TEAM ID: PNT2022TMID45193

TEAM MEMBERS: SIVARANJANI A, VISHWA R, DEEPAK A, SIVAJI , AADHISIVAN N

1. INTRODUCTION

1.1 Project Overview

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.

1.2 Purpose

Humans know each other by conveying their ideas, thoughts, and experiences to the people around them. There are numerous ways to achieve this and the best one among the rest is the gift of “Speech”. Through speech everyone can very convincingly transfer their thoughts and understand each other. It will be injustice if we ignore those who are deprived of this invaluable gift; the deaf and dumb people. The only means of communication available to the deaf and dumb people is the use of “Sign Language”. Using sign language they are limited to their own world. This limitation prevents them from interacting with the outer world to share their feelings, creative ideas and Potentials. Very few people who are not themselves deaf and dumb ever learn to Sign language. These limitation increases the isolation of deaf and dumb people from the common society. Technology is one way to remove this hindrance and benefit these people. Hand gesture recognition provides an intelligent and natural way of human

computer interaction (HCI). Human computer Interaction (HCI) is a branch of artificial intelligence, it is a scientific discipline that is concerned with the development of algorithms that take as input empirical data from sensors or databases, and yield patterns or predictions thought to be features of the underlying mechanism that generated the data. A major focus of HCI research is the design of algorithms that recognize complex patterns and make intelligent decisions based on input data. As the integration of digital cameras within personal computing devices becomes a major trend, a real opportunity exists to develop more natural Human-Computer Interfaces that rely on user gestures.Hand gesture recognition is an area in computer science and language technology that aims in defining human gestures via mathematical algorithms. With gesture recognition it is possible for humans to interact naturally with machines without the aid of any mechanical devices. Hand gesture is one of the most expressive and most frequently used among a variety of gestures. Applications of hand gesture recognition are varied from sign language to virtual reality. Thus, we propose a new technique called artificial speaking mouth for dumb people which will be very useful to them for conveying their views to others. Mute people can use fingers to perform hand gesture and it will be converted into speech so that normal people can understand their expression.

2. LITERATURE SURVEY

The purpose of the Literature Survey is to give the brief overview and also to establish complete information about the reference papers. The goal of Literature Survey is to completely specify the technical details related to the main project in a concise and unambiguous manner. In Different approaches are employed by completely different researchers for recognition of varied hand gestures that were enforced in numerous fields. the total approaches can be divided into 3 broad classes Hand segmentation approaches Feature extraction approaches and Gesture recognition approaches. All the offered systems don't seem to be moveable

and not reasonable to poor folks. This paper introduces new automaton application which can discover the Indian signing via mobile camera and converts into corresponding text or voice output. This application uses bound image process techniques to check the input with the already hold on signs and needs solely automaton phone and doesn't need any special markers or magic gloves on the hand of the user. This includes totally different sizes of gestures within the pictures, totally different background of pictures, totally different orientations and angle of gestures, etc. the various illumination for various pictures too expose a drag. currently our system provides sixty fifth of correct predicting and that we ar acting on rising its potency. therefore we tend to took the thought of implementing the gesture video with the assistance of hand speak technology that helps the deaf folks to look at their relevant signing video supported the text given as input. we tend to embody the thought of providing the link to the applying that helps in extracting the video. It proves its most potency. In Sign language is used as a communication medium among deaf and dumb people to convey the message with each other. In order to bridge the gap in communication among deaf , dumb community and normal community, lot of research work has been carried out to automate the process of sign language interpretation with the help of image processing and pattern recognition techniques. This paper proposes optimized approaches of implementing the famous Viola Jones algorithm with LBP (Local Binary Pattern) features for hand gesture recognition which will recognize Indian sign language gestures in a real time environment. An optimized algorithm has been implemented in the form of an android application and tested with real time data. Optimized classifier can be obtained with less number of positive samples provided by considering the suitable number of stages and 1:2 ratio of positive to negative images. It has been proved through this that sign recognition depends on mobile RAM capacity. With high RAM size more number of sign letters can be accommodated into single android activity. An android application has been designed to demonstrate the implementation of Viola-Jones algorithm with LBP features for hand

gesture recognition. The Open CV libraries have been used to develop the application and android app is available in Google Play store for free. During runtime, camera continuously captures the image of sign formation which will be processed and matched with the database. Here, for database the .xml file generated after the cascade training will be used. Further, detected gesture will be marked with the rectangle and appropriate sign will be named. This implemented algorithm is not a robust and real time. Hence we are using the already recorded video stored in a cloud storage which is considered to be the easiest way of interpreting the users input in relevant manner. This above algorithm does not prove its efficiency in any sort of background but our project overcomes this issue to the larger extent. In a number of developing countries continue to provide educational services to students with disabilities in "segregated" schools. Also all students, regardless of their personal circumstances, have a right of access to and participation in the education system, according to their potential and ability. However, with the rapidly growing population and increasing number of people with blindness along with other disabilities, need for use of technology in the field of education has become imminent. In this project, through the use of speech technology, attempts to provide solutions for some of these issues by creating an interactive system. Thus, the application will help in creating an environment that provides equal opportunities for all the students in taking up competitive exams. Application automates the examination process through reading out questions to the user and receiving their input orally. Application also provides accessories for other requirements, like knowing the time remaining, during exams. Use of this application shall benefit students with Learning disabilities, including dyslexia and dysgraphia, Poor or limited motor skills, Vision impairments, Physical disabilities, Limited English Language The application will help the students with reading writing disabilities (students with dyslexia or dysgraphia) as well as sensory disabilities (blind or handicapped). This system has implemented proposed system with three individual section and features like timer and result for

each one. For the implemented sections and subjects the system is running perfectly and flawlessly. There by proposed application is suitable for use in real-time with high performance. We took the idea of using voice over text technology from the above proposed system because on considering the deaf people, they either have speech ability or be a dumb which again depends on their birth. It will be a revolutionary change that will benefit hearing impaired people, boost their confidence and put them with regular people. In [4]for the past many decades, designers have processed speech for a good style of applications starting from mobile communications to automatic reading machines. Speech has not been used abundant within the field of physics and computers owing to the complexness and style of speech signals and sounds. However, with trendy processes, algorithms, and strategies we are able to method speech signals simply and acknowledge the text. The system acquires speech at run time through a mike and processes the sampled speech to acknowledge the verbalized text. The recognized text are often keep in an exceedingly file. we tend to ar developing this on humanoid platform exploitation eclipse work bench. Our speech-to-text system directly acquires and converts speech to text. It will supplement different larger systems, giving users a unique selection for knowledge entry. A speech-to-text system also can improve system accessibility by providing knowledge entry choices for blind, deaf, or physically incapacitated users. Voice SMS is AN application developed during this work that permits a user to record and convert spoken messages into SMS text message. User will send messages to the entered number. Speech recognition for Voice uses a method supported hidden Markov |Markoff| Andre Mark off |mathematician} models (HMM - Hidden Markov Model). it's presently the foremost undefeated and most versatile approach to speech recognition. exploitation the speech recognizer, that works over the web, permits abundant quicker processing. Another advantage is that the abundant larger databases that ar used. The accuracy of the system has considerably inflated and become a lot of accessible to everybody. even supposing this method has abundant advantage in our

project Speech recognition is finished via the web, connecting to Google's server. the appliance is customized to input messages in English. Double faucet on the contact space displayscontacts that has the interface with contact numbers from mobile and allows user to settle on number on that message are going to be sent once pressing button Send. client receives response in an exceedingly very little cloud (toast) if message has been sent.

2.1 EXISTING PROBLEM

There are few android based mobile applications that has been developed for Deaf and dumb like ‘speak it’, ’Signily’ etc., The features of these application enable only the communication between deaf and dumb through American sign language. The paper introduced an application that proposes a sign language keyboard that translate word from sign language to English or Arabic vice versa. It also introduces quizzes and games for deaf and dumb to identify Arabic and English words. The paper has introduced a sign language converter system using hand gesture recognition feature to recognize the gesture’s in Indian sign language. The paper [3] has demonstrated an application of android that will help speech disabled deaf and dumb people to get trained and start communication with normal people. This app will focus on using Google Offline speech recognition system, which converts the voice spoken to text. The converted text will be searched in the dictionary built in app to convert that text into its appropriate Hand-sign. Through this paper, we inferred to implement Google offline speech recognition for voice to text conversion in our Android app. This is a web resource that introduces “Live Relay” that is a app developing by Google that will allow speech disabled users to conduct a phone call. There will be a voice to text conversion in an ongoing call. This app targets differently disabled person to have a normal conversation. The paper gives us an insight of how to design user-friendly app for speech disabled people by evaluating through Heuristics method. Heuristics evaluation is a systematic usability inspection method. This

paper provides an insight to an android app called “Speak it”. The application ease of use is assessed through heuristics assessment and proposals are given to defeat the shortcomings. The communication between a dumb and hearing person poses to be an important disadvantage compared to communication between blind and ancient visual people. This creates an extremely little house for them with communication being associate degree elementary aspect of human life . The blind people can speak freely by implies that of ancient language whereas the dumb have their own manual-visual language referred to as sign language. Sign language is also a non-verbal form of intercourse that's found among deaf communities at intervals the planet. The sign languages haven't got a typical origin and hence hard to interpret. A Dumb communication interpreter is also a tool that interprets the hand gestures to sensibility speech. A gesture in associate degree extremely language is also a certain movement of the hands with a particular kind created out of them. A gesture in a sign language is a particular movement of the hands with a specific shape made out of them. A sign language usually provides sign for whole words. It can also provide sign for letters to perform words that don’t have corresponding sign in that sign language. In this device Flex Sensor plays the major role, Flex sensors are sensors that change in resistance depending on the amount of bend on the sensor . This digital glove aims to lower this barrier in communication. It is electronic device that can translate Sign language into speech in order to make the communication take place between the mute communities with the general public possible. A hand gesture recognition system is also used to recognize real time gesture in unconstrained environments. The system consists of three modules:

- real time hand tracking
- training gesture
- gesture recognition

using pseudo two dimension hidden Markov models. In this they have used a Kalman filter and hand blobs analysis for hand tracking to obtain motion

descriptors and hand region. The recently developed depth sensors, e.g., the Kinect sensor, have provided new opportunities for humancomputer interaction (HCI). Although great progress has been made by leveraging the Kinect sensor, e.g., in human body tracking, face recognition and human action recognition, robust hand gesture recognition remains an open problem. Compared to the entire human body, the hand is a smaller object with more complex articulations and more easily affected by segmentation errors. It is thus a very challenging problem to recognize hand gestures. This paper focuses on building a robust part-based hand gesture recognition system using Kinect sensor.

2.2 Reference

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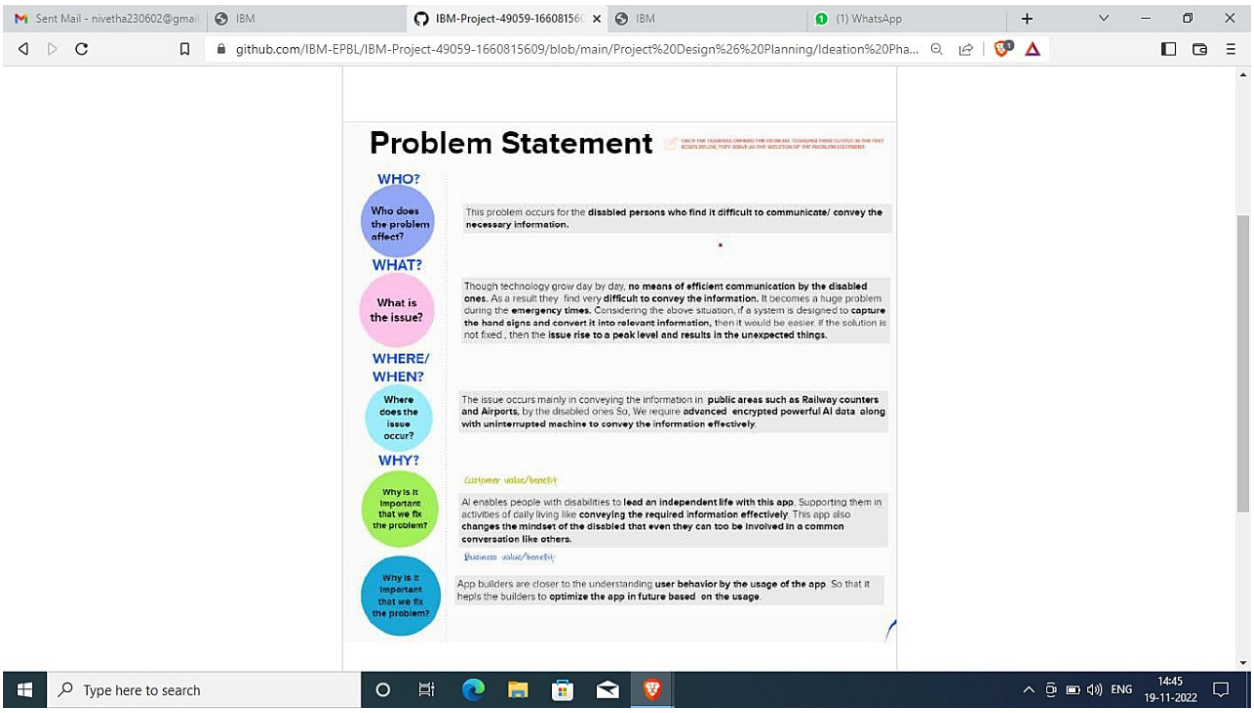
2.3 PROBLEM STATEMENT DEFINITION



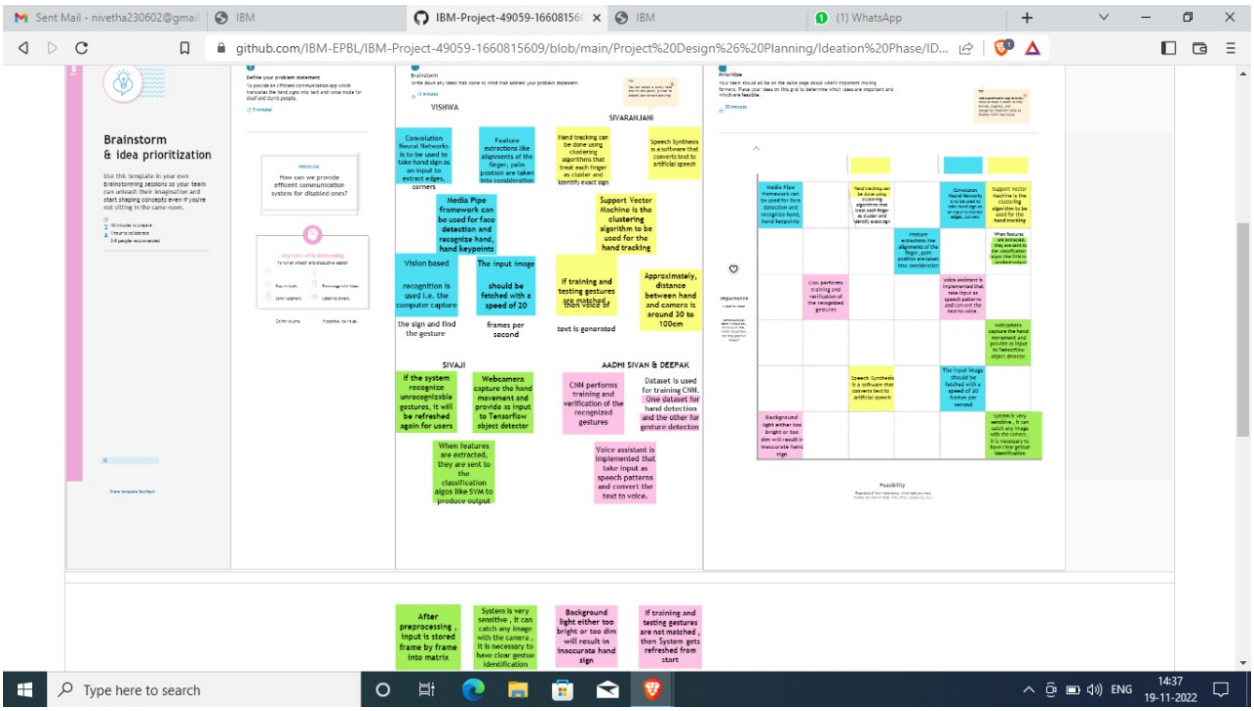
1.5 billion people on this earth have some form of hearing impairment, and statistically, eight out of 100.000 people are born mute.In our society, we have people with disabilities. The technology is developing day by day but no significant developments are undertaken for the betterment of these people. 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. Generally deaf and dumb people use sign language for communication but they find **difficulty in communicating with others who don't understand sign language**. Sign language is an expressive and natural way for communication between normal and dumb people (information majorly conveyed through the hand gesture). Life is equally

beautiful and amazing for deaf people if they are treated as equals and accepted with the fact that they use sign language to communicate instead of any vocal language. The life is made difficult by the condescending attitude of people and inaccessible environment around them. Talking of India, Television/movies/entertainment is not accessible as there are no captions and subtitles, education is not inclusive to give them an equal and rightful access to education, information is not available in easy to understand format or sometimes information in written format or directions at outside places are not available. Talk shows, events have no sign language interpreters for deaf people to have equal access to them. Issue of driving license has recently been resolved in few states. Equal opportunity in jobs is an issue. Sign language is still not considered as one of the official languages of communication. If we can have an environment, places and people accepting and accessible to deaf including them in mainstream life would be so much better for all of us. A common problem people have when speaking with people who are deaf is to overcompensate. Rather than speaking clearly, they'll just speak loudly. They may get the wrong idea about lip reading and make really exaggerated enunciations, which actually makes lips harder to read. They may try to avoid complicated words and really dumb down their speech, which can be patronising. Just **relax and treat it like any other conversation**. Speak as you normally would and avoid mumbling or covering your mouth. Most communication is in expression and body language, so feel free to use natural instances of these to help get your point across better. Communication is the only medium by which we can share our thoughts or convey the message but for a person with disability (deaf and dumb) faces **difficulty in communication with normal person**. Because of this, a person who lacks in hearing and speaking ability is not able to stand in race with normal person. Communication with a hearing-impaired individual is a big challenge for a normal person. **Hearing-impaired people uses hand gesture language.**

3. IDEATION AND PROPOSED SOLUTION

3.1 Empathy Map Canvas

3.2 Ideation and Brainstorming



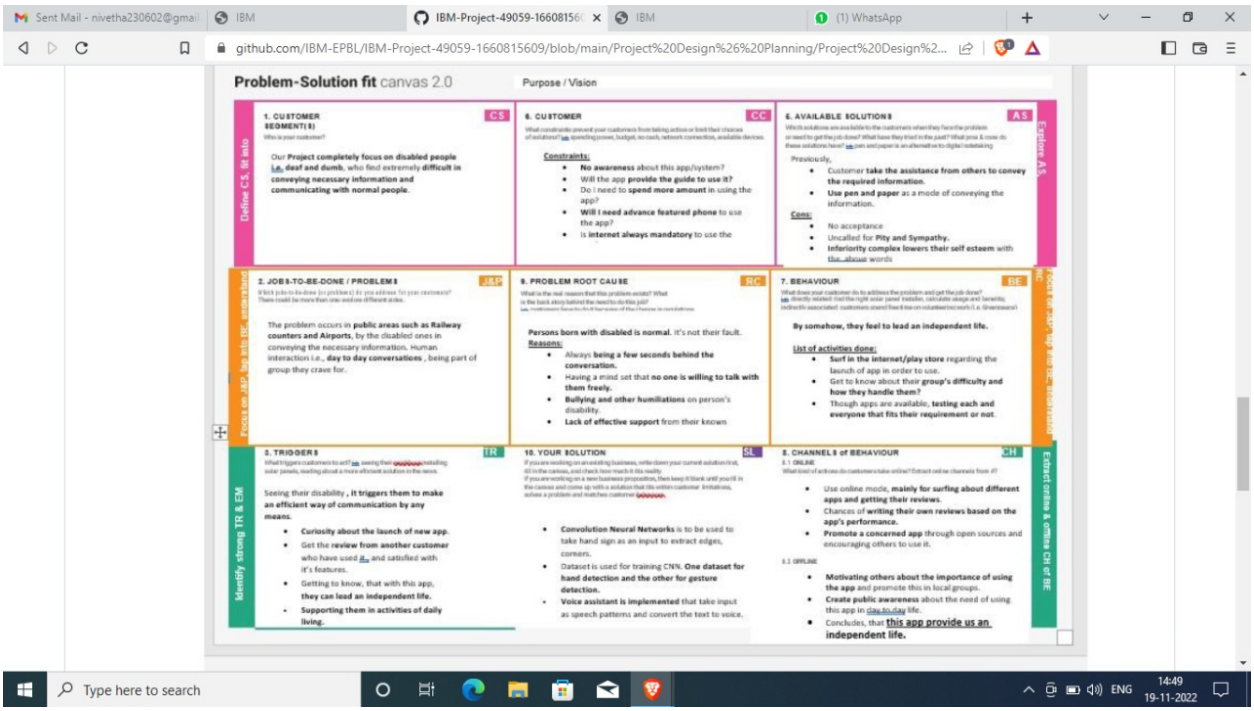
3.3 Proposed Solution

To provide an Efficient communication app which translates the hand signs into text and voice mode for deaf and dumb people. Convolution Neural Networks are to be used to take hand sign as an input to extract edges, corners. Dataset is used for training CNN. One dataset for hand detection and the other for gesture detection. Voice assistant is implemented that take input as speech patterns and convert the text into voice. This website has given a way for the deaf person to interact with normal people anywhere. Our proposed system includes a number of technologies like voice to text conversion speech to text conversion. Being a completely software based application, the app uses Google- speech API to achieve that result. In our application, for building this the main software which we have used here is Android Studio. Frontend designs are made using XML connected using Java along with SQLITE as a database. This application has user login for the first time following displaying different options like sending text message, voice to

text message, emergency message, sending GPS location and also a feature that assists the Indian Sign Language to the normal people. There are many such applications available ready in the Google play store. But we have integrated all such available features in our Android app for the benefit of mankind. We have number of symbols to be trained for our project and many of them look similar to each other like the gesture for symbol ‘V’ and digit ‘2’ .To produce better accuracies, we keep the background of hand a stable single colour, so that we don’t need to segment it on basis of skin colour. AI enables people with disabilities to lead an independent life with this app. Supporting them in activities of daily living . It changes the mind set of the disabled, that even they can too be involved in a common conversation like others. Faster and efficient , the concerned text or voice as output is produced, the more it leads to optimize the app with new advancements. The productivity is gained and at the same time, leads to improved speed of business.

3.4 Problem Solution Fit

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. It helps entrepreneurs, marketers and corporate innovators identify behavioural patterns and recognize what would work and why



Purpose:

- Solve complex problems in a way that fits the state of your customers. Succeed faster and increase your solution adoption by tapping into existing mediums and channels of behaviour.
- Sharpen your communication and marketing strategy with the right triggers and messaging.
- Increase touch-points with your company by finding the right problem-behavior fit and building trust by solving frequent annoyances, or urgent or costly problems.
- Understand the existing situation in order to improve it for your target group.

4. REQUIREMENT ANALYSIS

4.1 Functional Requirements

Here , Desktop along with Camera is presented as black box. Deaf/Dumb is the person, who will show different signs based on the type of information being conveyed. Normal Person is the passive user of

the desktop. In The Software Requirement Specification is to completely specify the technical requirements for the software product in a concise and unambiguous manner.The requirements specification is a technical specification of requirements for the software products. It is the first step in the requirements analysis, process; it lists the requirements of the particular software system including functional, performance, and security requirements. The requirements also provide usage scenarios from a user, an operational and an administrative perspective. The purpose of the software requirements specification is to provide a detailed overview of the software of the project, its parameters and goals. This describes a project target audience and its user interface, hardware and software requirements. It defines how the client, team and audience see the project and its functionality. The system requirements that are required are specified below, Deaf/Dumb person should be able to perform a sign that represents digit/number. Deaf/Dumb person should be able to perform a sign that represents a character. Deaf/Dumb person should be able to perform a sign , where group of characters forms a word. Deaf/Dumb person should be able to perform a sign, where group of words forms a sentence. Especially Deaf person should be able to see the translation of sign to text format. Dumb person should be able to understand the conversion of text into voice mode. Normal user should be able to understand the corresponding information conveyed by disabled through sign language.

Default Operation:

- User of the app faces the camera and perform the concerned hand sign to convey information.
- System/Desktop analyses the sign made by the user.
- Once analysis gets finished, then the concerned signs together are shown as a text based and also through voice.

Unexpected Operations:

Desktop indicates that user's hand sign is not within the frame or in Region of Interest(ROI).

1. User of the app show the hand sign towards the camera.
2. Desktop shows that sign is not within ROI.
3. Still User , make sure to present his/her sign within frame.
4. At last, Desktop finally detect the hand sign.

Signs are not recognized

1. Excepts the signs that are trained and included in the dataset, the Desktop will never detect the sign rather than this.
2. User Performs the sign and see that after 50ms, the concerned letter occupy in the space of text.

Speech/Voice assistant is implemented

1. Speech assistant is to be implemented in order to convert the output text into voice .

5. PROJECT DESIGN

5.1 Data Flow Diagram

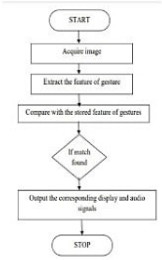
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.They are often elements of a formal methodology such as Structured Systems Analysis and Design Method (SSADM).

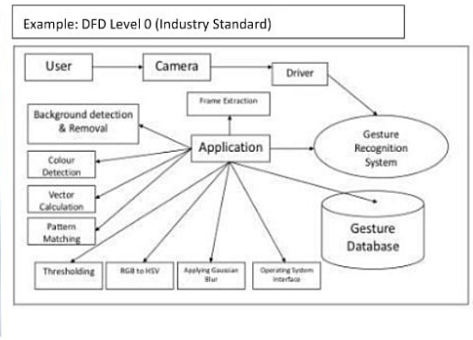
	Powered By AI For Specially Abled
Maximum Marks	4 Marks

Data Flow Diagrams:

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.

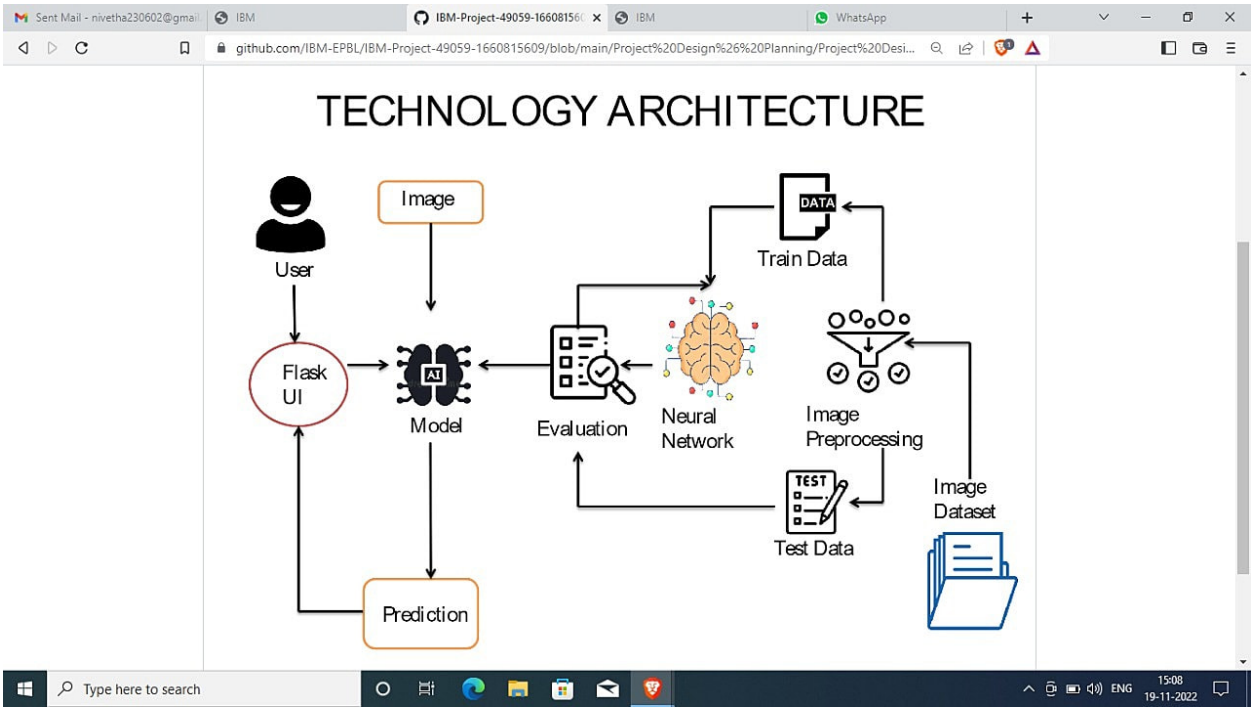
Example: (Simplified)





User Stories

5.2 Solution and Technical Architecture



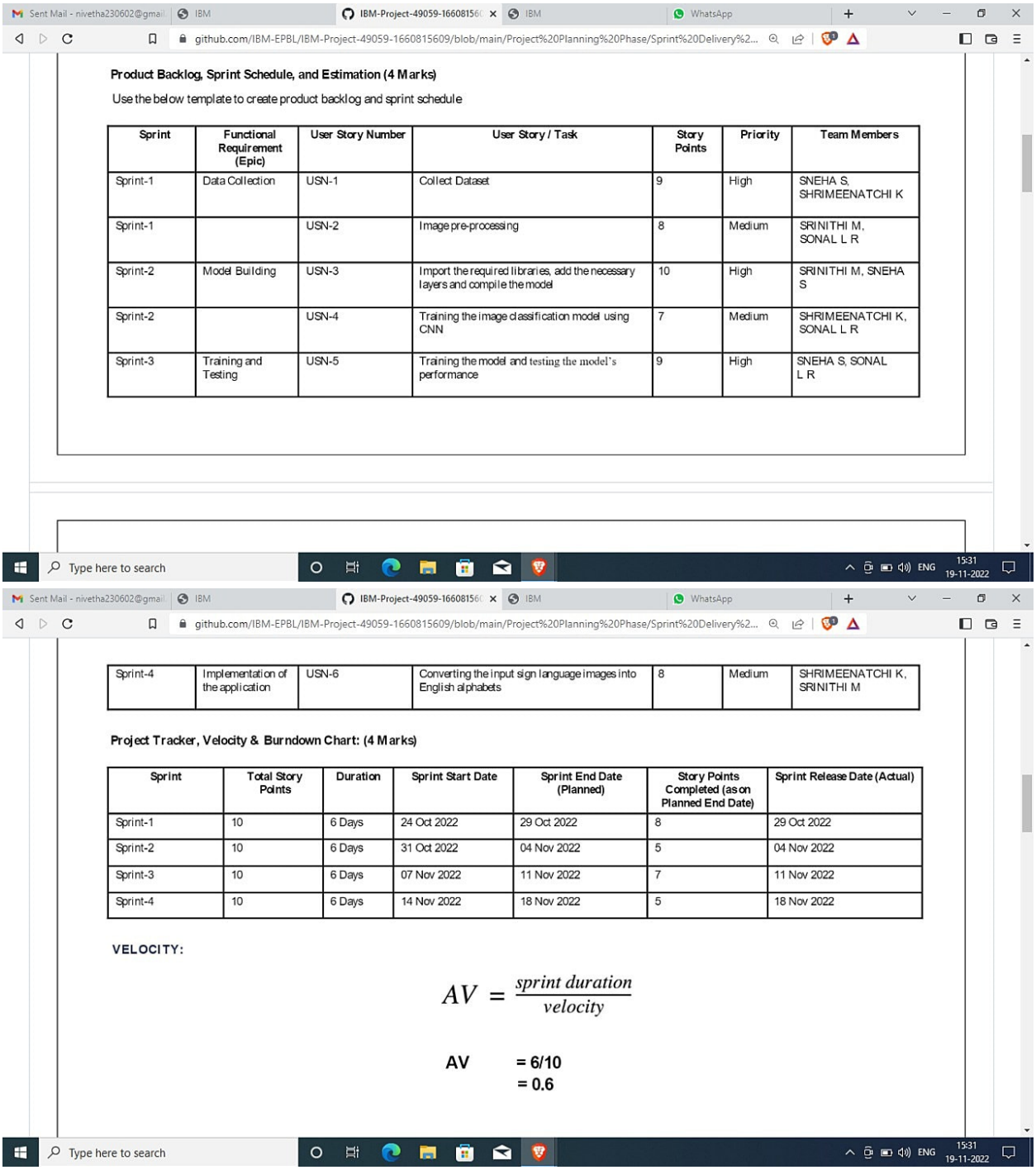
5.3 User Stories

Use the below template to list all the user stories for the product.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer *(Desktop user)*	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 *(Desktop user)*	**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 (Desktop user)	**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 *(Desktop user)*	**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 directed me to main screen.**	Medium	Sprint-2
Customer *(Desktop user)*	**Camera(Hand movement detection)**	USN-7	As a User, **I can show my hand sign towards the camera which converts them into text manner.**	**I can show my hand sign** towards the camera accurately.	High	Sprint-2
Customer *(Desktop user)*	**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 required to use the app.**		As an Executive, I can **provide the Specifications of Camera required, and other factors** that are required for smooth functioning of the app.	**I can provide the Specifications** of Camera required, and other factors	Low	Sprint-1
Customer Care Executive	**Check the performance of the app**		As an Executive, I can **check the usage and queries obtained from the end users.**	I can **check the usage and queries** obtained from the end users.	Medium	Sprint-1
Administrator	**Receive queries based on 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 effectively.	I can **take the queries from the customer care and perform necessary phases again.**	High	Sprint-2

6. PROJECT PLANING AND SCHEDULING

6.1 Sprint Planning and Estimation



Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Use the below template to create product backlog and sprint schedule

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	SNEHA S, SHRIMEENATCHI K
Sprint-1		USN-2	Image pre-processing	8	Medium	SRINITHI M, SONAL L R
Sprint-2	Model Building	USN-3	Import the required libraries, add the necessary layers and compile the model	10	High	SRINITHI M, SNEHA S
Sprint-2		USN-4	Training the image classification model using CNN	7	Medium	SHRIMEENATCHI K, SONAL L R
Sprint-3	Training and Testing	USN-5	Training the model and testing the model's performance	9	High	SNEHA S, SONAL L R
Sprint-4	Implementation of the application	USN-6	Converting the input sign language images into English alphabets	8	Medium	SHRIMEENATCHI K, SRINITHI M

Project Tracker, Velocity & Burndown Chart: (4 Marks)

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 = 6/10
= 0.6

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Burndown chart:

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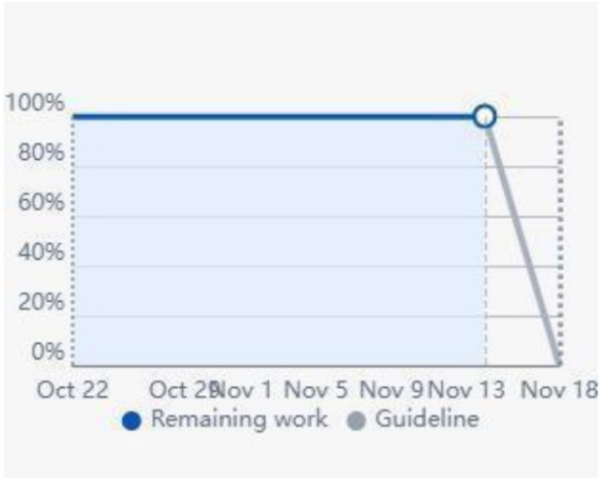
SPRINT BURNDOWN CHART:



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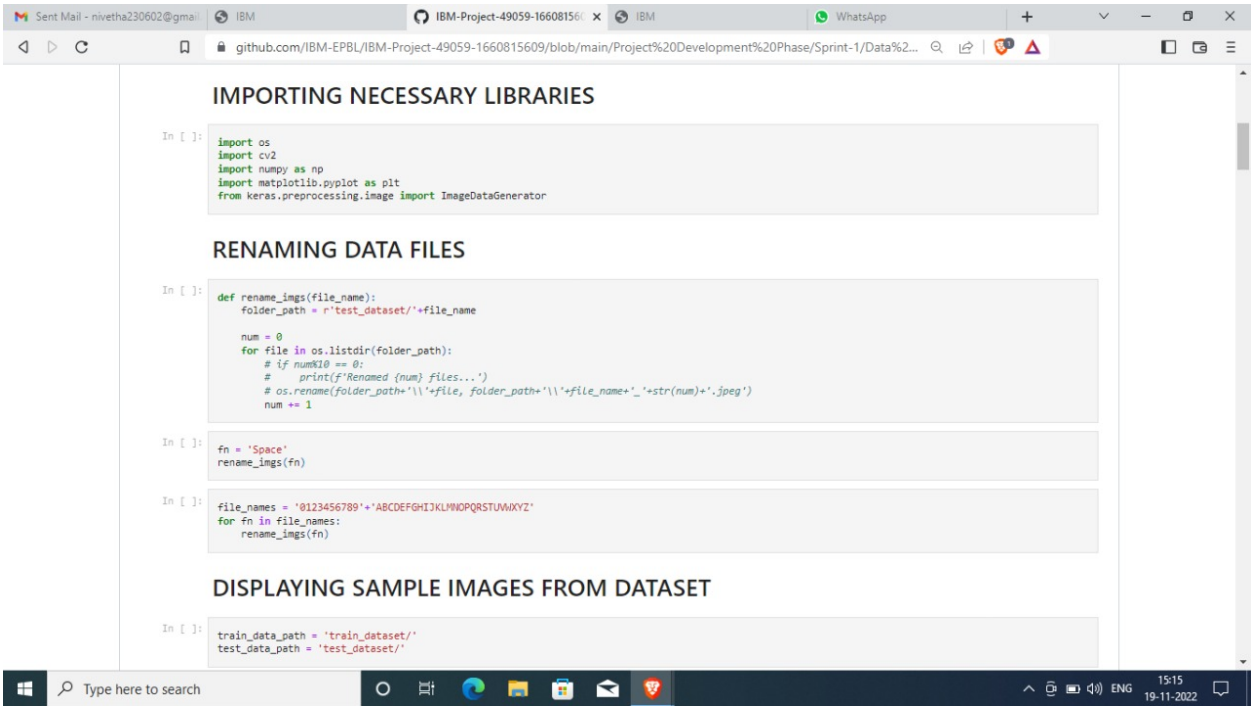
6.2 Sprint Delivery Schedule



IMPORTING NECESSARY LIBRARIES

```
import os
import cv2
import numpy as np
import matplotlib.pyplot as plt
from keras.preprocessing.image import ImageDataGenerator
```

RENAMING DATA FILES

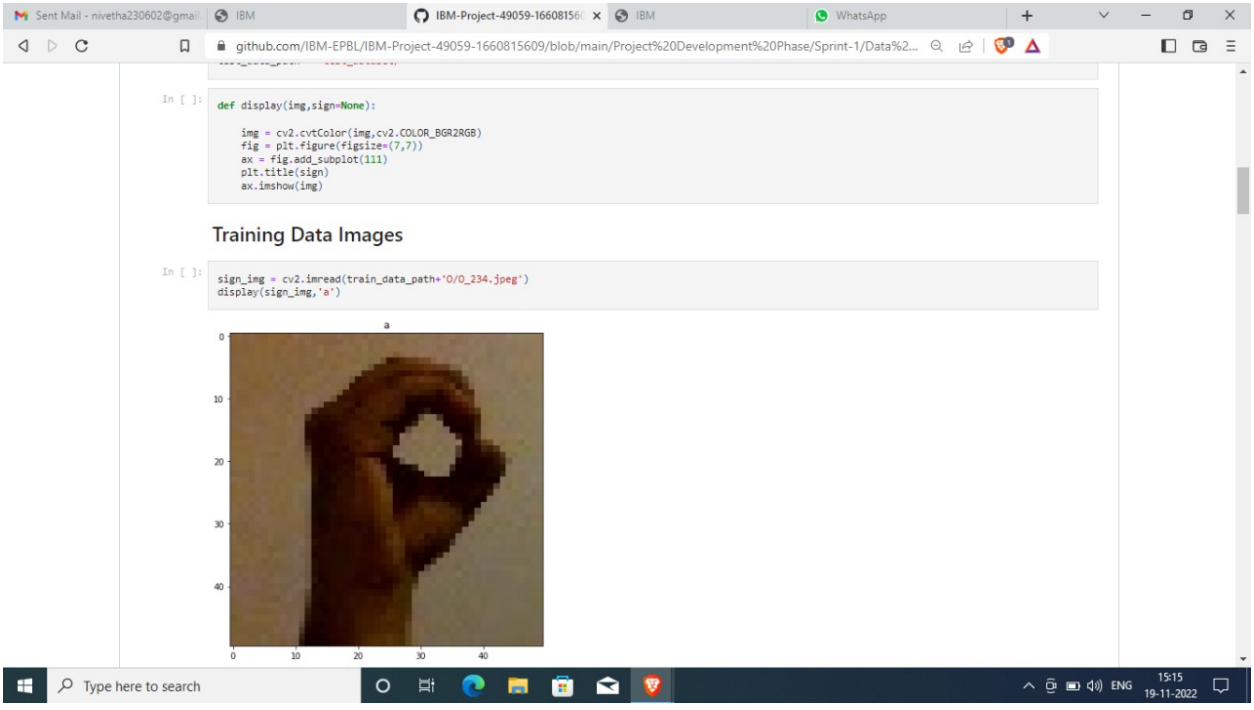
```
def rename_imgs(file_name):
    folder_path = r'test_dataset/'+file_name

    num = 0
    for file in os.listdir(folder_path):
        # if num%10 == 0:
        #     print(f'Renamed {num} files...')
        # os.rename(folder_path+'\\'+file, folder_path+'\\'+file_name+'_'+str(num)+'.jpeg')
        num += 1
```

```
fn = 'Space'
rename_imgs(fn)
```

```
file_names = '0123456789'+'ABCDEFGHIJKLMNOPQRSTUVWXYZ'
for fn in file_names:
    rename_imgs(fn)
```

DISPLAYING SAMPLE IMAGES FROM DATASET

```
train_data_path = 'train_dataset/'
test_data_path = 'test_dataset/'
```



```
def display(img,sign=None):

    img = cv2.cvtColor(img,cv2.COLOR_BGR2RGB)
    fig = plt.figure(figsize=(7,7))
    ax = fig.add_subplot(111)
    plt.title(sign)
    ax.imshow(img)
```

Training Data Images

```
sign_img = cv2.imread(train_data_path+'O/O_234.jpeg')
display(sign_img,'a')
```

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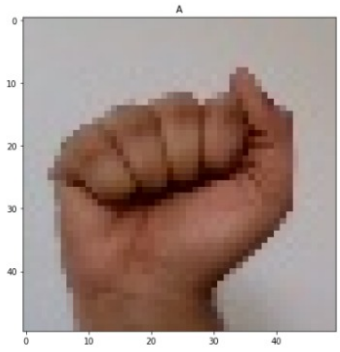
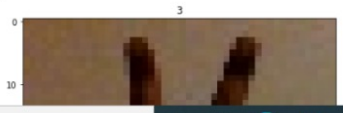
github.com/IBM-EPBL/IBM-Project-49059-1660815609/blob/main/Project%20Development%20Phase/Sprint-1/Data%2...

In [ ]:
```
sign_img = cv2.imread(train_data_path+'A/A_204.jpeg')
display(sign_img,'A')
```



In [ ]:
```
sign_img = cv2.imread(train_data_path+'3/3_340.jpeg')
display(sign_img,'3')
```



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github.com/IBM-EPBL/IBM-Project-49059-1660815609/blob/main/Project%20Development%20Phase/Sprint-1/Data%2...

In [ ]:
```
sign_img = cv2.imread(train_data_path+'M/M_100.jpeg')
display(sign_img,'M')
```

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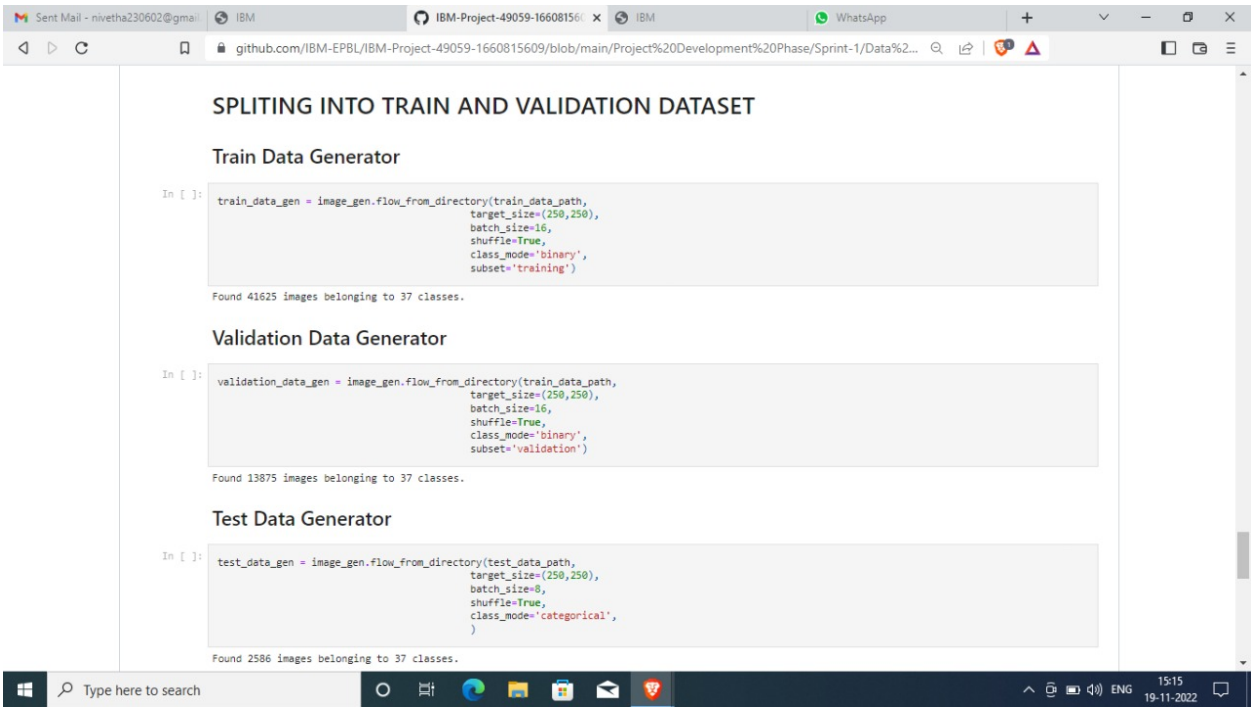


SPLITING INTO TRAIN AND VALIDATION DATASET

Train Data Generator

In [ ]:
```
train_data_gen = image_gen.flow_from_directory(train_data_path,
                                               target_size=(250,250),
                                               batch_size=16,
                                               shuffle=True,
                                               class_mode='binary',
                                               subset='training')
```

```
Found 41625 images belonging to 37 classes.
```

Validation Data Generator

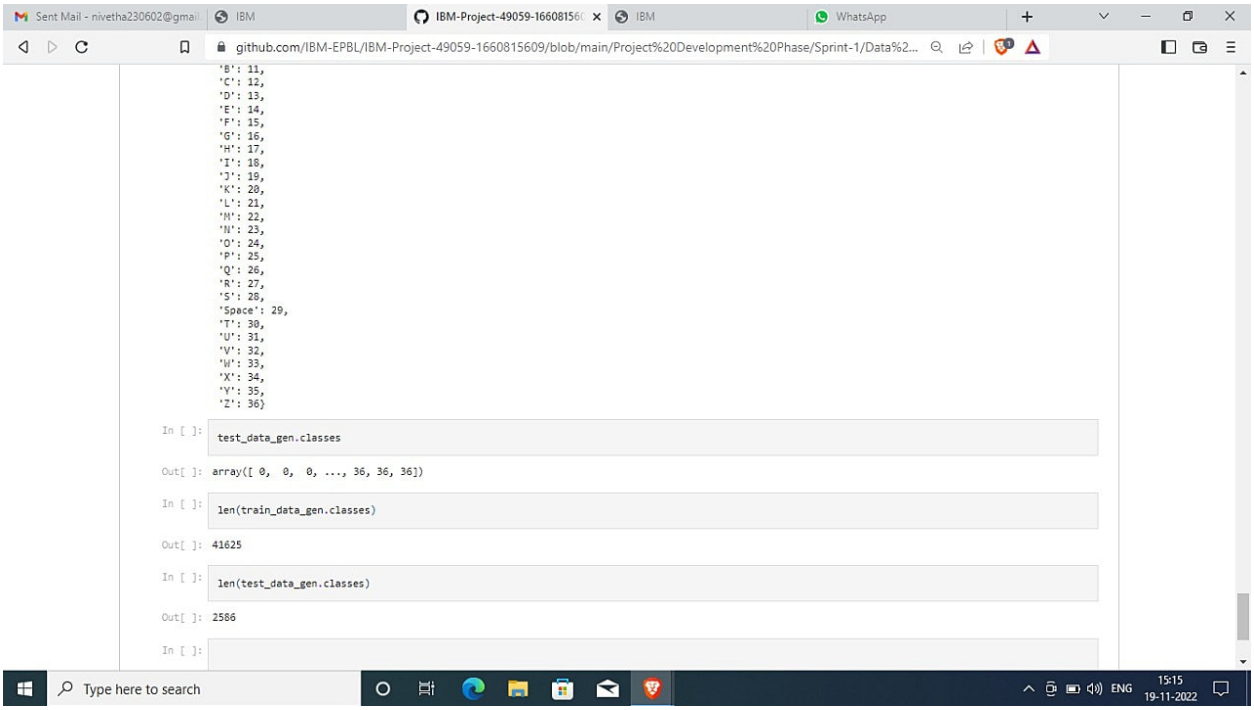
In [ ]:
```
validation_data_gen = image_gen.flow_from_directory(train_data_path,
                                               target_size=(250,250),
                                               batch_size=16,
                                               shuffle=True,
                                               class_mode='binary',
                                               subset='validation')
```

```
Found 13875 images belonging to 37 classes.
```

Test Data Generator

In [ ]:
```
test_data_gen = image_gen.flow_from_directory(test_data_path,
                                               target_size=(250,250),
                                               batch_size=8,
                                               shuffle=True,
                                               class_mode='categorical',
                                               )
```

```
Found 2586 images belonging to 37 classes.
```



```
'B': 11,
'C': 12,
'D': 13,
'E': 14,
'F': 15,
'G': 16,
'H': 17,
'I': 18,
'J': 19,
'K': 20,
'L': 21,
'M': 22,
'N': 23,
'O': 24,
'P': 25,
'Q': 26,
'R': 27,
'S': 28,
'Space': 29,
'T': 30,
'U': 31,
'V': 32,
'W': 33,
'X': 34,
'Y': 35,
'Z': 36}
```

In [ ]:
```
test_data_gen.classes
```

Out[ ]:
```
array([ 0,  0,  0, ..., 36, 36, 36])
```

In [ ]:
```
len(train_data_gen.classes)
```

Out[ ]:
```
41625
```

In [ ]:
```
len(test_data_gen.classes)
```

Out[ ]:
```
2586
```

In [ ]:

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github.com/IBM-EPBL/IBM-Project-49059-1660815609/blob/main/Project%20Development%20Phase/Sprint-2/Test_Th...

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

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

Out[ ]:

In [ ]:
```
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 [ ]:
```
img=image.load_img("/content/Dataset/test_set/H/107.png")
detect(img)
```

```
1/1 [==============================] - 0s 412ms/step
THE PREDICTED LETTER IS  H
```

In [ ]:
```
img = image.load_img('/content/Dataset/test_set/A/110.png')
pred=detect(img)
```

```
1/1 [==============================] - 0s 23ms/step
THE PREDICTED LETTER IS  A
```

In [ ]:
```
img=image.load_img('/content/Dataset/test_set/F/108.png')
detect(img)
```

```
1/1 [==============================] - 0s 25ms/step
THE PREDICTED LETTER IS  F
```

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github.com/IBM-EPBL/IBM-Project-49059-1660815609/blob/main/Project%20Development%20Phase/Sprint-3/Testing...

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

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

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

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

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

In [ ]:
```
model.add(Dense(200,activation='relu'))
model.add(Dense(9,activation="softmax"))
```

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

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

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
 in
----> 1 len(x_train)

NameError: name 'x_train' is not defined
```

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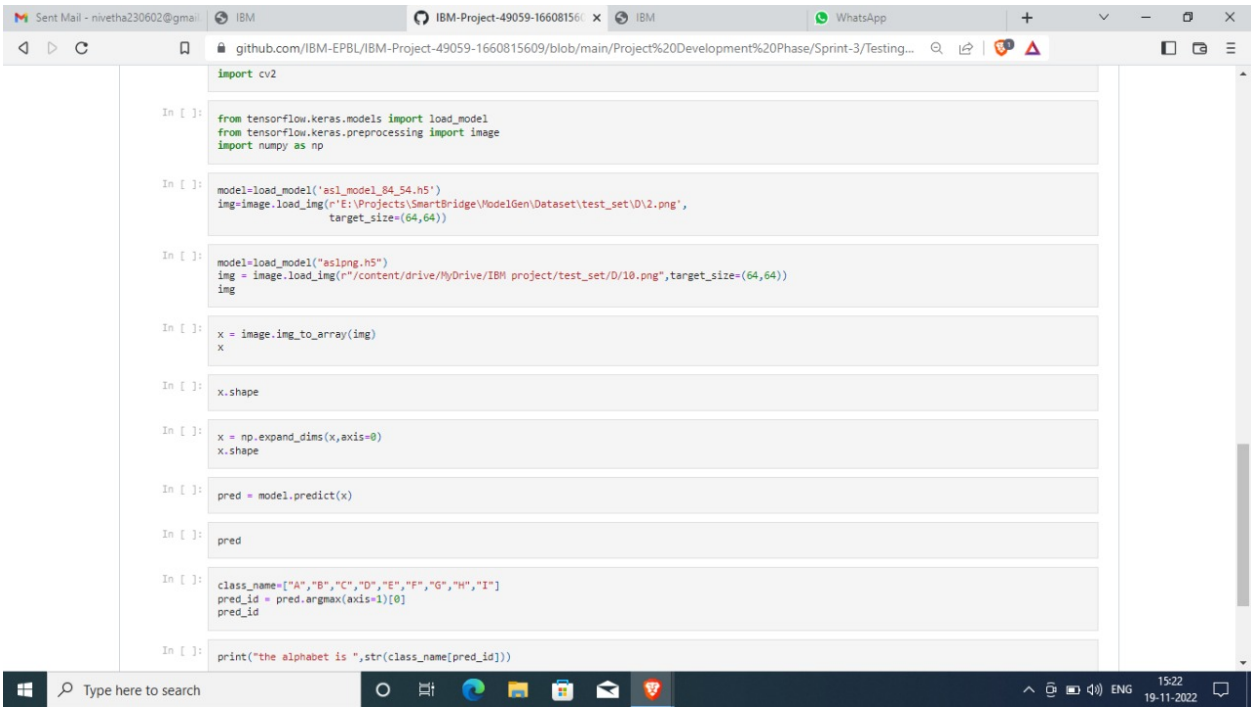


```
import cv2
```

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

```
model=load_model('asl_model_84_54.h5')
img=image.load_img(r'E:\Projects\SmartBridge\ModelGen\Dataset\test_set\D\2.png',
                   target_size=(64,64))
```

```
model=load_model("aslpng.h5")
img = image.load_img(r"/content/drive/MyDrive/IBM project/test_set/D/10.png",target_size=(64,64))
img
```

```
x = image.img_to_array(img)
x
```

```
x.shape
```

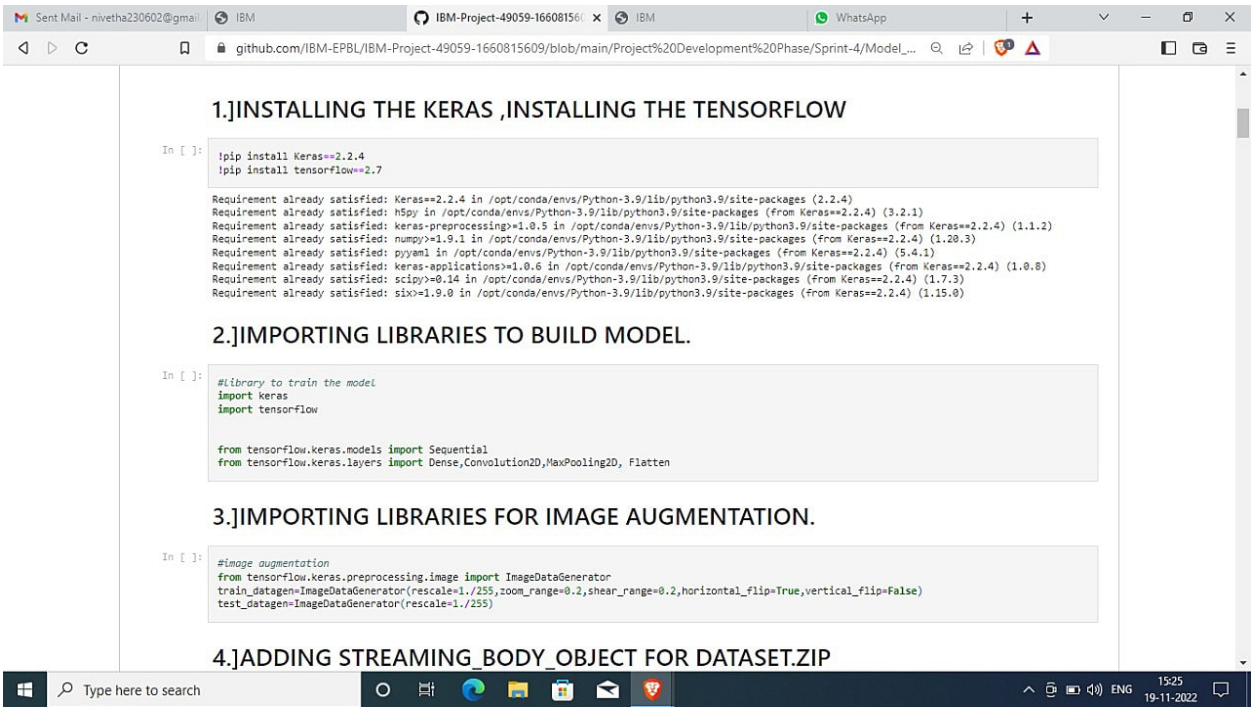
```
x = np.expand_dims(x,axis=0)
x.shape
```

```
pred = model.predict(x)
```

```
pred
```

```
class_name=["A","B","C","D","E","F","G","H","I"]
pred_id = pred.argmax(axis=1)[0]
pred_id
```

```
print("the alphabet is ",str(class_name[pred_id]))
```



1.]INSTALLING THE KERAS ,INSTALLING THE TENSORFLOW

```
!pip install Keras==2.2.4
!pip install tensorflow==2.7
```

```
Requirement already satisfied: Keras==2.2.4 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (2.2.4)
Requirement already satisfied: h5py in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from Keras==2.2.4) (3.2.1)
Requirement already satisfied: keras-preprocessing>=1.0.5 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from Keras==2.2.4) (1.1.2)
Requirement already satisfied: numpy>=1.9.1 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from Keras==2.2.4) (1.20.3)
Requirement already satisfied: pyyaml in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from Keras==2.2.4) (5.4.1)
Requirement already satisfied: keras-applications>=1.0.6 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from Keras==2.2.4) (1.0.8)
Requirement already satisfied: scipy>=0.14 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from Keras==2.2.4) (1.7.3)
Requirement already satisfied: six>=1.9.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from Keras==2.2.4) (1.15.0)
```

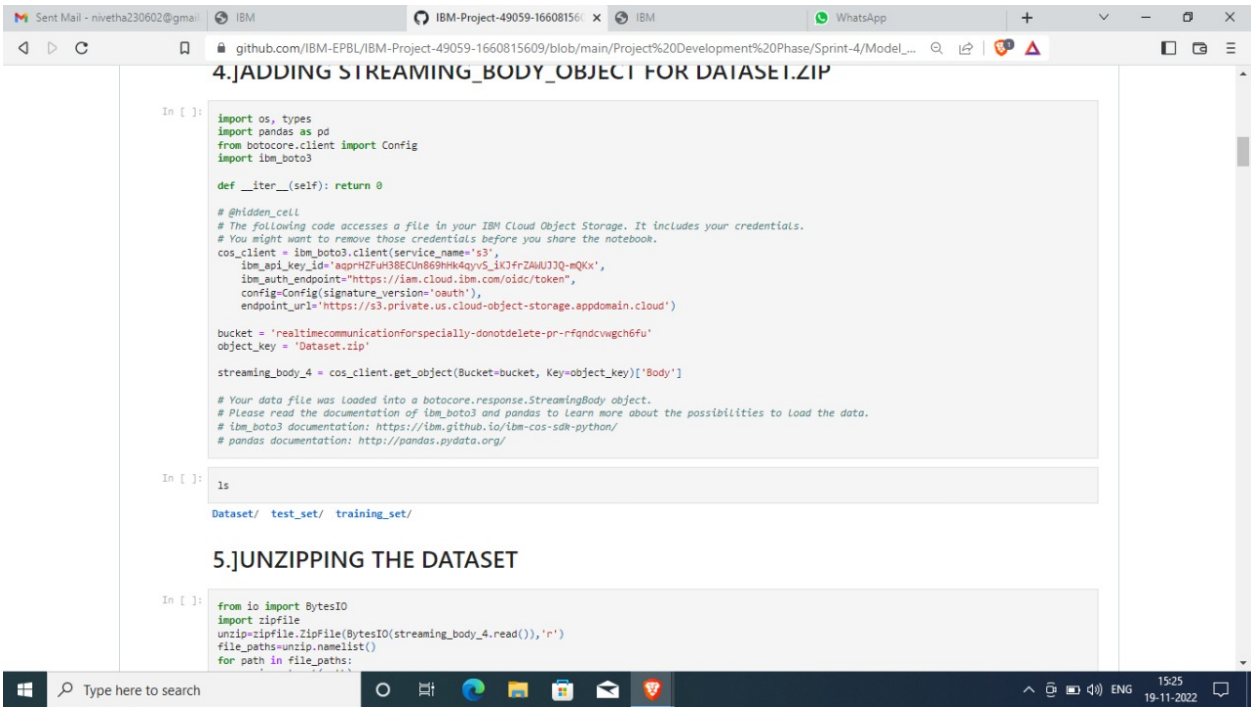
2.]IMPORTING LIBRARIES TO BUILD MODEL.

```
#library to train the model
import keras
import tensorflow


from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense,Convolution2D,MaxPooling2D, Flatten
```

3.]IMPORTING LIBRARIES FOR IMAGE AUGMENTATION.

```
#image augmentation
from tensorflow.keras.preprocessing.image import ImageDataGenerator
train_datagen=ImageDataGenerator(rescale=1./255,zoom_range=0.2,shear_range=0.2,horizontal_flip=True,vertical_flip=False)
test_datagen=ImageDataGenerator(rescale=1./255)
```

4.]ADDING STREAMING_BODY_OBJECT FOR DATASET.ZIP



4.]ADDING STREAMING_BODY_OBJECT FOR DATASET.ZIP

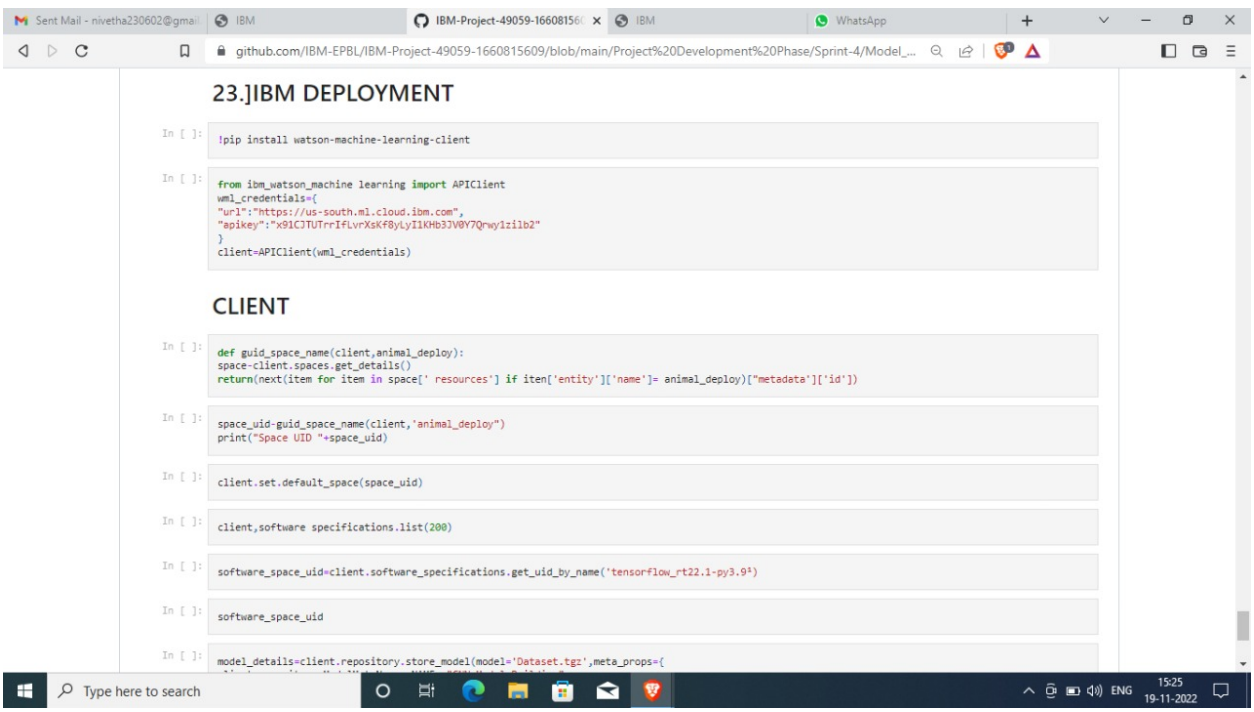
In [ ]:
```
import os, types
import pandas as pd
from botocore.client import Config
import ibm_boto3

def __iter__(self): return 0

# @hidden_cell
# The following code accesses a file in your IBM Cloud Object Storage. It includes your credentials.
# You might want to remove those credentials before you share the notebook.
cos_client = ibm_boto3.client(service_name='s3',
    ibm_api_key_id='aqprHZFuH38ECUn869hHk4qyvS_iKJfrZAWUJJQ-mQKx',
    ibm_auth_endpoint="https://iam.cloud.ibm.com/oidc/token",
    config=Config(signature_version='oauth'),
    endpoint_url='https://s3.private.us.cloud-object-storage.appdomain.cloud')

bucket = 'realtimecommunicationforspecially-donotdelete-pr-rfqndcvwgch6fu'
object_key = 'Dataset.zip'

streaming_body_4 = cos_client.get_object(Bucket=bucket, Key=object_key)['Body']

# Your data file was loaded into a botocore.response.StreamingBody object.
# Please read the documentation of ibm_boto3 and pandas to learn more about the possibilities to load the data.
# ibm_boto3 documentation: https://ibm.github.io/ibm-cos-sdk-python/
# pandas documentation: http://pandas.pydata.org/
```

In [ ]:
```
ls
```

```
Dataset/  test_set/  training_set/
```

5.]UNZIPPING THE DATASET

In [ ]:
```
from io import BytesIO
import zipfile
unzip=zipfile.ZipFile(BytesIO(streaming_body_4.read()),'r')
file_paths=unzip.namelist()
for path in file_paths:
```



23.]IBM DEPLOYMENT

In [ ]:
```
!pip install watson-machine-learning-client
```

In [ ]:
```
from ibm_watson_machine_learning import APIClient
wml_credentials={
"url":"https://us-south.ml.cloud.ibm.com",
"apikey":"x91CJTUTrrIfLvrXsKf8yLyI1KHb3JV0Y7Qrwy1zilb2"
}
client=APIClient(wml_credentials)
```

CLIENT

In [ ]:
```
def guid_space_name(client,animal_deploy):
space-client.spaces.get_details()
return(next(item for item in space[' resources'] if iten['entity']['name']= animal_deploy)["metadata']['id'])
```

In [ ]:
```
space_uid-guid_space_name(client,'animal_deploy")
print("Space UID "+space_uid)
```

In [ ]:
```
client.set.default_space(space_uid)
```

In [ ]:
```
client,software specifications.list(200)
```

In [ ]:
```
software_space_uid=client.software_specifications.get_uid_by_name('tensorflow_rt22.1-py3.9¹)
```

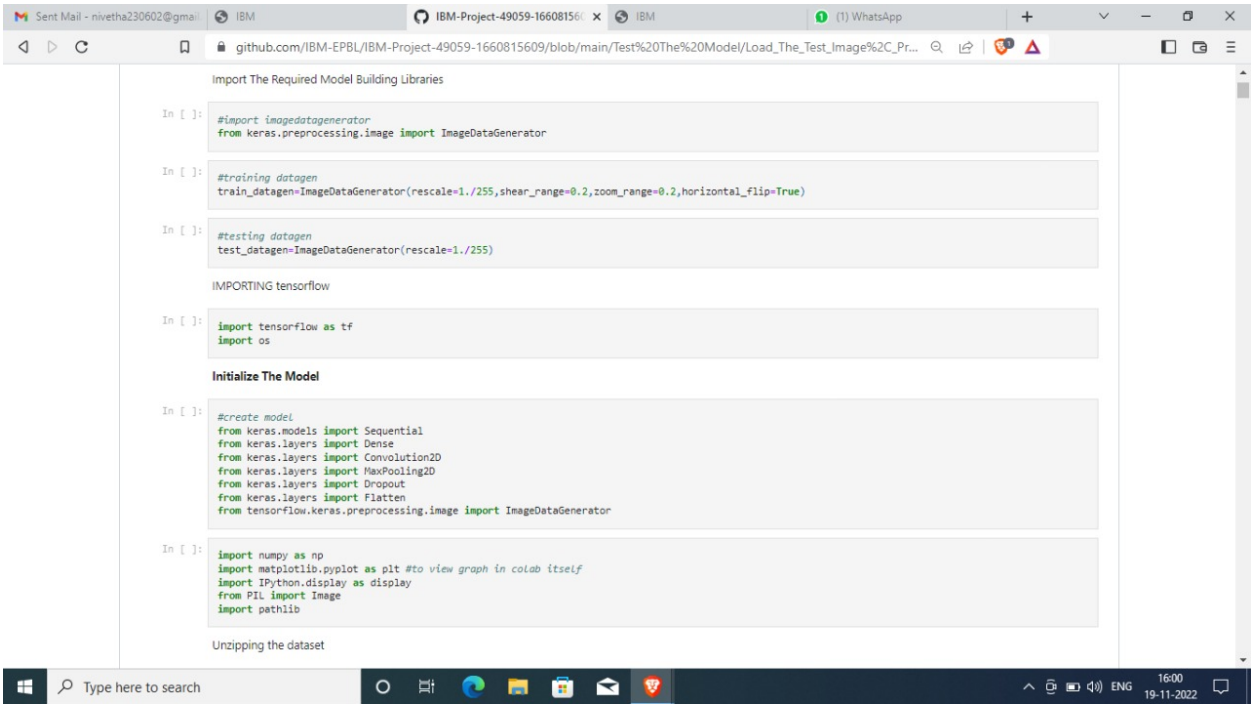
In [ ]:
```
software_space_uid
```

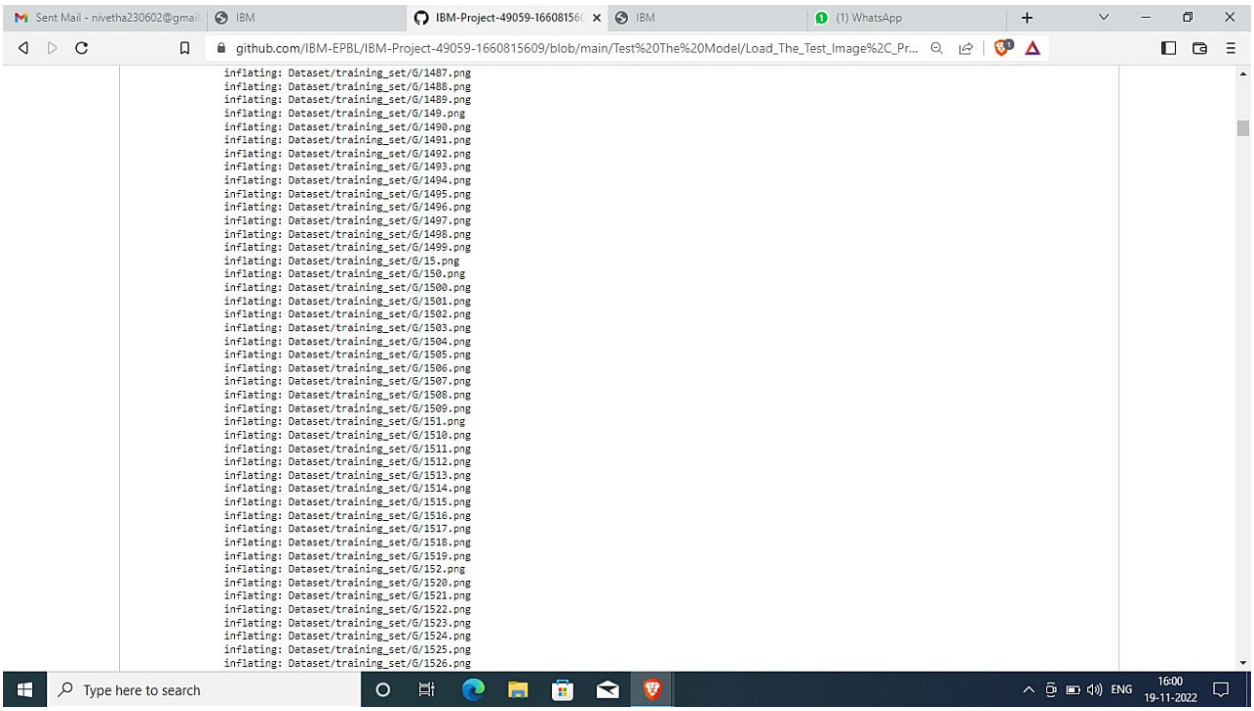
In [ ]:
```
model_details=client.repository.store_model(model='Dataset.tgz',meta_props={
```

7. CODING AND SOLUTIONING

7.1 Feature

- Without dialing number we can communicate to other like face to face communication.
- It does not require large amount of storage as it uses the Hand speak support through online.
- The sign words are signed in the same order as letters appear in English alphabets.
- This project prepares individuals to work as interpreter/translators facilitating and mediating communication between Deaf/Hard of Hearing and hearing people.
- Accurate and appropriate transfer of a message from a source language into a target language from the point of view of style and culture.
- Learn the culture and history of Deaf people to better understanding communication between Deaf and Hearing individuals.

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github.com/IBM-EPBL/IBM-Project-49059-1660815609/blob/main/Test%20The%20Model/Load_The_Test_Image%2C_Pr...
inflating: Dataset/training_set/G/1487.png
inflating: Dataset/training_set/G/1488.png
inflating: Dataset/training_set/G/1489.png
inflating: Dataset/training_set/G/149.png
inflating: Dataset/training_set/G/1490.png
inflating: Dataset/training_set/G/1491.png
inflating: Dataset/training_set/G/1492.png
inflating: Dataset/training_set/G/1493.png
inflating: Dataset/training_set/G/1494.png
inflating: Dataset/training_set/G/1495.png
inflating: Dataset/training_set/G/1496.png
inflating: Dataset/training_set/G/1497.png
inflating: Dataset/training_set/G/1498.png
inflating: Dataset/training_set/G/1499.png
inflating: Dataset/training_set/G/15.png
inflating: Dataset/training_set/G/150.png
inflating: Dataset/training_set/G/1500.png
inflating: Dataset/training_set/G/1501.png
inflating: Dataset/training_set/G/1502.png
inflating: Dataset/training_set/G/1503.png
inflating: Dataset/training_set/G/1504.png
inflating: Dataset/training_set/G/1505.png
inflating: Dataset/training_set/G/1506.png
inflating: Dataset/training_set/G/1507.png
inflating: Dataset/training_set/G/1508.png
inflating: Dataset/training_set/G/1509.png
inflating: Dataset/training_set/G/151.png
inflating: Dataset/training_set/G/1510.png
inflating: Dataset/training_set/G/1511.png
inflating: Dataset/training_set/G/1512.png
inflating: Dataset/training_set/G/1513.png
inflating: Dataset/training_set/G/1514.png
inflating: Dataset/training_set/G/1515.png
inflating: Dataset/training_set/G/1516.png
inflating: Dataset/training_set/G/1517.png
inflating: Dataset/training_set/G/1518.png
inflating: Dataset/training_set/G/1519.png
inflating: Dataset/training_set/G/152.png
inflating: Dataset/training_set/G/1520.png
inflating: Dataset/training_set/G/1521.png
inflating: Dataset/training_set/G/1522.png
inflating: Dataset/training_set/G/1523.png
inflating: Dataset/training_set/G/1524.png
inflating: Dataset/training_set/G/1525.png
inflating: Dataset/training_set/G/1526.png
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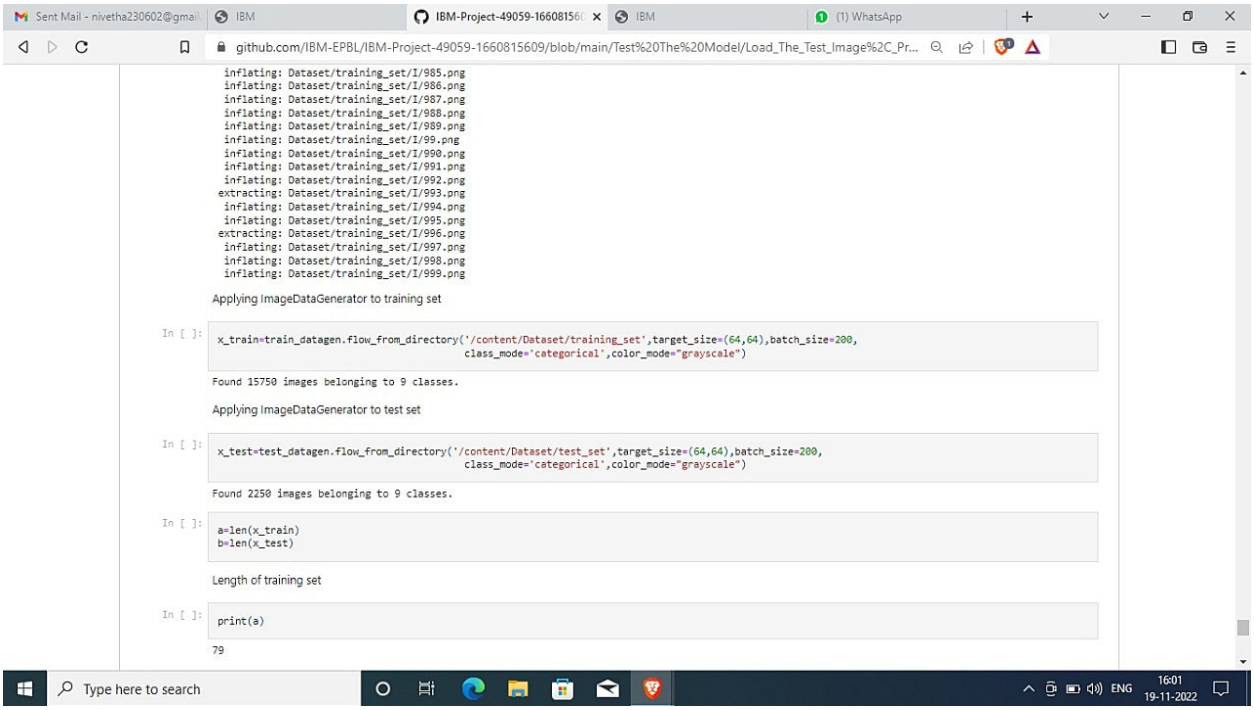
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github.com/IBM-EPBL/IBM-Project-49059-1660815609/blob/main/Test%20The%20Model/Load_The_Test_Image%2C_Pr...
inflating: Dataset/training_set/I/985.png
inflating: Dataset/training_set/I/986.png
inflating: Dataset/training_set/I/987.png
inflating: Dataset/training_set/I/988.png
inflating: Dataset/training_set/I/989.png
inflating: Dataset/training_set/I/99.png
inflating: Dataset/training_set/I/990.png
inflating: Dataset/training_set/I/991.png
inflating: Dataset/training_set/I/992.png
extracting: Dataset/training_set/I/993.png
inflating: Dataset/training_set/I/994.png
inflating: Dataset/training_set/I/995.png
extracting: Dataset/training_set/I/996.png
inflating: Dataset/training_set/I/997.png
inflating: Dataset/training_set/I/998.png
inflating: Dataset/training_set/I/999.png
Applying ImageDataGenerator to training set
In [ ]:
x_train=train_datagen.flow_from_directory('/content/Dataset/training_set',target_size=(64,64),batch_size=200,
class_mode='categorical',color_mode="grayscale")
Found 15750 images belonging to 9 classes.
Applying ImageDataGenerator to test set
In [ ]:
x_test=test_datagen.flow_from_directory('/content/Dataset/test_set',target_size=(64,64),batch_size=200,
class_mode='categorical',color_mode="grayscale")
Found 2250 images belonging to 9 classes.
In [ ]:
a=len(x_train)
b=len(x_test)
Length of training set
In [ ]:
print(a)
79
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```
In [ ]:
#1st hidden Layer
model.add(Dense(units=512,activation='relu'))
#2nd hidden Layer
model.add(Dense(units=261,activation='relu'))
```

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

Compile The Model

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

Fit The Model

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

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1: UserWarning: `Model.fit_generator` is deprecated and will be removed in a future versi
on. Please use `Model.fit`, which supports generators.
  """Entry point for launching an IPython kernel.
Epoch 1/10
79/79 [==============================] - 90s 1s/step - loss: 0.3965 - accuracy: 0.8746 - val_loss: 0.2797 - val_accuracy: 0.9529
Epoch 2/10
79/79 [==============================] - 86s 1s/step - loss: 0.0419 - accuracy: 0.9884 - val_loss: 0.2846 - val_accuracy: 0.9751
Epoch 3/10
79/79 [==============================] - 84s 1s/step - loss: 0.0195 - accuracy: 0.9947 - val_loss: 0.3436 - val_accuracy: 0.9751
Epoch 4/10
79/79 [==============================] - 87s 1s/step - loss: 0.0083 - accuracy: 0.9982 - val_loss: 0.3722 - val_accuracy: 0.9751
Epoch 5/10
79/79 [==============================] - 83s 1s/step - loss: 0.0066 - accuracy: 0.9983 - val_loss: 0.4095 - val_accuracy: 0.9756
Epoch 6/10
79/79 [==============================] - 88s 1s/step - loss: 0.0072 - accuracy: 0.9979 - val_loss: 0.3874 - val_accuracy: 0.9756
Epoch 7/10
79/79 [==============================] - 86s 1s/step - loss: 0.0059 - accuracy: 0.9985 - val_loss: 0.3891 - val_accuracy: 0.9747
Epoch 8/10
79/79 [==============================] - 86s 1s/step - loss: 0.0027 - accuracy: 0.9992 - val_loss: 0.4429 - val_accuracy: 0.9756
Epoch 9/10
79/79 [==============================] - 84s 1s/step - loss: 0.0073 - accuracy: 0.9981 - val_loss: 0.4907 - val_accuracy: 0.9756
Epoch 10/10
79/79 [==============================] - 85s 1s/step - loss: 0.0048 - accuracy: 0.9987 - val_loss: 0.4866 - val_accuracy: 0.9702
```

Load The Test Image, Pre-Process It And Predict

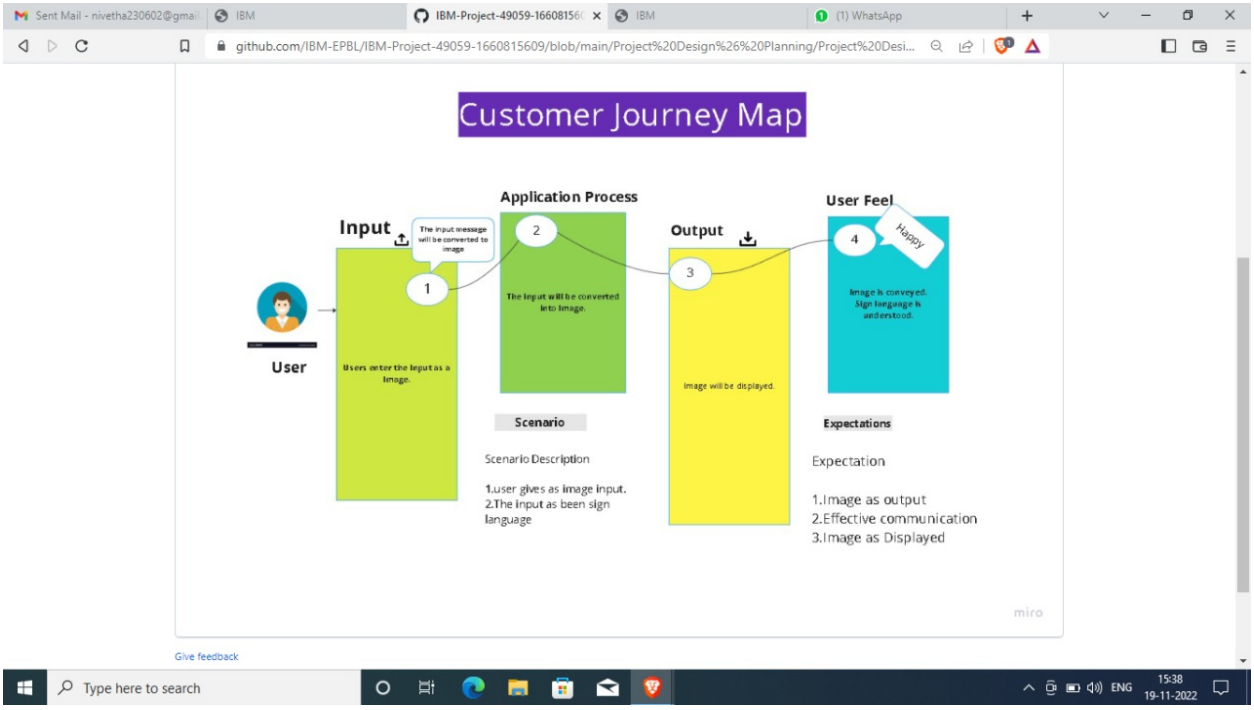
```
In [ ]:
from skimage.transform import resize
def detect(frame):
  img=resize(frame,(64,64,1))
  img=np.expand_dims(img,axis=0)
  if(np.max(img)>1):
    prediction=model.predict(img)
    print(prediction)
    prediction=model.predict_classes(img)
    print(prediction)
```

```
In [ ]:
arr= image.img_to_array(img)
```

```
In [ ]:
frame=cv2.imread('/content/Dataset/test_set/A/10.png')
data=detect(frame)
from google.colab.patches import cv2_imshow
cv2_imshow(frame)
cv2.waitKey(0)
cv2.destroyAllWindows()
```

8. TESTING

8.1 User Acceptance Testing



9. RESULTS

By using sign language app we can communicate deaf people easily with the help of this application. First we need to register this application with specified details the message will convert into video message with the help of video real services. The internet is necessary for buffering the video and coversion of it. By using handshape algorithm this application has been developed.It will be very useful to deaf people day to day life. By using this application deaf person can easily interact with normal person anywhere, and he can also use this application for mobile sign translation using VSR and by using UTF-7 he can communicate in daily activates without dialing number. We can use this application for mobile sign translation using VRS, and with UTF-7 communication can be made without dialing number.expand of curiosity and consequent usages of wearable devices in near future, the price of the gadgets can be expected to

fall leading to of wide application within the society.

10. CONCLUSION

Sign language is a useful tool to ease the communication between the deaf person and normal person. The system aims to lower the communication gap between deaf people and normal world, since it facilitates two way communications. The projected methodology interprets language into speech. The system overcomes the necessary time difficulties of speech-hearing impaired and improves their manner. This system converts the language in associate passing voice that's well explicable by deaf people. With this project the deaf-mute people can use the gloves to perform sign language and it will be converted into speech.

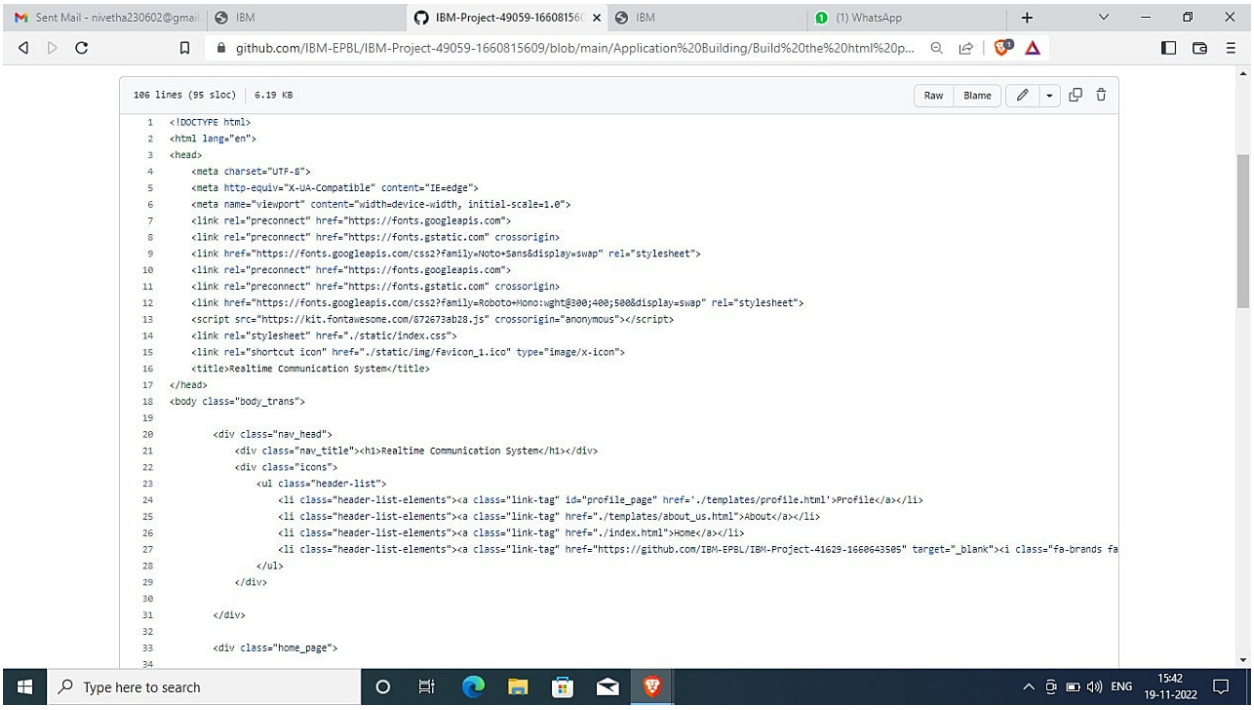
11. FUTURE SCOPE

The proposed procedure was implemented and tested with set of images. The set of 26 images of single person is used for training database; the sample database is shown in fig.2. Preprocessing results of the same hand gesture shows in fig.3. These preprocessed gesture taken as input for feature extraction and classification stage. The graphs generated in the preprocessing statge are shown in fig.4. Once the gesture is recognised; the equivalent gesture audio file is played at the output.

1. Extend our website into app and launch it.
2. Adding words for more signs.
3. Designing application for support iOS.
4. The framework should be updated regularly.
5. Add some more languages for the use of all state people.

12. APPENDIX

SOURCE CODE



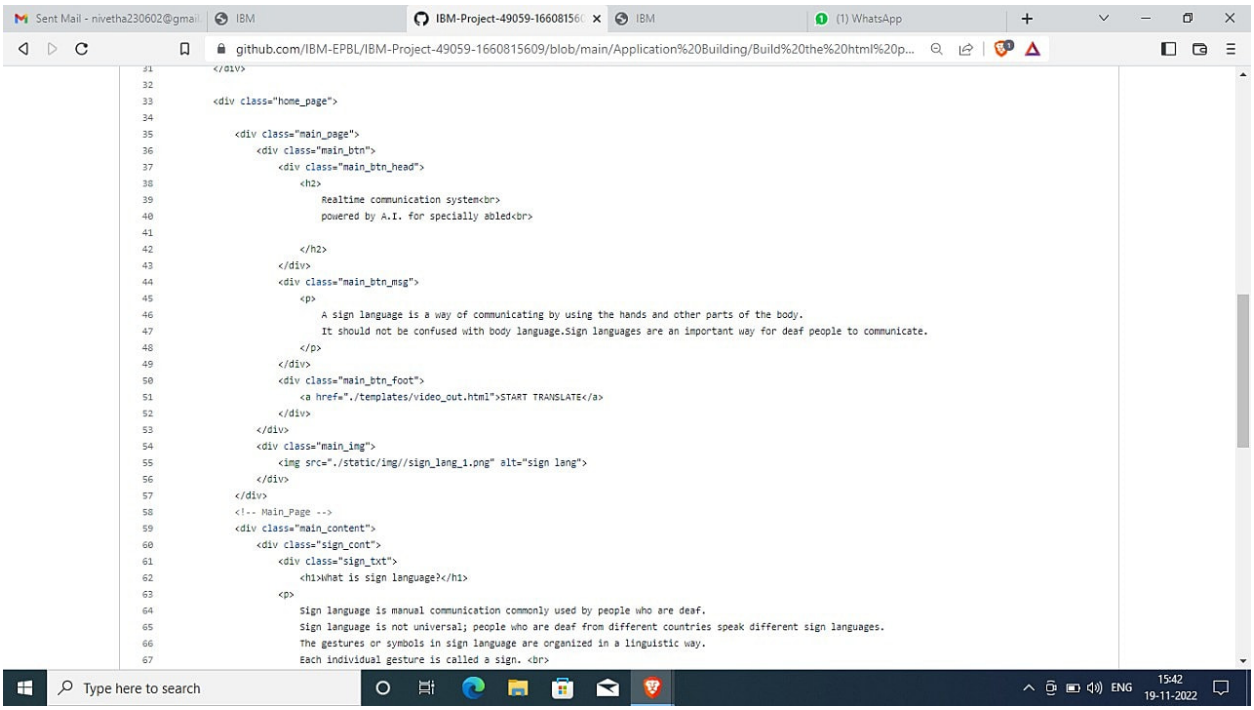
106 lines (95 sloc) | 6.19 KB

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <link rel="preconnect" href="https://fonts.googleapis.com">
    <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
    <link href="https://fonts.googleapis.com/css2?family=Noto+Sans&display=swap" rel="stylesheet">
    <link rel="preconnect" href="https://fonts.googleapis.com">
    <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
    <link href="https://fonts.googleapis.com/css2?family=Roboto+Mono:wght@300;400;500&display=swap" rel="stylesheet">
    <script src="https://kit.fontawesome.com/872673ab28.js" crossorigin="anonymous"></script>
    <link rel="stylesheet" href="./static/index.css">
    <link rel="shortcut icon" href="./static/img/favicon_1.ico" type="image/x-icon">
    <title>Realtime Communication System</title>
</head>
<body class="body_trans">

        <div class="nav_head">
            <div class="nav_title"><h1>Realtime Communication System</h1></div>
            <div class="icons">
                <ul class="header-list">
                    <li class="header-list-elements"><a class="link-tag" id="profile_page" href='./templates/profile.html'>Profile</a></li>
                    <li class="header-list-elements"><a class="link-tag" href="./templates/about_us.html">About</a></li>
                    <li class="header-list-elements"><a class="link-tag" href="./index.html">Home</a></li>
                    <li class="header-list-elements"><a class="link-tag" href="https://github.com/IBM-EPBL/IBM-Project-41629-1660643505" target="_blank"><i class="fa-brands fa
                </ul>
            </div>

        </div>

        <div class="home_page">
```

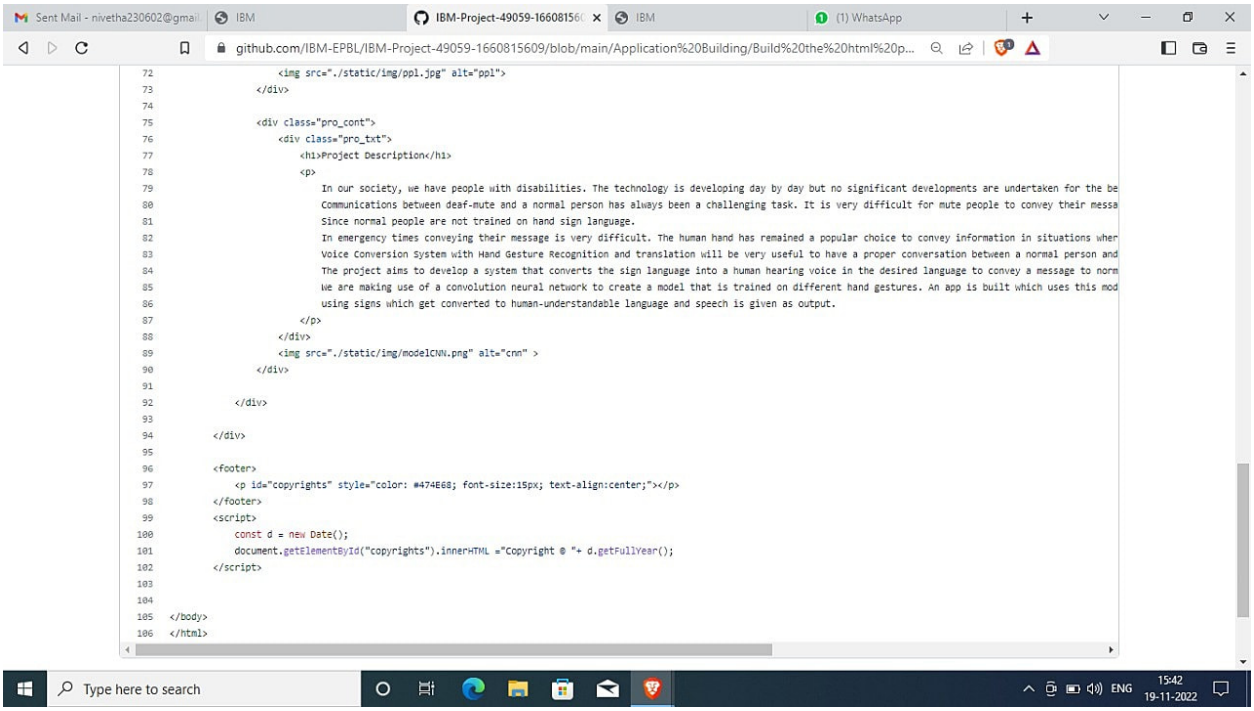


```
        </div>

        <div class="home_page">

            <div class="main_page">
                <div class="main_btn">
                    <div class="main_btn_head">
                        <h2>
                            Realtime communication system<br>
                            powered by A.I. for specially abled<br>

                        </h2>
                    </div>
                    <div class="main_btn_msg">
                        <p>
                            A sign language is a way of communicating by using the hands and other parts of the body.
                            It should not be confused with body language.Sign languages are an important way for deaf people to communicate.
                        </p>
                    </div>
                    <div class="main_btn_foot">
                        <a href="./templates/video_out.html">START TRANSLATE</a>
                    </div>
                </div>
                <div class="main_img">
                    <img src="./static/img//sign_lang_1.png" alt="sign lang">
                </div>
            </div>
            <!-- Main_Page -->
            <div class="main_content">
                <div class="sign_cont">
                    <div class="sign_txt">
                        <h1>What is sign language?</h1>
                        <p>
                            Sign language is manual communication commonly used by people who are deaf.
                            Sign language is not universal; people who are deaf from different countries speak different sign languages.
                            The gestures or symbols in sign language are organized in a linguistic way.
                            Each individual gesture is called a sign. <br>
```



GITHUB AND PROJECT DEMO LINK

- https://github.com/IBM-EPBL/IBM-Project-49059-1660815609
- https://drive.google.com/file/d/1RLh0pCCkNJ45CiKhfr4fs29bZQz5rB24/view?usp=share_link