLED

TEAM ID - PNT2022TMID28719

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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 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:

[1] **Bigham, J. P., Jayant, C., Miller, A., White, B., & Yeh, T. (2010, June). VizWiz::Locate It-enabling blind people to locate objects in their environment. In 2010 IEEE Computer Society Conference on Computer Vision and Pattern Recognition-Workshops (pp. 65-72). IEEE.**

The sixth sense is a multi-platform app for aiding the people in need that is people who are handicapped in the form of lack of speech (dumb), lack of hearing (deaf), lack of sight (blind), lack of judicial power to differentiate between objects (visual agnosia) and people suffering from autism (characterized by great difficulty in communicating and forming relationships with other people and in using language and abstract concepts). Our current implementation of the product is on two platforms, namely, mobile and a web app. The mobile app even works for object detection cases in offline mode. What we want to achieve using this is to make a better world for the people suffering from disabilities as well as an educational end for people with cognitive disabilities using our app. The current implementation deals with object recognition and text to speech and a speech to text converter .The speech to text converter and text to speech converter utilized the Web Speech API (Application Program Interface) for the website and text to speech and speech to text library for the mobile platform. The object recognition wouldn't fetch enough use out of a website. Hence, it has been

implemented on the mobile app utilizing the Firebase ML toolkit and different pre-trained models, which are both available offline as well as online.

[2] G. Eason, B. Noble, and I. N. Sneddon, "On certain integrals of LipschitzHankel type involving products of Bessel functions," Phil. Trans. Roy. Soc.

[3]London, vol. A247, pp. 529–551, April 1955.(references) Sohail Abid, Shahid Abid, Tafzeel Ahmed, "Mobile Application for Disabled People" in International Journal of Modern Computer Science ISSN: 2320-7868 (Online) Volume No.-1, IssueNo.-1, February 2013

The overall purpose of the research is to locate rest rooms and keep hygiene in consideration for those who are specially- abled. The app will be designed with the assistance of Artificial Intelligence and Machine Learning, providing navigation, every step of the way which will be susceptible to use and comprehend. People with having disabilities implies that having fundamental difficulty accomplishing aspects. They are of numerous types like physical disability in nature, due to amputation inability to walk, sensory like blindness, hearing impairment with the assistance of this app, this gap can be filled. The problems faced by specially abled people have been taken into consideration creating a balanced platform for them. Utilizing the necessary tools and functions required for enabling them to locate and understand where the restrooms are, keeping in mind hygiene and safety factors. Certain parameters are taken into consideration such as voice recognition, Maps Live feature, magnifier, sign language interpretation, hands-free settings, and many more features.

They could converse or speak and reach their destination with the support of the virtual assistant of a very specialized navigation system designed especially for them with a simple user interface which is easy to interpret and work efficiently according to the needs of the user.

[3] Mahasak Ketcham, Vassana Inmoonnoy, " The Message Notification for Patients Care System Using Hand Gesture Recognition," 2017International Conference on Digital Arts, Media and Technology(ICDAMT), Chiang Mai, Thailand, 2017, doi:

In recent times, there are more number of people prone to disabilities due to various factors. To alleviate the life of differently abled people, we propose a project which us eshand gestures to operate devices in the surrounding. The need for human assistance is reduced which also reduces the financial burden on the patients. We have used the concept of computer vision to recognize hand gestures and perform the function of operating devices. Each hand gesture is assigned with a predefined function to execute a certain task.

[4] O. A. Ruşanu, L. Cristea and M. C. Luculescu, "Simulation of a BCISystem

Based on the Control of a Robotic Hand by Using Eye-blinksStrength," 2019 E-Health and Bioengineering Conference (EHB), Iasi, Romania, 2019,PP.1-4

Many assistive technologies implemented to help the disabled people. The purpose of this research is to design and implement a new mechanism for disabled people which can be used as a helping hand. Generally, disabled people depend onothers to live their lives. Our target is to make a robotic system that has different characteristics to help the physically challenged people. The robot will be able to move in any direction. An open-source Android application is used to control the robot via Bluetooth. The robot responds to move commands in the forward, backward, left, and right directions. A disabled person, especially those who cannot walk will be able to send this robot any where. The project also implements a robotic arm with pick and place capability. It is able to pick any object and carry it and place it to the required position. The robotic arm is designed such that it can be controlled by a number of different mechanisms, namely a smart phone as the remote control, or human voice command or an RF controller. Disabled people can use any one of these methods according to his or her comfort. The robot al souses an IP camera for video observation as well as video communication with others.

[5]White, J.J.: Fairness of AI for people with disabilities: problem analysis and interdisciplinary collaboration. ACM SIGACCESS Access. Comput. 125, 1 (2020)

Much has been written about the potential of artifcial intelligence (AI) to support, and even transform, the lives of disabled people. It is true that many advances have been made, ranging from robotic arms and other prosthetic limbs supported byAI, decision support tools to aid clinicians and the disabled themselves, and route planning software for those with visual impairment. Many individuals are benefting from the use of such tools, improving our accessibility and changing lives. But what are the true limits of such tools? What are the ethics of allowing AI tools to suggest diferent courses of action, or aid in decision-making? And does AI ofter too much promise for individuals? I have recently undergone a life changing accident which has left me severely disabled, and together with my daughter who is blind, we shall explore the day-to-day realities of how AI can support, and frustrate, disabled people. From this, we will draw some conclusions as to how AI software and technology might best be developed in the future.

CHAPTER-3

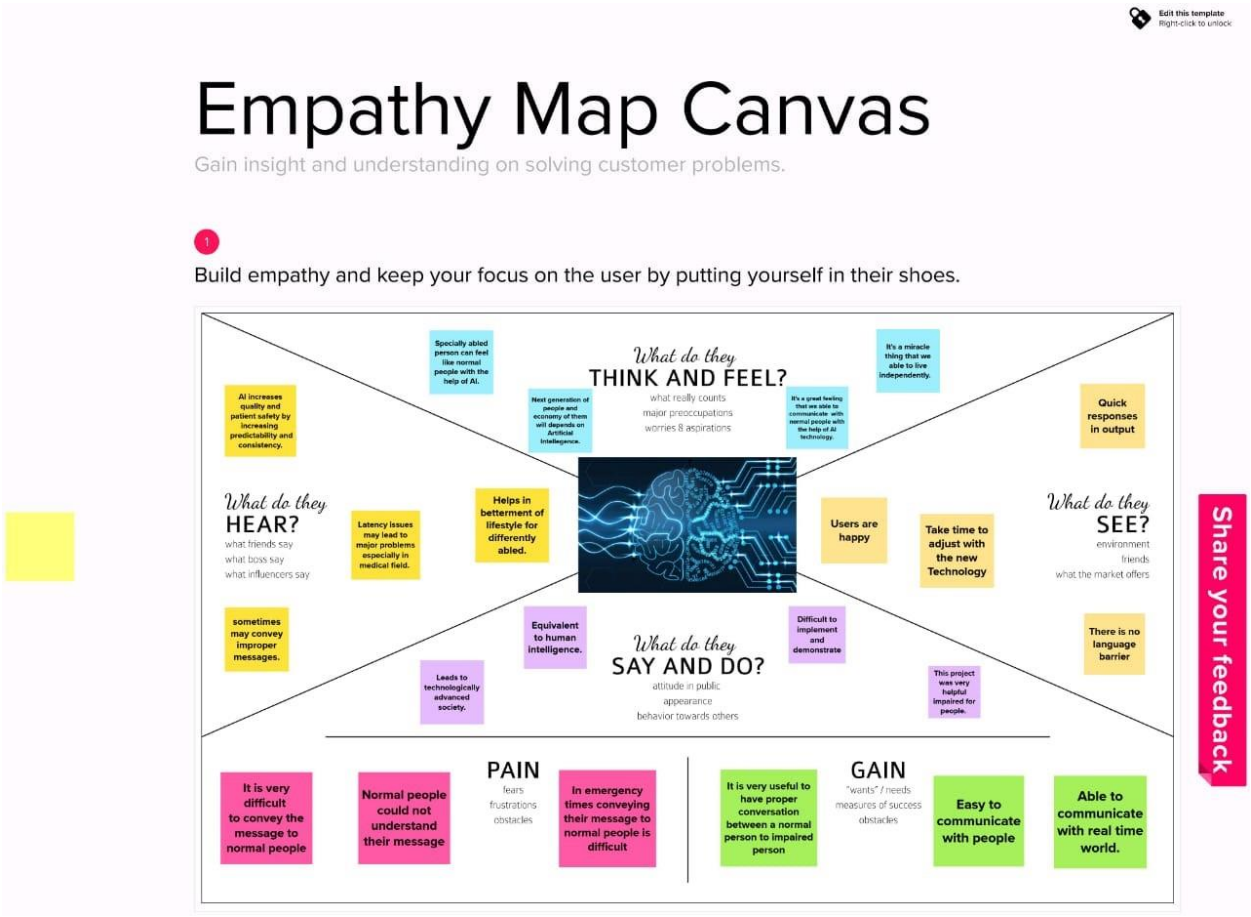
IDEATION AND PROPOSED SOLUTION

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.

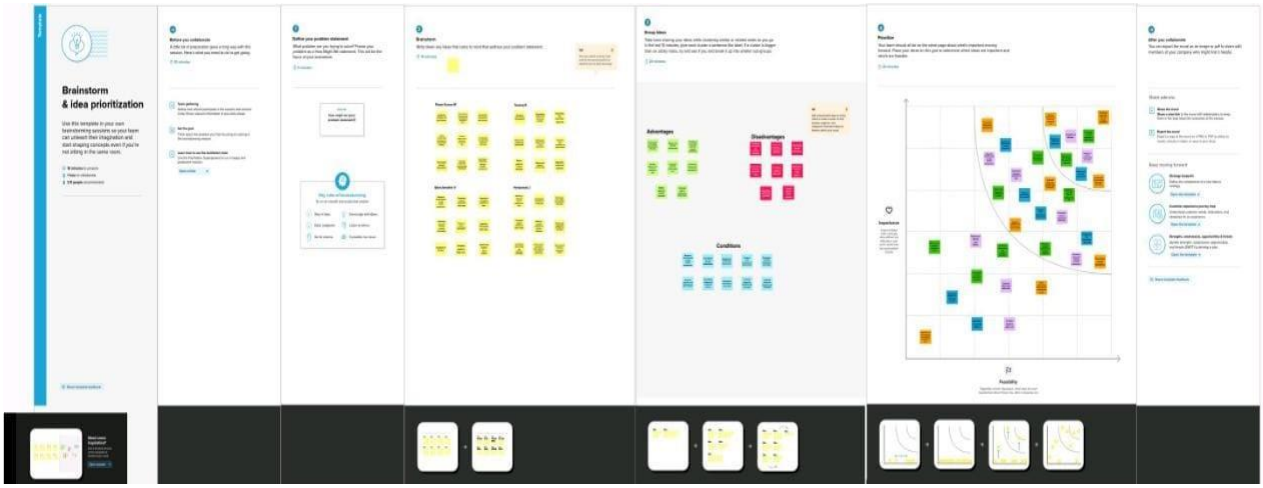
An empathy map canvas helps brands provide a better experience for users by helping teams understand the perspectives and mindset of their customers. Using a template to create an empathy map canvas reduces the preparation time and standardizes the process so you create empathy map canvases of similar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

S.No	Parameter	Description
1.	Problem Statement (Problem to be solved)	Deaf and dumb people couldn't able to communicate with the normal people 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 signs as words instead of old traditional translators, that are very slow and take too much since every alphabet as to be recognized to form the whole statement in old methods.
4.	Social Impact/Customer satisfaction	It drastically reduce communication difference gap between normal people and specially abled people 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 features for free of charge but they 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 model as well. The same system can 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 and that the solution you have realized for it actually solves the customer's problem.

Problem-Solution fit canvas 2.0

Purpose / Vision

Define CS, fit into

1. CUSTOMER SEGMENT(S) — CS

Who is your customer?

People who lost their speech or hearing ability by birth or due to some other factors.

6. CUSTOMER — CC

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

Difficult accessibility, not user friendly, need more technical knowledge to handle, cost,…etc. There are so many choice of solutions available but due to these some constraints, choice of solutions were limited.

5. AVAILABLE SOLUTIONS — AS

Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking

The first ever approach to sign language it has only 6 sign gestures detection.Using colored hands for hand position recognition.But our model is trained to detect different sign languages without any colour gloves, using bare hands only.

Explore AS,

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

2. JOBS-TO-BE-DONE / PROBLEMS — J&P

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

Deaf and dumb people couldn't able to convey their messages to the normal people easily. Deaf people cannot hear the words as others speaks and dumb people cannot express their feelings by words.

9. PROBLEM ROOT CAUSE — RC

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

In Previously developed solution, they have to use coloured hand gloves for hand position recognition. Also, the old method uses traditional translators which take too much of time to process.

7. BEHAVIOUR — BE

What does your customer do to address the problem and get the job done?
i.e. directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace)

In our device, there's an option called problem detection display in which our customer can able to see the type of problem occurs & solution will be displayed.

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

Identify strong TR & EM

3. TRIGGERS — TR

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

By comparing normal people,Specially Abled people should depend on others and want to live their life independently like other people

4. EMOTIONS: BEFORE / AFTER — EM

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

BEFORE: It is very difficult to convey the message to normal people.
AFTER: They overcome their reluctance to have communication with normal people.

10. YOUR SOLUTION — SL

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

Using SSD ML algorithm recognizing the signs as words instead of old traditional translators, that are very slow and take too much since every alphabet as to be recognized to form the whole statement in old methods.

8. CHANNELS of BEHAVIOUR — CH

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

Advertise on online with influencers to test the product and promote it also on blog channels

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

On offline, we have our product experience stores where our customer can experience the product in real

Extract online & offline CH of BE

AMALTAMA

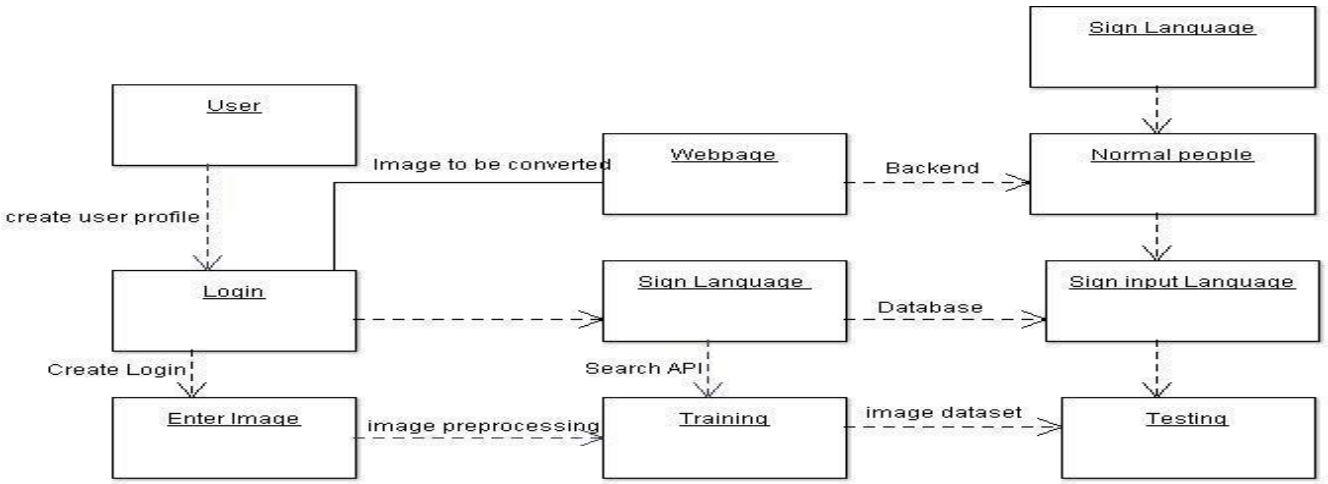
CHAPTER- 4

REQUIREMENT ANALYSIS

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:

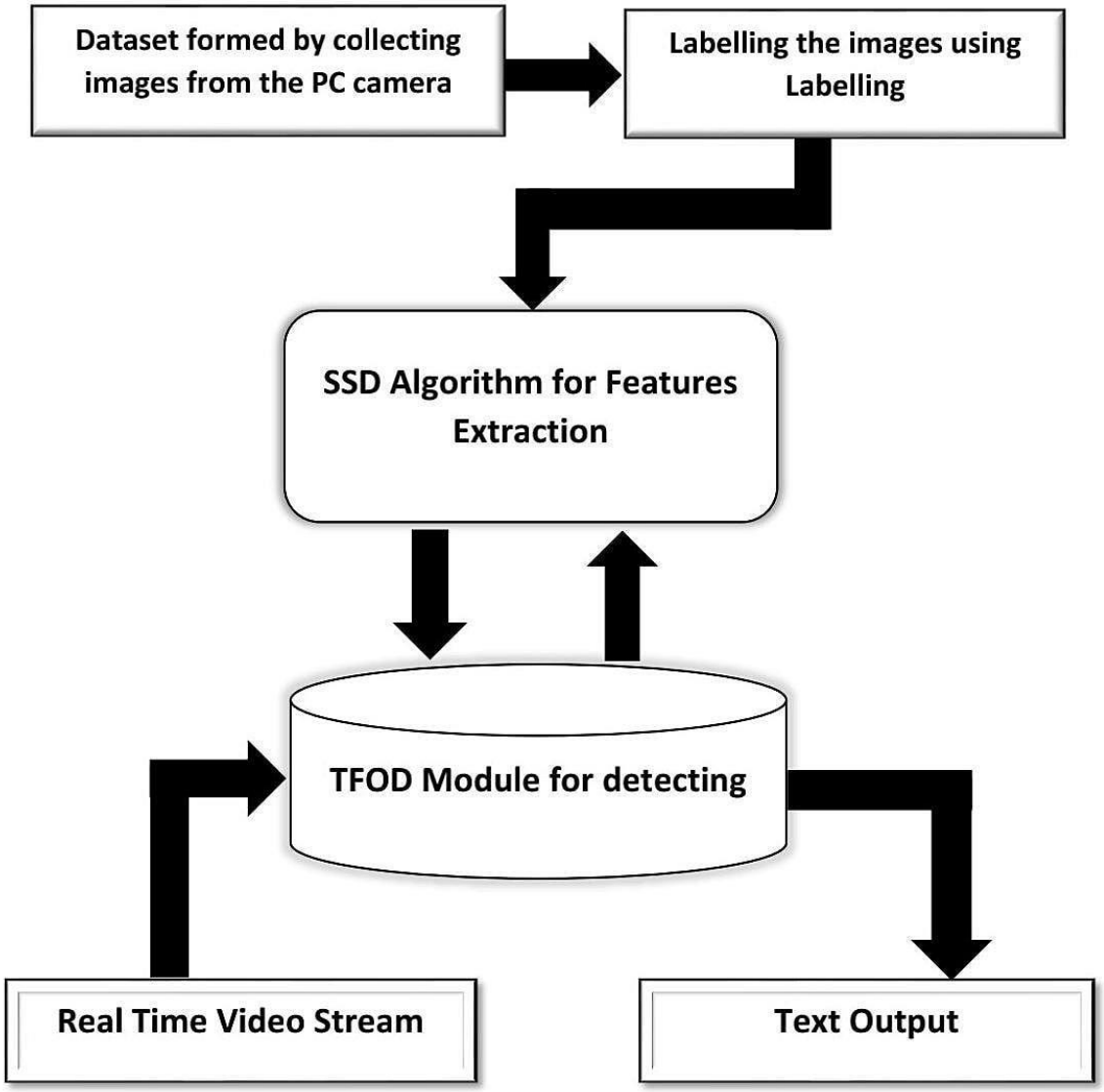
1. Find the best tech solution to solve existing business problems.

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 :



SYSTEM ARCHITECTURE

Technology Stack (Architecture & Stack):

Technical Architecture:

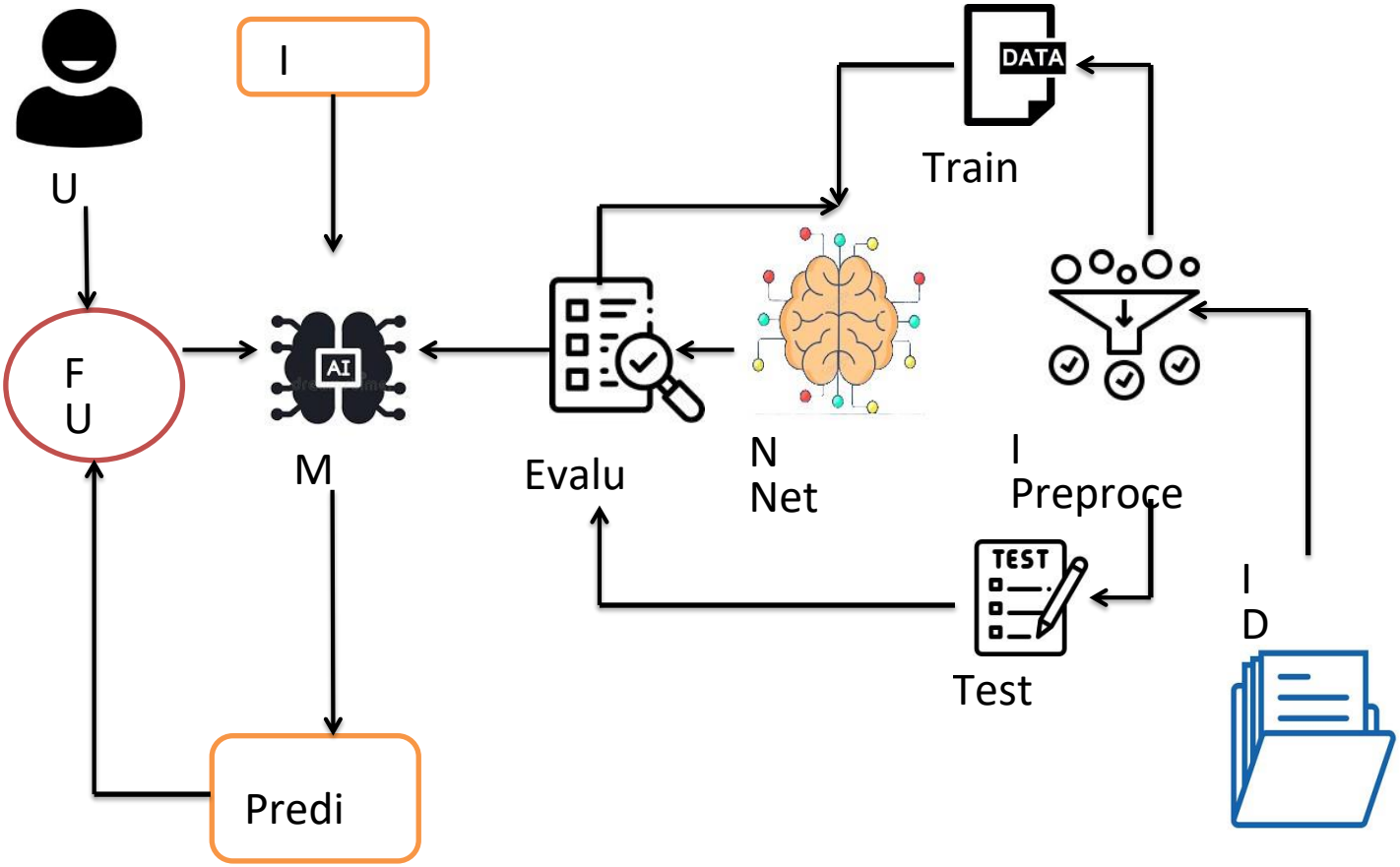


Table-1 Components and Technologies:

S.NO	Component	Description	Technology
1.	User Interface	Customer have to login through their respective website or phone number. Then interaction will happen withthe User interface.	javascript, CSS,HTML
2.	Application Logic-1	It requires various types libraries, frameworks to develop the project	Java / Python
3.	Application Logic-2	Helps to converting the human gestures/actions into written words.	Machine learning
4.	Application Logic-3	Provides helpful,feasible answers after recognising the human gestures.	ANN,CNN
5.	Database	Data couldbe numbers or words.	MySQL, Rational database
6.	Cloud Database	Providing customer to use hostdatabase without buyingadditional 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 data drivendecision making...	Aadhar API
10.	Machine Learning Model	Machine learning interact with variousalgorithms that are required for implementation.	Image acquisation
11.	Infrastructure (Server / Cloud)	Application deployment on local system /local cloud serverconfiguration. Install the windows version and execute the installer..	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 using firewall..	Firewall and some security related softwares..
3.	Scalable Architecture	The architecture will be scalable (Micro services).	Data, models, speedand consistency..
4.	Availability	The availablity of application (use of load balancers, 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 per second, use of cacheetc...,	Using Convolutional neural network, maching learning for conversation and improve the sensivity of the performance..

5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As customer, I couldable to register for the app by entering my E-mail and proper password.	I could able to access my registered account.	High	Sprint 1
		USN-2	As a user, I'll get the acknowledgement verification emailonce after my registration hasbeen done for theapp	I can get verification email and clickok to confirm it..	High	Sprint 1

		USN-3	As a customer, I could able to register for application via their official websites and social media.	I could able to register and access my account by using theirwebsite & socialmedia.	Medim	Sprint 2
		USN-4	As a customer, I could able to register for application through Gmail	via some thirdparties link	Low	Sprint 2
	Login	USN-5	As a customer, I could able to login into application by entering alreadyregistered email and password	I can type manually and also can used saved login credentials	High	Sprint 1

	Dashboard	USN6	As a customer,I can get all services andhelp in dashboard	I can access my dashboard and change profile	Medium	Sprint 2
Customer (Webuser)	Registration	USN7	As a customer, I could able to login throughregistered phone numberby using otp instead of Gmail	I could able to register & login via phone numberto access my account	High	Sprint 2
Customer Care Executive	Service	USN8	Can avail the service by calling customer care or reaching through E-mail.	Can avail the service by calling customer care or reaching throughE-mail.	Medium	Sprint 1
Administrator		USN9	Respective personin the companyshould take care all of this.	All the requirements arethere.	High	Sprint 2

	Sign up	USN-10	Customer have to sign-up to use these things 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 choices to availthese services.	As a customer can review and choose theirservices as he want/preferred.	Medium	Sprint 1
	Enrollment	USN-12	Now, customer can avail all services oncehe/she enrolled.	As a customer, it'squite enchanting	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	AJID, PATURI SAIRAM,PUJARI BADRI,ULSA SAKETH
Sprint-1		USN-2	Image preprocessing	8	Medium	SHAIK AJID
Sprint-2	Model Building	USN-3	Import the required libraries, add the necessary layers and compile the model	10	High	AJID, PATURI SAIRAM,PUJARI BADRI,ULSA SAKETH
Sprint-2		USN-4	Training the image classification model usingCNN	7	Medium	SHAIK AJID,PUJARI BADRI
Sprint-3	Training and Testing	USN-5	Training the model and testing the model's performance	9	High	AJID, PATURI SAIRAM,PUJARI BADRI,ULSA SAKETH
Sprint-4	Implementation of the application	USN-6	Converting the input sign language images into Englishalphabets	8	Medium	

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 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

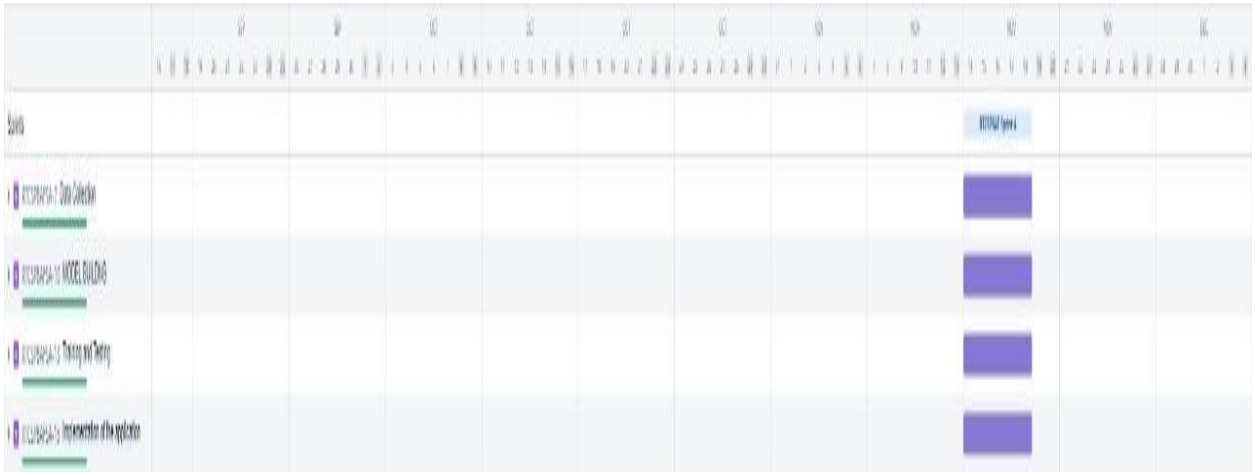
Burndown chart:

A burn down chart is a graphical representation of work left to do versus time. It is often used 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

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.



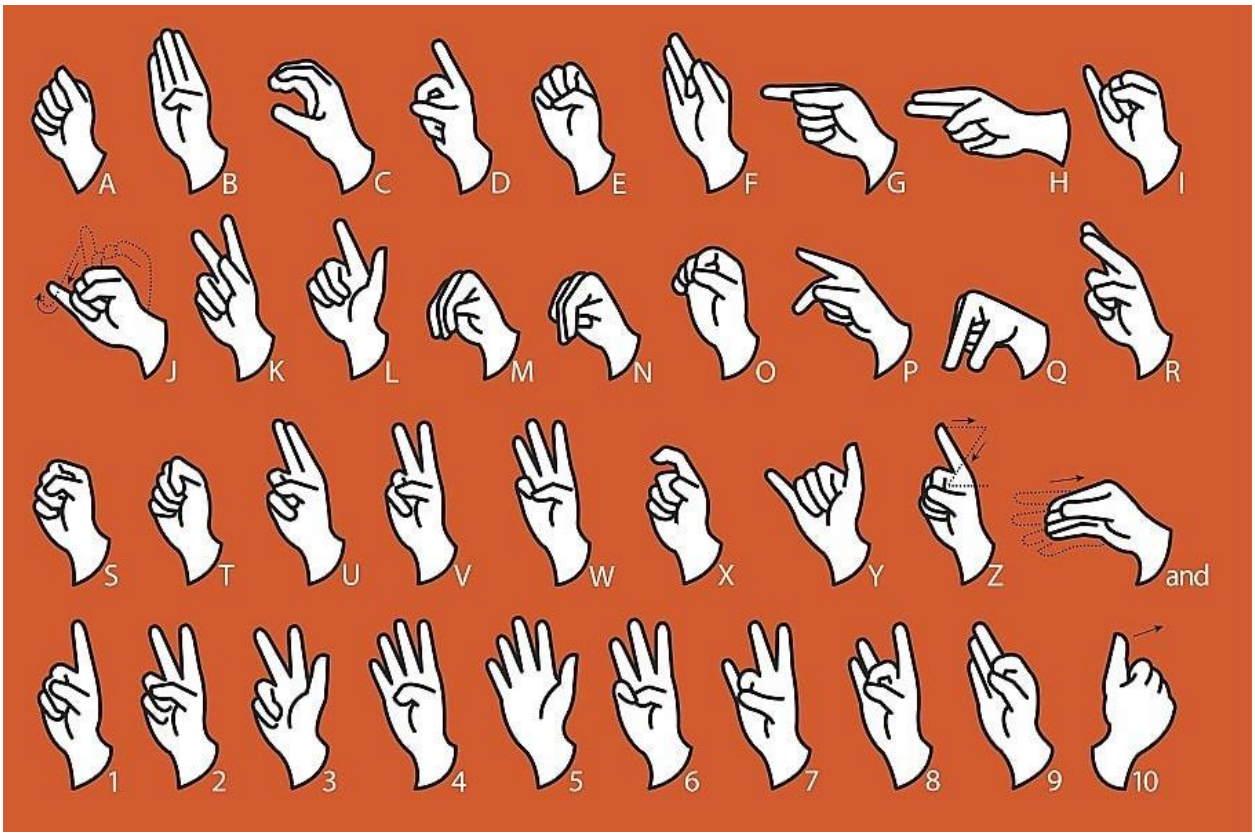
CHAPTER-7

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

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 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 [==============================] - 18s 587ms/step - loss: 0.0083 - accuracy:
0.9957 - val_loss: 0.2910 - val_accuracy: 0.9693
Epoch 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 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

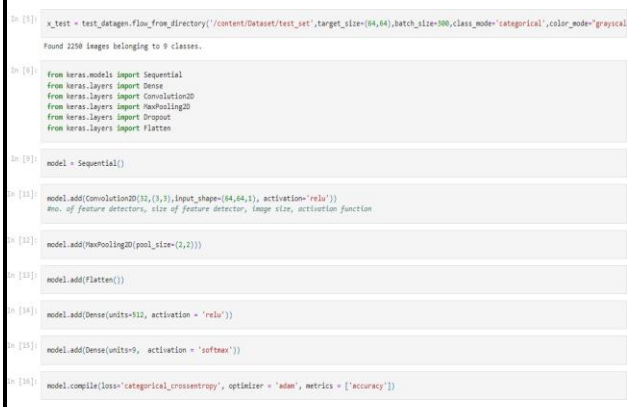
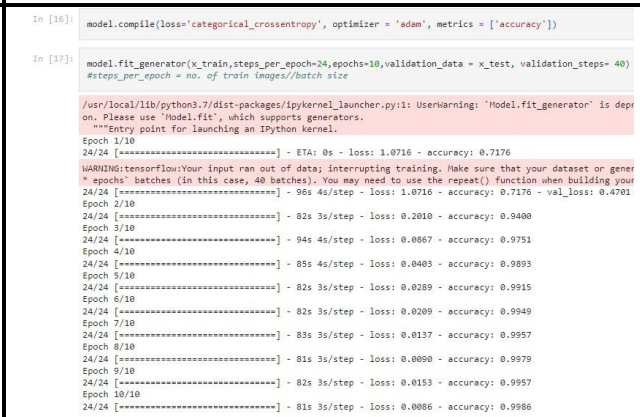
8.1 Test cases

➤ 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 [8]: 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'])
```

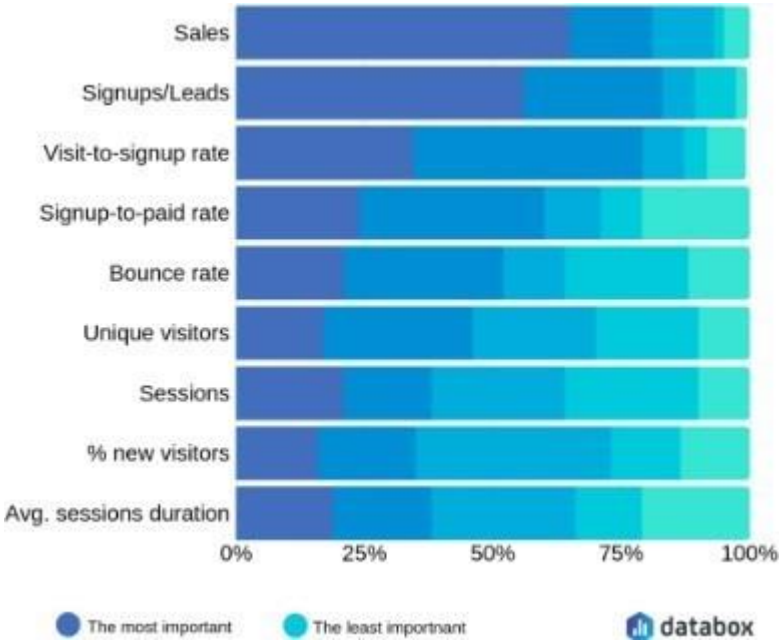
```
In [16]: model.compile(loss='categorical_crossentropy', optimizer = 'adam', metrics = ['accuracy'])

In [17]: model.fit_generator(x_train,steps_per_epoch=24,epochs=10,validation_data = x_test, validation_steps= 40)
         #steps_per_epoch = no. of train images//batch size

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

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

CHAPTER-9

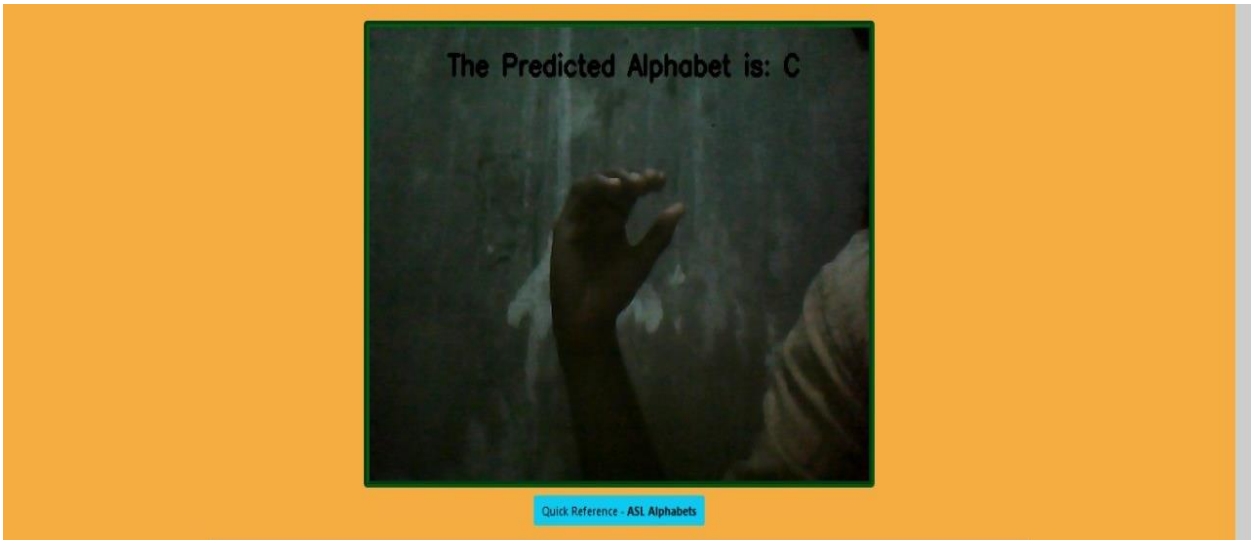
RESULTS

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.**


Sales
Signups/Leads
Visit-to-signup rate
Signup-to-paid rate
Bounce rate
Unique visitors
Sessions
% new visitors
Avg. sessions duration
0%
25%
50%
75%
100%
The most important
The least important
databox

output:


The Predicted Alphabet is: C
Quick Reference - ASL Alphabets

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.

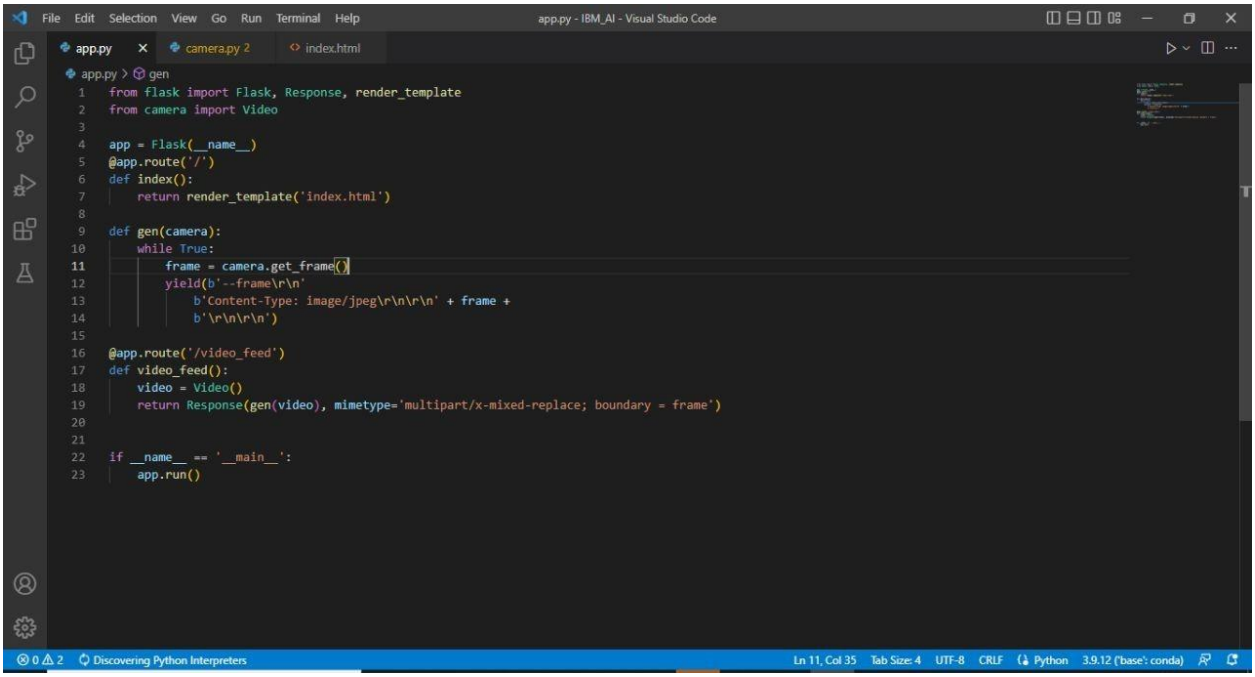
CHAPTER-13

APPENDIX

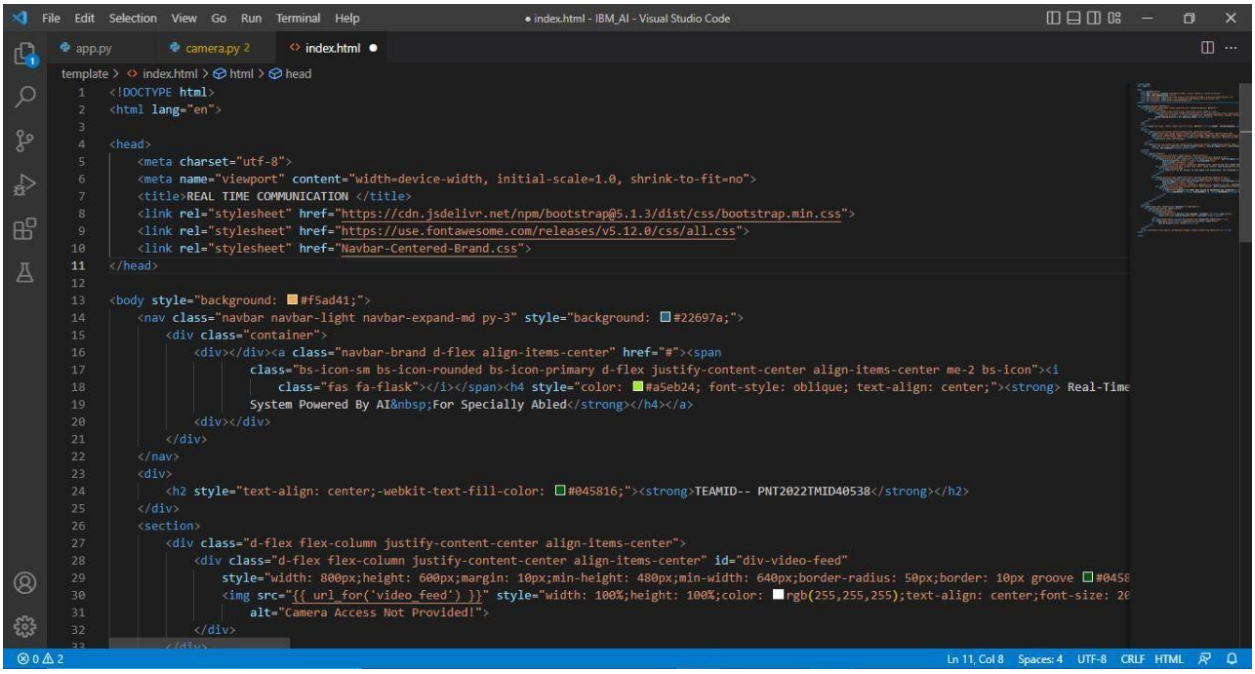
APPENDIX:

Source code:

Flask:



HTML:


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 > head
<!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;">

<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><h4 style="color: #a5eb24; font-style: oblique; text-align: center;"> Real-Time
System Powered By AI For Specially Abled</h4>

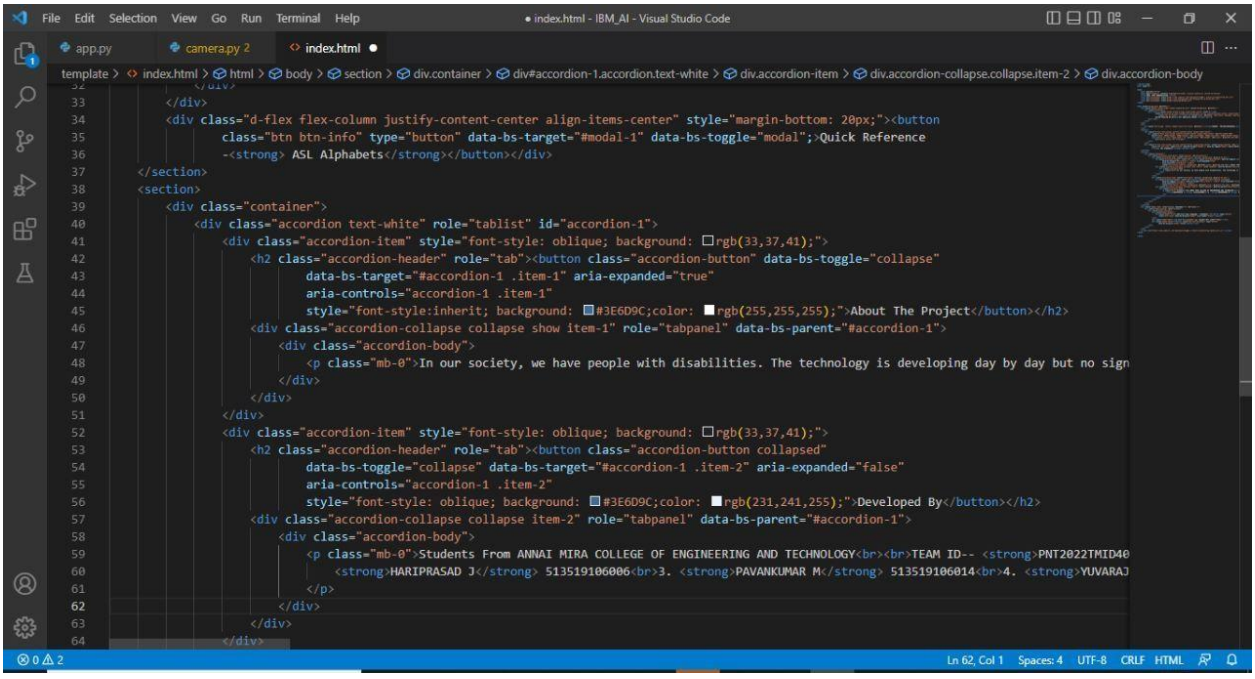
</nav>

<h2 style="text-align: center;-webkit-text-fill-color: #045816;">TEAMID-- PNT2022TMID40538</h2>

<section>

<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!">

0 2
Ln 11, Col 8 Spaces: 4 UTF-8 CRLF HTML


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 > body > section > div.container > div#accordion-1.accordion.text-white > div.accordion-item > div.accordion-collapse.collapse.item-2 > div.accordion-body

<button
class="btn btn-info" type="button" data-bs-target="#modal-1" data-bs-toggle="modal";>Quick Reference
- ASL Alphabets</button>
</section>
<section>

<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>

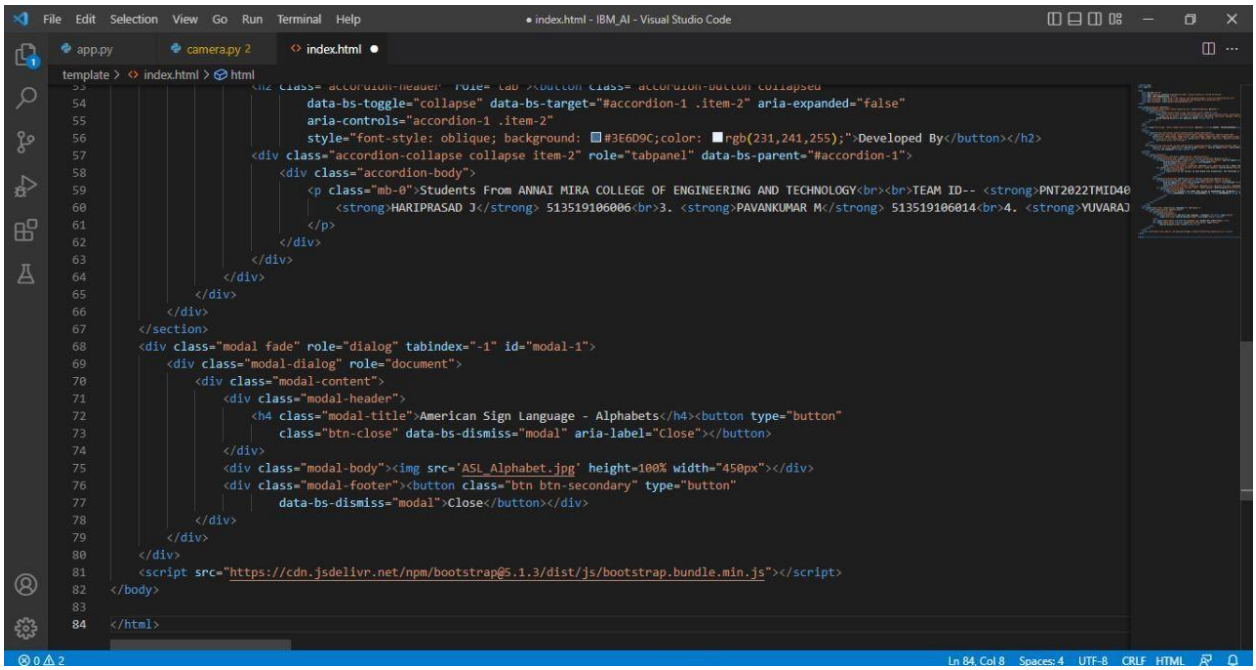
In our society, we have people with disabilities. The technology is developing day by day but no sign

<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>

Students From ANNAI MIRA COLLEGE OF ENGINEERING AND TECHNOLOGY

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

0 2
Ln 62, Col 1 Spaces: 4 UTF-8 CRLF HTML


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>

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TEAM ID-- PNT2022TMID40
HARIPRASAD J 513519106006
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4. YUVARAJ

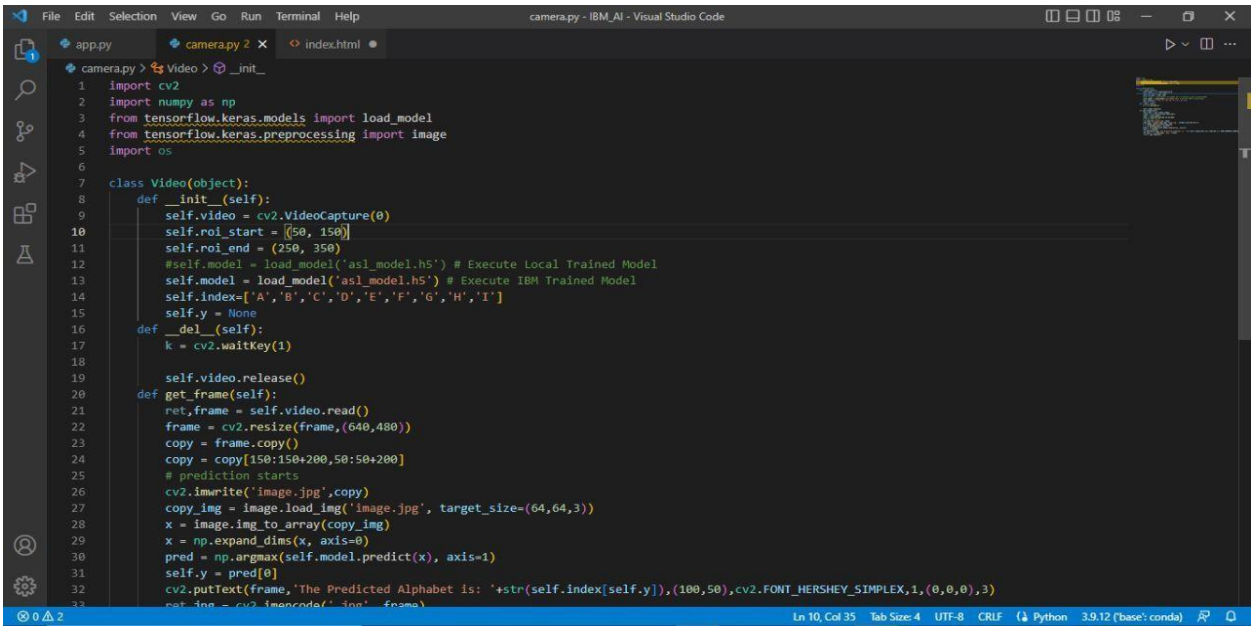
</section>

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

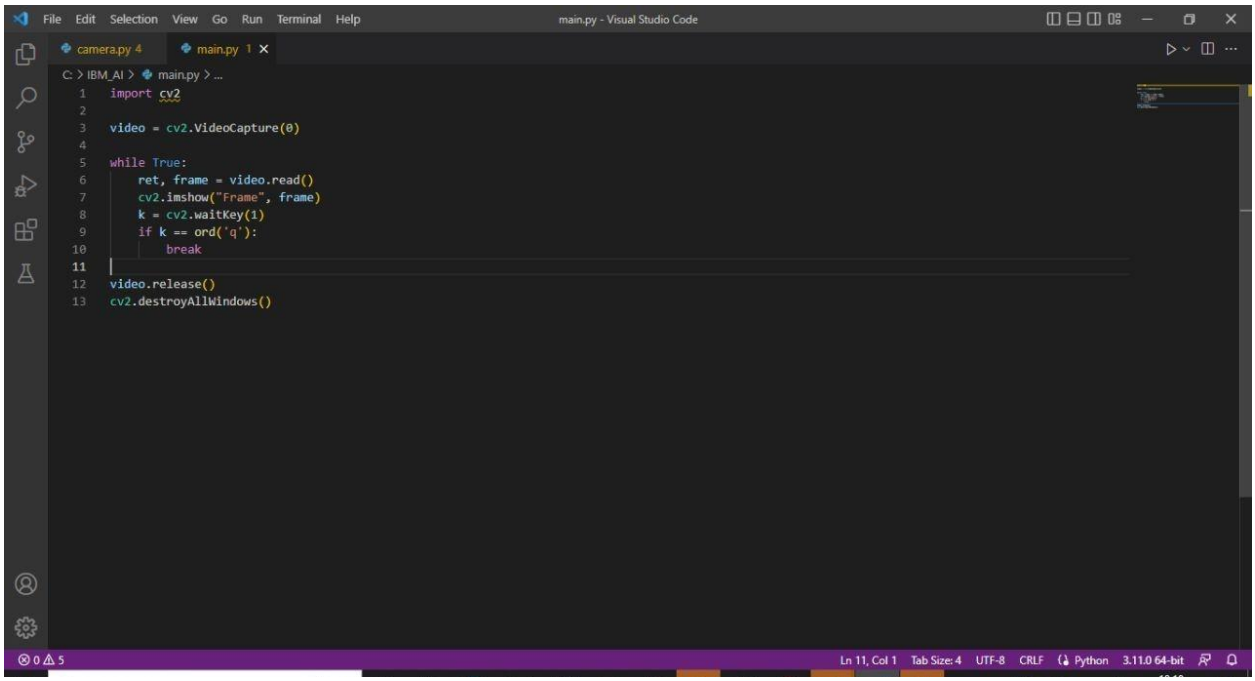
<img src='ASL_Alphabet.jpg' height=100% width="450px">
<button class="btn btn-secondary" type="button"
data-bs-dismiss="modal">Close</button>

<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

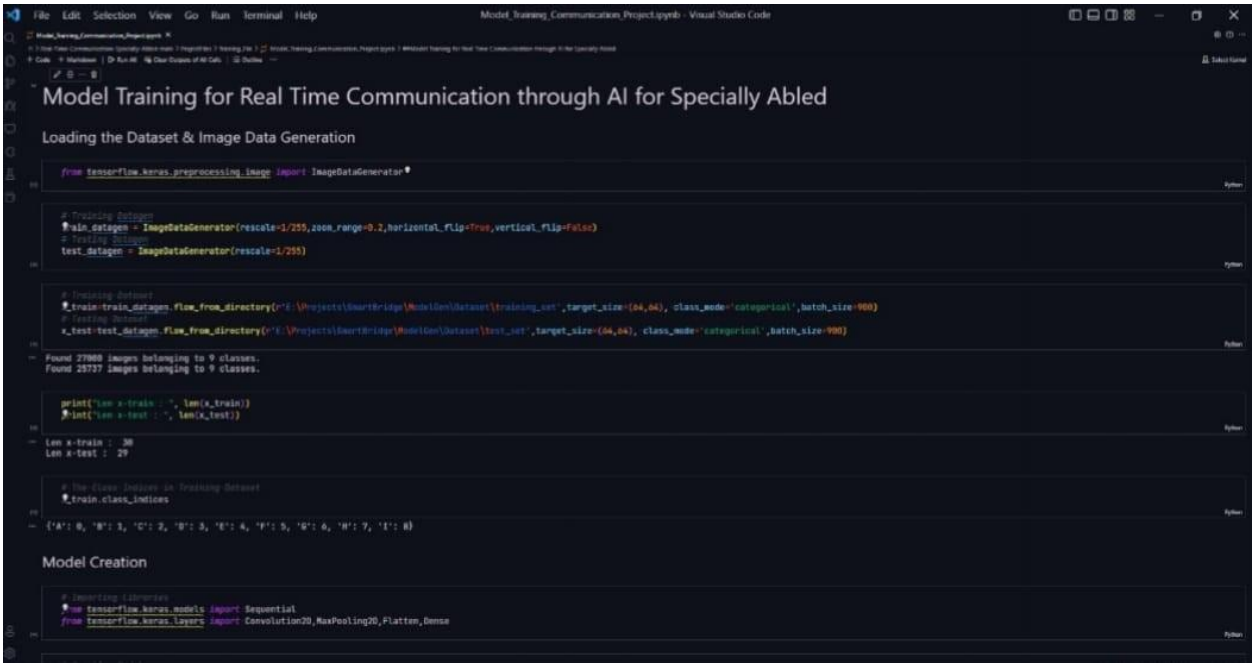
Camera:


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: [Commits · IBM-EPBL/IBM-Project-51947-1660986982 (github.com)]

Project Demonstration

Link : https://drive.google.com/file/d/1WamMiDHlSebjVBW-trq12B9dUoNDueAT/view?usp=drivesdk