UNIVERSITY COLLEGE OF ENGINEERING ARIYALUR

B.E – ELECTRONICS AND COMMUNICATION ENGINEERING

REAL-TIME COMMUNICATION SYSTEM POWERED BY AI FOR SPECIALLY ABLED

PROJECT REPORT

Submitted by

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ABSTRACT

Deaf and mute people use sign language to communicate. Unlike acoustically conveyed sound patterns, sign language uses hand gestures, facial expressions, body language and manual communication to convey thoughts. Due to the considerable time required in learning Sign Language, people find it difficult to communicate with specially-abled people, creating a communication gap. Hence conventionally, people face problems in recognizing sign language. Moreover, different countries have their respective form of sign gesture communication which results in non-uniformity. The ISL (Indian Sign Language) used in India is largely different from the American Sign Language used in the US, mostly because of the difference in culture, geographical and historical context. Somewhere between 138 and 300 different types of sign language are currently being used throughout the world. Sign language structure varies spatially and temporally. We have identified these as a major barrier in communication with a significant part of society. And hence, we propose to design a system that recognizes different signs and conveys the information to people. The component of any sign language consists of hand shape, motion, and place of articulation. When combined, these three components (together with palm orientation) uniquely determine the meaning of the manual sign. For sign language identification, sensorbased and vision-based methods are used In vision-based gesture recognition technology, a camera reads the movements of the human body, typically hand movements and uses these gestures to interpret sign language, whereas in sensor-based methods, realtime hand and finger movements can be monitored using the leap motion sensor. We aim at developing a scalable project where we will be considering different hand gestures to recognize the letters and words. We plan to use different deep learning models to predict the sign. This may be developed as a desktop or mobile application to enable specially abled people to communicate easily and effectively with others. However, this project can later be extended to capture the whole vocabulary of ASL (American Sign Language) through manual and non-manual signs.

Keywords: Sign language, ASL, ISL, Dynamic hand gesture recognition

1.INTRODUCTION

1.1Project Overview

Real-time communications (RTC) is any mode of telecommunications in which all users can exchange information instantly or with negligible latency or transmission delays. In RTC, there is always a direct path between the source and the destination. Although the link might contain several intermediate nodes, the data goes from source to

destination without being stored in between them. In contrast, asynchronous or time shifting communications, such as email and voicemail, always involve some form of data storage between the source and the destination. In these cases, there is an anticipated delay between the transmission and receipt of the information.

1.2 PROBLEM STATEMENT

The Deaf and mute community can only communicate using sign language. Sign language involves simultaneously combining hand shapes, orientations, gestures and movement of the hands, arms, or body to express the speaker's thoughts. Because of cultural, geographic and historical differences, there exists over 300 different types of sign languages around the world. The ISL (Indian Sign Language) used in India is very different from the American Sign Language used in the United States. This causes inconsistency of sign languages around the world. Moreover, learning sign language requires significant amount of time and effort. This makes it difficult for the conventional world to learn and hence interact with the deaf and mute community. According to a recent study, out of every thousand kids born, 2 to 3 of them are deaf or hard-of-hearing, and, as degrees of hearing loss go, there are 16 to 30 times more children who are identified as Deaf (having a Profound 91+dB hearing loss) than hardof-hearing. For those deaf or hard of hearing children, only 10% of parents & family learn sign language to communicate with them. We identify this as a major barrier in communicating with a significant part of the society. 1.2 Purpose Real-time communication (RTC) refers to any communication that happens between two (or more) individuals in real-time – with minimal latency and without transmission delays. Some examples of real-time communication include landline phones, mobile calls, instant messaging, VoIP, and video conferencing.

OBJECTIVE AND MOTIVATION

The objective of our project is to bridge the gap and ensure the inclusion of deaf and mute community into the conventional society meanwhile ensuring an easy and effective mode of communication. We aim at designing a real time system that recognizes the sign language and expresses the same in an easy language, like English. Currently, extensive work has been done on American sign language recognition, but Indian sign language differs significantly from American sign language. ISL uses two hands for communicating (20 out of 26) whereas ASL uses single hand for communicating. Using both hands often lead to obscurity of features due to overlapping of hands. In addition to this, lack of datasets and variance in sign language with locality has resulted in restrained efforts in ISL gesture detection. Our project aims at taking the basic step in bridging the communication gap between normal people and deaf and dumb people using Indian sign language. Effective extension of this project to words and common expressions may not only make the deaf and mute people communicate

faster and easier with outer world, but also provide a boost in developing autonomous systems for understanding and aiding them.

Communication between Deaf and Mute People and Normal People Chat applications have become a powerful media that assist people to communicate in different languages with each other. There are lots of chat applications that are used different people in different languages but there is not such a chat application that has facilitated to communicate with sign languages. The developed system is based on Sinhala Sign language. The system has included four main components as text messages are converted to sign messages, voice messages are converted to sign messages, sign messages are converted to text messages and sign messages are converted to voice messages. Google voice recognition API has used to develop speech character recognition for voice messages. The system has been trained for the speech and text patterns by using some text parameters and signs of Sinhala Sign language is displayed by emojis. Those emojis and signs that are included in this system will bring the normal people closer to the disabled people. This is a 2-way communication system, but it uses pattern of gesture recognition which is not very reliable in getting appropriate output.

Intelligent Sign Language Recognition

Using Image Processing Computer recognition of sign language is an important research problem for enabling communication with hearing impaired people. This project introduces an efficient and fast algorithm for identification of the number of fingers opened in a gesture representing an alphabet of the Binary Sign Language. The system does not require the hand to be perfectly aligned to the camera. The project uses image processing system to identify, especially English alphabetic sign language used by the deaf people to communicate. The basic objective of this project is to develop a computer based intelligent system that will enable dumb people significantly to communicate with all other people using their natural hand gestures. The idea consisted of designing and building up an intelligent system using image processing, machine learning and artificial intelligence concepts to take visual inputs of sign language's hand gestures a generate easily recognizable form of outputs. Hence the objective of this project is to develop an intelligent system which can act as a translator between the sign language and the spoken language dynamically and can make the communication between people with hearing impairment and normal people both effective and efficient. The system is we are implementing for Binary sign language, but it can detect any sign language with prior image processing.

Sign Language Recognition Using Image Processing One of the major drawbacks of our society is the barrier that is created between disabled or handicapped persons and the normal person. Communication is the only medium by which we can share our thoughts or convey the message but for a person with disability (deaf and mute) faces

difficulty in communication with normal person. For many deaf and dumb people, sign language is the basic means of communication. Sign language recognition
(SLR) aims to interpret sign languages automatically by a computer in order to help the deaf communicate with hearing society conveniently. Our aim is to design a system to help the person who trained the hearing impaired to communicate with the rest of the world using sign language or hand gesture recognition techniques. In this system, feature detection and feature extraction of hand 23 gesture is done with the help of SURF algorithm using image processing. All this work is done using MATLAB software. With the help of this algorithm, a person can easily train a deaf and mute

2.LITERATURE SURVEY

2.1 Existing Problem

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

2.2 REFERENCES

[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.

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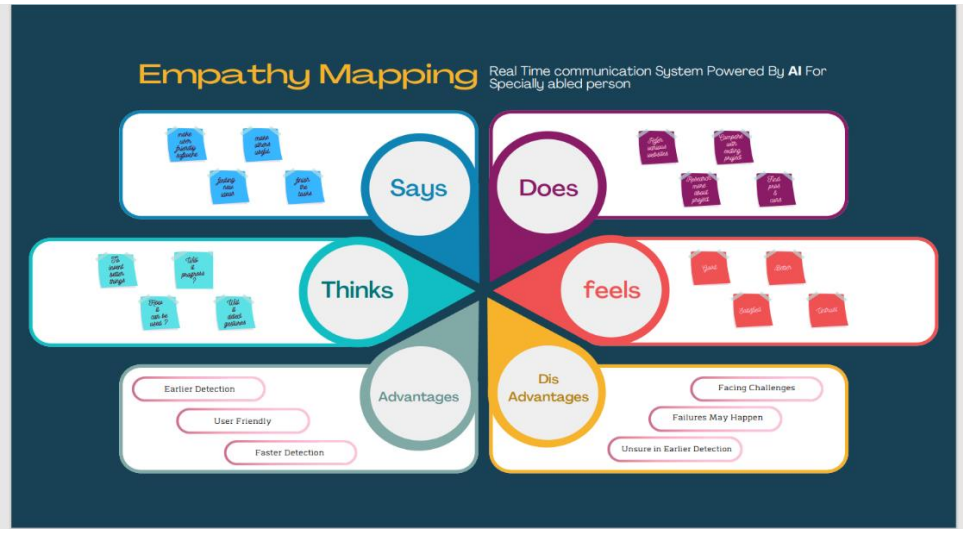
2.3 Problem Statement Definition

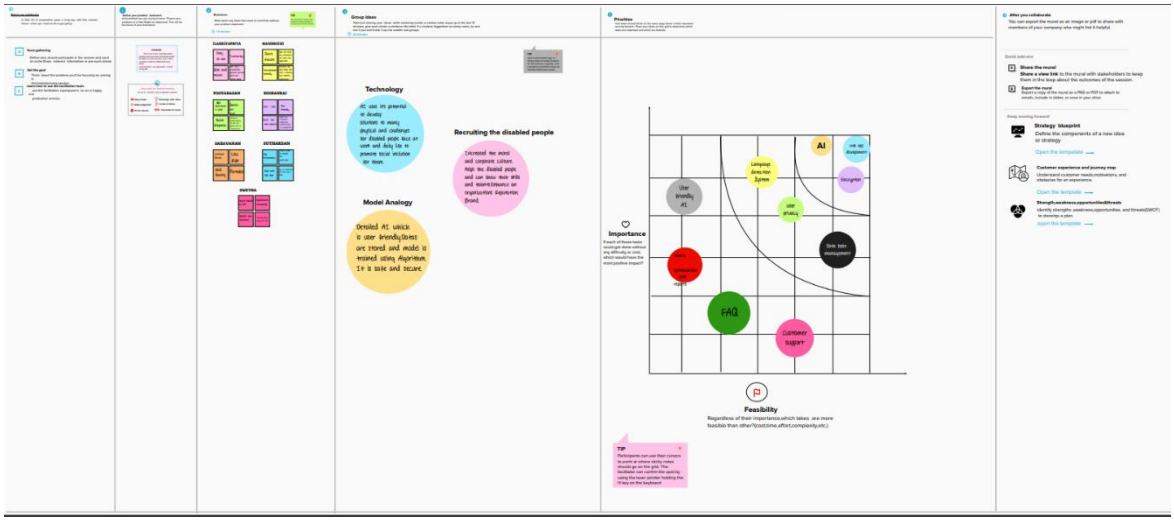
In our society, we have people with disabilities. The technology is developing day by day but no significant developments are undertaken for the betterment of these people. Communications between deaf-mute and a normal person has always been a challenging task. It is very difficult for mute people to 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.

3.IDEATION AND PROPOSED SOLUTION

3.1 Empathy Map Canvas



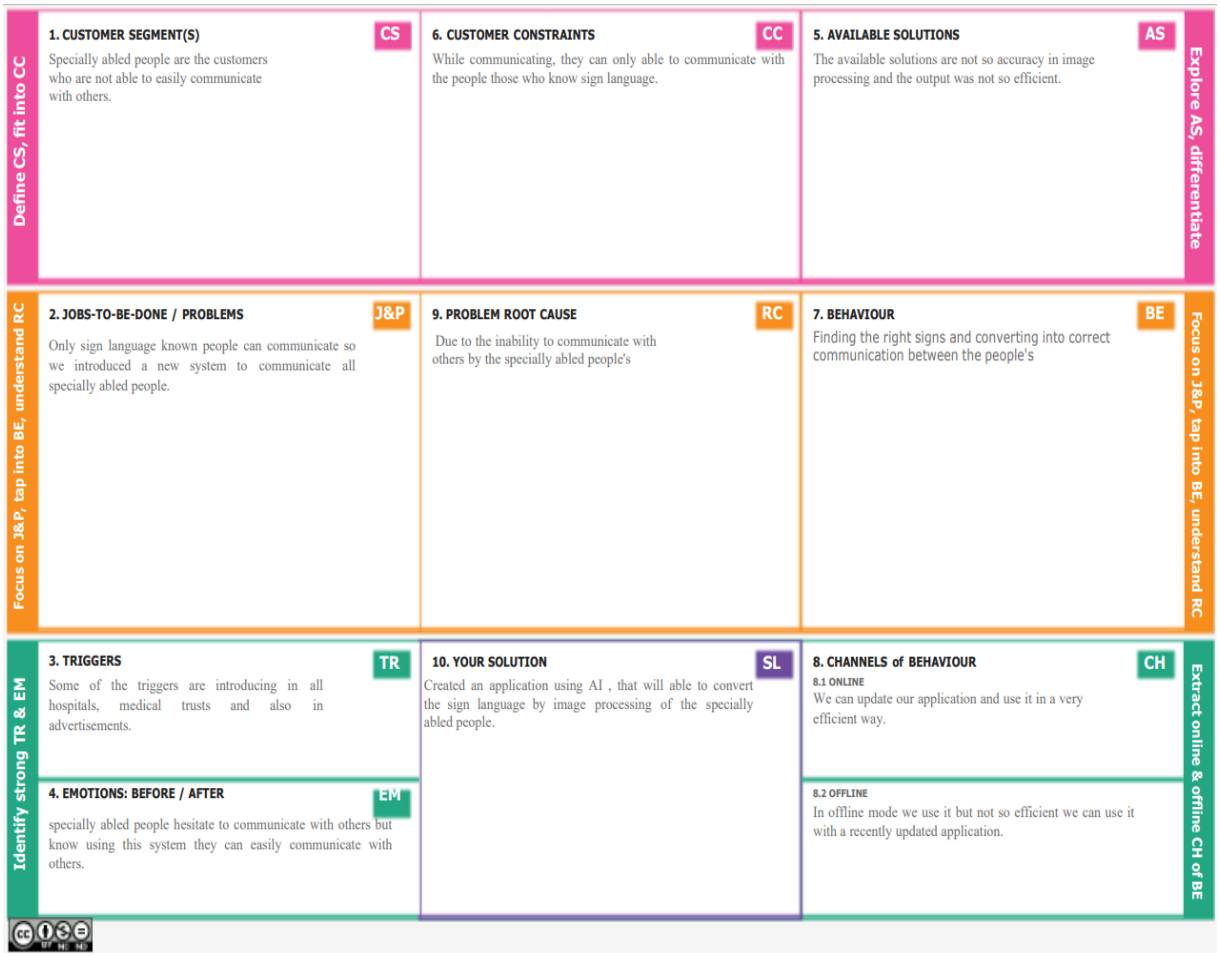
3.2 Ideation & brainstorming



3.3 Proposed Solution

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

3.4 PROBLEM SOLUTION FIT



4 REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

- System is presented as black box
- Hearing impaired is the person that performs the signs
- Normal hearing is the passive user of the system The System Requirements Can Be Specified
- Hearing impaired person should be able to perform sign that represent digit number
- Hearing impaired person should be able to perform sign that represent alphabet letter 29
- Hearing impaired person should be able to perform sign that represent word
- Hearing impaired person should be able to perform sign that represent sentence
- Hearing impaired person should be able to see the translation of sign to text
- Hearing impaired person should be able to change the component (number/alphabet or word/sentence) for which translation to speech is provided

NORMAL FLOW

- User comes in front of camera and performs the alphabet letter
- System analyzes the performed sign
- System shows the sign meaning as text and speech

ALTERNATIVE FLOWS

 System indicates that user is not within field of view of Kinect
- System shows that user is not detected
- User enters the field of view
- System shows that user is detected

 Sign not recognized

1. System does not react to indicate thatsign was not recognized 2. User performs again the alphabet letter until it is recognized

 Enabling speech for this component:

1. Enable speech component

4.2 NON FUNCTIONAL REQUIREMENT

FRNo.	Non-FunctionalRequirement	Description
NFR-1	**Usability**	The designed system is easy to use for speciallyabledpersonsasitisportableand platformindependent.

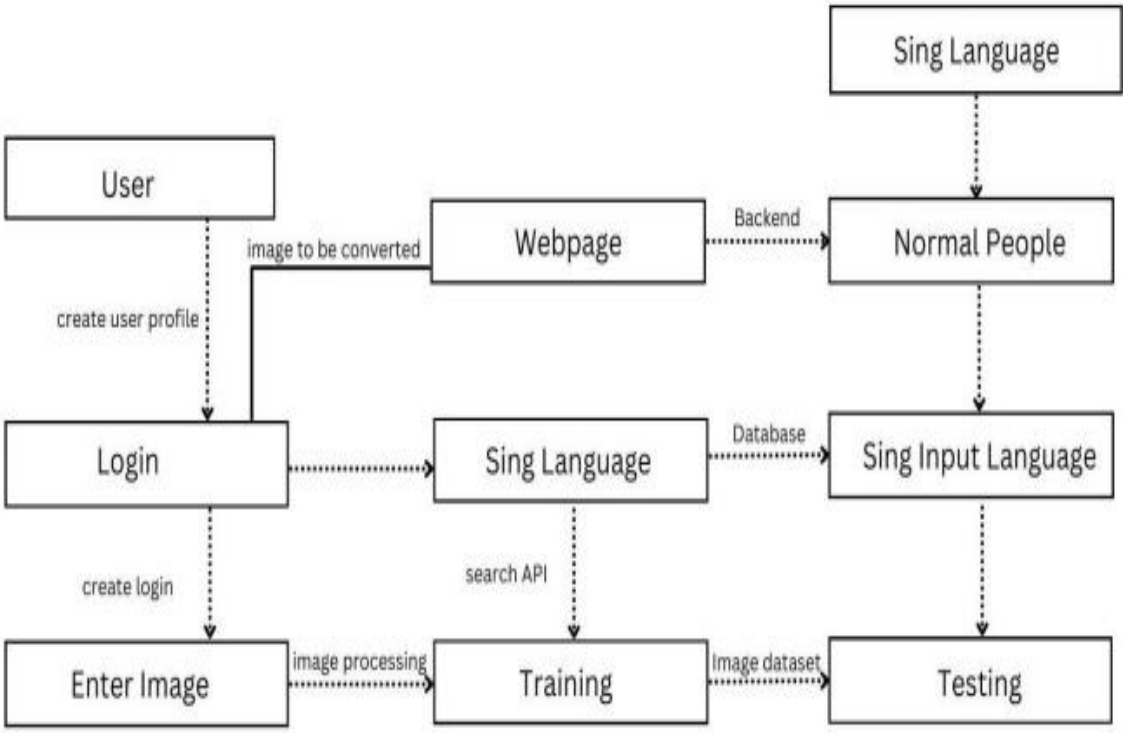
NFR-2	**Security**	Convertedinformationusingsignsintospeechis accessed only by the user.
NFR-3	**Reliability**	Systemistestedwithlargenumberofdataand Providesinsight into issues.
NFR-4	**Performance**	QuickLaunchtimeofapplicationandfasterinconverting signs into speech
NFR-5	**Availability**	Providesautomaticrecoveryand Useraccess.
NFR-6	**Scalability**	Standard network condition the device shouldconvertinformationwithinsecond.

5 PROJECT DESIGN

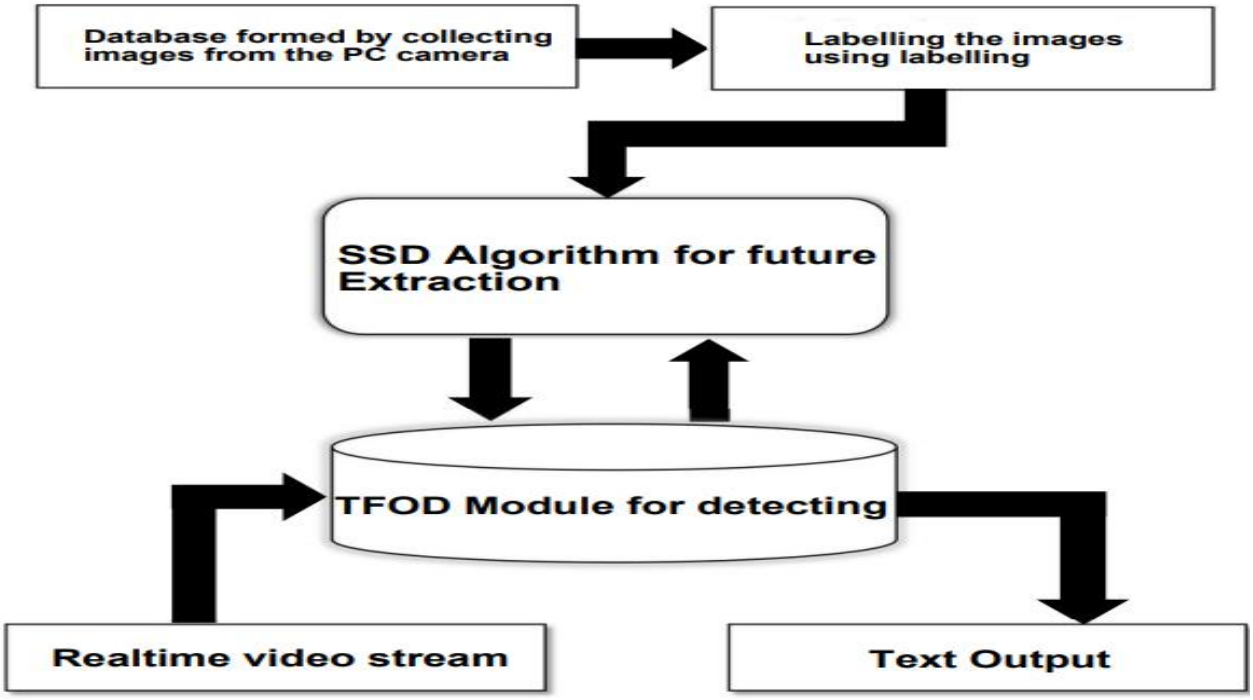
5.1 DATA FLOW DIAGRAM

A data flow diagram is a traditional visual representation of the information flow within a system. It shows how data enters and leaves the system. It uses defined symbols like rectangles, circles and arrows, plus short text labels,to show data inputs, outputs, storage points and the routes between each destination.

Data Flow Diagrams:

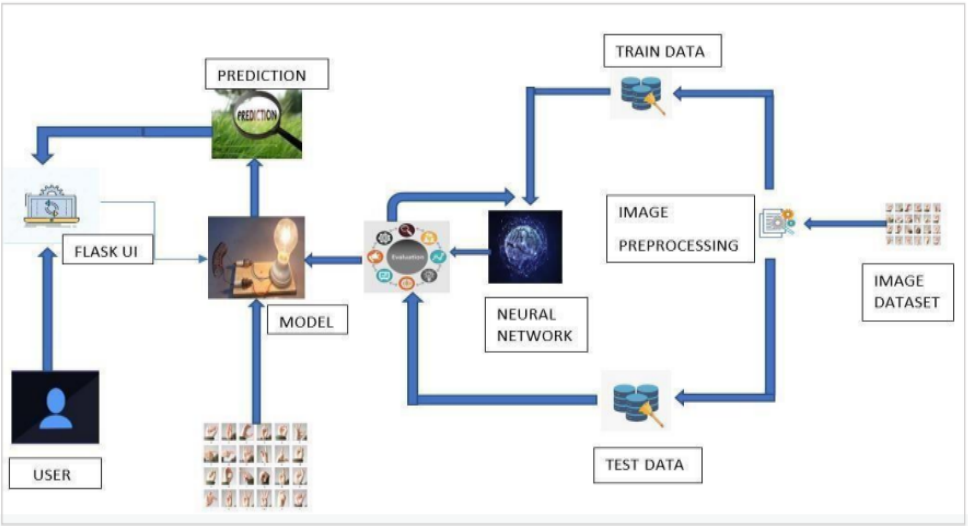


5.2 Solution Architecture



Technical Architecture:

Technical Architecture (TA) is a technical blueprint with regard to the arrangement, interaction, and interdependence of all elements so that system-relevant requirements are met.



Guidelines:

1. Include all the processes (As an application logic / Technology Block)
2. Provide infrastructural demarcation (Local / Cloud)
3. Indicate external interfaces (third party API's etc.)
4. Indicate Data Storage components / services

Table 1:

Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	Chat bot user interface	HTML, CSS, Python.
2.	Application Logic	Logic for a process in the application	Python
3.	Application Logic	Logic for a process in the application	IBM Watson STT service & TTS service
4.	Cloud Database	Database Service on Cloud	IBM Cloudant
5.	File Storage	File storage requirements	Local File system
6.	Machine Learning Model	Neural Networks –CNN model, ANN model	Object Recognition Model –CNN model
7.	Infrastructure (Server / Cloud)	Application Deployment on Local System	Local, Cloud Foundry, Kubernetes.
8.	External Interfaces	Any interface that is transmitting information from the product to a third-party may contain information that is useful for an attack	Operating System - Windows, Mac, Linux; CPU & GPU (for training), WebCam, Scanners, Speakers and PC

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Numpy, Pandas , Keras, Tensorflow, NLTK, Sonnet.	Python framework
2.	Security Implementations	Security access controls ,Use of firewalls	SHA-256
3.	Scalable Architecture	Scalable AI	SEI Digital library
4.	Availability	Use of Cloud, Virtual assistant	IBM Cloud IBM Watson Assistant
5.	Performance	Image pre-processing and CNN	Python

6.PROJECT PLANNING & SCHEDULING

Planning and scheduling are distinct but inseparable aspects of managing the successful project.The process of planning primarily deals with selecting the appropriate policies and procedures in order to achieve the objectives of the project.Scheduling converts the project action plansforscope,time cost and quality into anoperating timetable.

6 SPRINT DELIVERYPLAN

To create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	Ilakkiyapriya, Manimozhi
Sprint-1	Registration	USN-2	As a user, I will receive confirmation emailonce I have registered for the application	1	High	Swetha
Sprint-2	Registration	USN-3	As a user, I can register for the application through phone number	2	Medium	Roobanraj
Sprint-2	User interface	USN-4	Professional responsible for user requirements & needs	2	Medium	Poovarsan
Sprint-3	Login	USN-5	As a user, I can log into the applicationby entering email & password	1	High	Saravanan
Sprint-3	Dashboard	USN-6	As a user, I must receive any updates orpop ups in my dashboard	2	High	Sutharsan,Saravanan
Sprint-4	Details	USN-7	As a user, I should get notification about the progress and any updates via email orsms	1	Medium	Ilakkiyapriya
Sprint-4	Privacy	USN-8	The developed application should be secure forthe users	2	High	Roobanraj,Sutharsan

Sprint planning & Estimation is the process for estimating the effort required to complete a prioritized task in the product backlog. This effort is usually measured withrespect to the time it will take to complete that task, which, in turn, leads to accurate sprint planning.

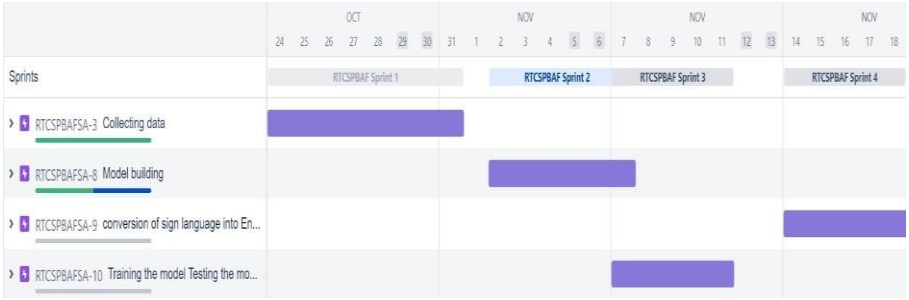
6.2 Sprint Delivery Schedule

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	20	6 Days	24 Oct 2022	29 Oct 2022	20	30 Oct 2022	
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022	
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	13 Nov 2022	
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	29 Nov 2022	

Since sprints take place over a fixed period of time, it's critical to avoid wasting time during planning and development.

6.3 Reports from JIRAROADMAP



Sprint 1

Sprint-2

Sprint-3

Sprint-4

This are the final reports that is been generated from the jira software. Initially with the help of the jira software we have made a plan for the sprint delivery. By using it so we are getting the four phase sprint report with roadmap.

7.CODING & SOLUTIONING

In order to design website that coverts sign language into English alphabets we need to develop the website.For developing the website, primarly we need a platform that is uesful for developing the code.Coding is nothing that which are the applications developed by the developers in a certain computer language.Here we are using Python language for developing the website.

Feature 1

Image Preprocessing

In [1]:
```
from tensorflow.keras.preprocessing.image import ImageDataGenerator
```

In [2]:
```
train_datagen=ImageDataGenerator(rescale=1./255,horizontal_flip=True,vertical_flip=True,zoom_range=0.2)
```

In [3]:
```
test_datagen=ImageDataGenerator(rescale=1./255)
```

In [6]:
```
x_train = train_datagen.flow_from_directory(r"/content/drive/MyDrive/IBM project/training_set",target_size=(64,64),class_mode="categorical",batch_si
```

```
Found 15130 images belonging to 9 classes.
```

In [7]:
```
x_test = test_datagen.flow_from_directory(r"/content/drive/MyDrive/IBM project/test_set",target_size=(64,64),class_mode="categorical",batch_size=30)
```

```
Found 1035 images belonging to 9 classes.
```

Model Building

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 [20]:
```
model.fit(x_train,epochs=10,validation_data=x_test,steps_per_epoch=len(x_train)//10,validation_steps=len(x_test))
```

```
Epoch 1/10
50/50 [==============================] - 407s 8s/step - loss: 0.1036 - accuracy: 0.9707 - val_loss: 0.1421 - val_accuracy: 0.9362
Epoch 2/10
50/50 [==============================] - 75s 1s/step - loss: 0.0937 - accuracy: 0.9767 - val_loss: 0.0786 - val_accuracy: 0.9768
Epoch 3/10
50/50 [==============================] - 74s 1s/step - loss: 0.0833 - accuracy: 0.9740 - val_loss: 0.0380 - val_accuracy: 0.9894
Epoch 4/10
50/50 [==============================] - 65s 1s/step - loss: 0.0493 - accuracy: 0.9853 - val_loss: 0.0354 - val_accuracy: 0.9913
Epoch 5/10
50/50 [==============================] - 56s 1s/step - loss: 0.0514 - accuracy: 0.9851 - val_loss: 0.0484 - val_accuracy: 0.9913
Epoch 6/10
50/50 [==============================] - 58s 1s/step - loss: 0.0661 - accuracy: 0.9813 - val_loss: 0.0597 - val_accuracy: 0.9894
Epoch 7/10
50/50 [==============================] - 50s 1s/step - loss: 0.0488 - accuracy: 0.9872 - val_loss: 0.0888 - val_accuracy: 0.9662
Epoch 8/10
50/50 [==============================] - 48s 958ms/step - loss: 0.0492 - accuracy: 0.9820 - val_loss: 0.0670 - val_accuracy: 0.9874
Epoch 9/10
50/50 [==============================] - 35s 709ms/step - loss: 0.0599 - accuracy: 0.9820 - val_loss: 0.0129 - val_accuracy: 0.9971
Epoch 10/10
50/50 [==============================] - 39s 770ms/step - loss: 0.0582 - accuracy: 0.9770 - val_loss: 0.1378 - val_accuracy: 0.9314
```

Out[20]:

In [21]:
```
model.save("aslpng.h5")
```

Feature 2

Testing the model

In [22]:
```
from keras.models import load_model
import numpy as np
import cv2
```

In [23]:
```
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
import numpy as np
```

In [34]:
```
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
```

Out[34]:

In [35]:
```
x = image.img_to_array(img)
x
```

Out[35]:
```
array([[[0., 0., 0.],
        [0., 0., 0.],
        [0., 0., 0.],
        ...,
        [0., 0., 0.],
        [0., 0., 0.],
        [0., 0., 0.]],

       [[0., 0., 0.],
        [0., 0., 0.],
        [0., 0., 0.],
        ...,
        [0., 0., 0.],
        [0., 0., 0.],
        [0., 0., 0.]],

       [[0., 0., 0.],
        [0., 0., 0.],
        [0., 0., 0.],
        ...,
        [0., 0., 0.],
        [0., 0., 0.],
        [0., 0., 0.]],

       ...,

       [[0., 0., 0.],
        [0., 0., 0.],
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        ...,
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        [0., 0., 0.],
        [0., 0., 0.]],

       [[0., 0., 0.],
        [0., 0., 0.],
        [0., 0., 0.],
        ...,
        [0., 0., 0.],
        [0., 0., 0.],
        [0., 0., 0.]],

       [[0., 0., 0.],
        [0., 0., 0.],
        [0., 0., 0.],
        ...,
        [0., 0., 0.],
        [0., 0., 0.],
        [0., 0., 0.]]], dtype=float32)
```

In [36]:
```
x.shape
```

Out[36]:
```
(64, 64, 3)
```

In [37]:
```
x = np.expand_dims(x,axis=0)
x.shape
```

Out[37]:
```
(1, 64, 64, 3)
```

In [38]:
```
pred = model.predict(x)
```

```
1/1 [==============================] - 0s 63ms/step
```

In [39]:
```
pred
```

Out[39]:
```
array([[0., 0., 0., 1., 0., 0., 0., 0., 0.]], dtype=float32)
```

In [45]:
```
class_name=["A","B","C","D","E","F","G","H","I"]
pred_id = pred.argmax(axis=1)[0]
pred_id
```

Out[45]:
```
3
```

8. TESTING

A Test report is an organized summary of testing objectives, activities, and results. Test Report is a document which contains a summary of all test activities and final test results of a design. Test report is an assessment of how well the Testing is performed. Based on the test report, we understand the designs quality and its performance.

8.1 Test cases

				Date	12-Nov-22							
				Team ID	PNT2022TMID01158							
				Project Name	Project- Real time communication system powered by AI for specially abled							
				Maximum Marks	4 marks							
Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation(Y/N)	BUG ID	Executed By
Login Page_TC_001	Functional	Home Page	Verify user is able to see the homepage	Mozilla Firefox Browser	Enter URL in browser and click go	http://127.0.0.1:5000	Homepage should be displayed	Working as expected	Pass	Steps are clear to follow	NO	NA	SHALINI A ,NAGA NANDHINI R,NIVEDHA M,SNEKA PRABHA S
Login Page_TC_002	UI	Home Page	Verify the UI elements in homepage	Mozilla Firefox Browser	1.Enter URL and click go 2.Verify homepage with given UI elements- Reference,camera access display,introduction to project	http://127.0.0.1:5000	Application should show below UI elements: a.Reference b.camera access display c.Introduction to project	Working as expected	Pass	Steps are clear to follow	NO	NA	SHALINI A ,NAGA NANDHINI R,NIVEDHA M,SNEKA PRABHA S
Login Page_TC_003	UI	Home page	Verify whether reference page is working	Mozilla Firefox Browser	1.Enter URL(http://127.0.0.1:5000) and click go 2.Click on reference button	http://127.0.0.1:5000	User should navigate to reference page where sub_alphabet images is displayed	working as expected	Pass	Steps are clear to follow	Yes	NA	SHALINI A ,NAGA NANDHINI R,NIVEDHA M,SNEKA PRABHA S
Login Page_TC_004	Functional	Home Page	Verify Camera access	Mozilla Firefox Browser,Web-Camera	1.Enter URL(http://127.0.0.1:5000) and click go 2.Click allow camera access	Allow camera access	Camera access is allowed and image is displayed	working as expected	Pass	Steps are clear to follow	Yes	NA	SHALINI A ,NAGA NANDHINI R,NIVEDHA M,SNEKA PRABHA S
Login Page_TC_004	Functional	Home Page	Gesture detection	Mozilla Firefox,CNN	1.Enter URL(http://127.0.0.1:5000) and click go 2.Click camera access 3.Image displayed 4.Detection of gesture occurs	Detection of gestures	Hand gestures needs to be detected and predicted	working as expected	Pass	Steps are clear to follow	Yes	NA	SHALINI A ,NAGA NANDHINI R,NIVEDHA M,SNEKA PRABHA S
Login Page_TC_005	Functional	Home page	Output prediction	CNN trained model	1.Enter URL(http://127.0.0.1:5000) and click go 2.Click camera access 3.Image displayed 4.Detection of gesture occurs 5.Output prediction	Predicted gestures	Hand gestures are detected and predicted ASL_alphabets are displayed	working as expected	Pass	Predicted output is displayed	Yes	NA	SHALINI A ,NAGA NANDHINI R,NIVEDHA M,SNEKA PRABHA S

A test case is nothing but a series of step executed on a design, using a predefined set of input data, expected to produce a pre-defined set of outputs, in a given environment. It describes “how” to implement those test cases.

8.2 User Acceptance Testing

User acceptance testing (UAT), also called application testing or end-user testing, is a phase of software development in which the software is tested in the real world by its intended audience.

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of project-Real Time Communication System Powered By AI For Specially Abled at the time of the release to User Acceptance Testing (UAT).

2. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved.

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	0	0	0	2	2
Duplicate	1	0	0	0	1
External	0	0	1	0	1
Fixed	0	1	1	0	2
Not Reproduced	0	1	0	0	1
Skipped	0	0	0	0	0
Won't Fix	0	1	0	0	1
Totals	1	3	2	2	8

3 Test Case

Analysis This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
View Home Page	7	0	1	6
Click Reference	15	0	3	12
Image displayed	12	0	0	12
Allow camera access	11	0	2	9
PrintEngine	8	0	0	8
ClientApplication	49	0	0	49
Security	4	0	0	4
OutsourceShipping	4	0	0	4
ExceptionReporting	11	0	0	11
FinalReportOutput	2	0	0	2
VersionControl	1	0	0	1

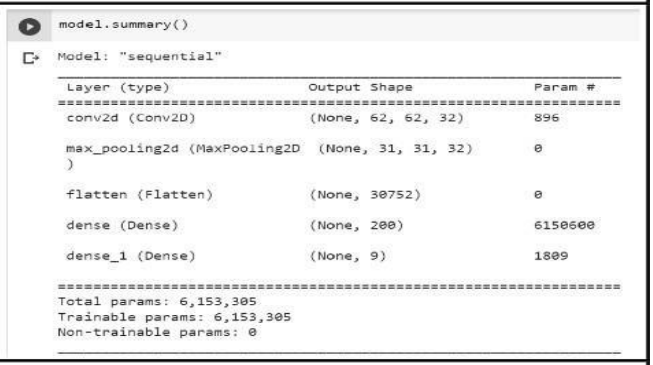
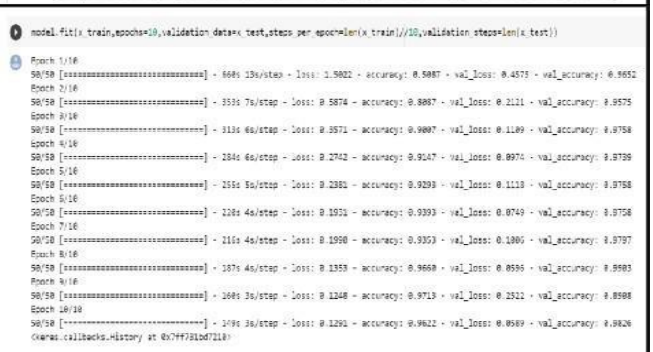
9. RESULT

Finally we got the output for the desired input.our ultimate aim is to covert sign language into English alphanets.We have created the user interface for impleting it so.Thus the website was created successfully.As a result both the deaf and dump alongwith normal people can able to understand the desired language that is required for them.

9.1 Performance metrics

Model Performance Testing:

Project team shall fill the following information in model performance testing template.

S.No.	Parameter	Values	Screenshot
1.	Model Summary	Model - Sequential model Layers: Conv2D-(None,62,62,32) MaxPooling2D-(None,31,31,32) Flatten-(None,30752) Dense-(None,200) Dense_1 -(None,9)	
2.	Accuracy	Training Accuracy - 0.9622 Validation Accuracy -0.9826	
3	Confidence Score	Class Detected – N/A Confidence Score -N/A	N/A

The proposed procedure was implemented and tested with set of images. The set of15750 images of Alphabets from “A” to “I” are used for training database and a set of 2250 images of Alphabets from “A” to “I” are used for testing database. Once the gesture is recognize the equivalent Alphabet is shown on the screen.

10. ADVANTAGES & DISADVANTAGES

Advantages:

Create a mobile application to bridge the communication gap between deaf and dumb persons and the general public.
Sign language standards exist, their dataset can be added, and the usercan choose which sign language to read.

Disadvantages:

1. Model only works from alphabets A to I.
2. Absence of gesture recognition, alphabets from J cannot be identified. 3. As the quantity/quality of images in the dataset is low, the accuracy is not great.

11. CONCLUSION

Sign language is a useful tool for facilitating communication between deaf and hearing people. Because it allows for two-way communication, the system aims to bridge the communication gap between deaf people and the rest of society.The proposed methodology translates language into English alphabets that are understandable to humans. This system sends hand gestures to the model, who recognises them and displays the equivalent Alphabet on the screen. Deaf-mute peoplecan use their hands to perform sign language, which will then be converted into alphabets, thanks to this project.

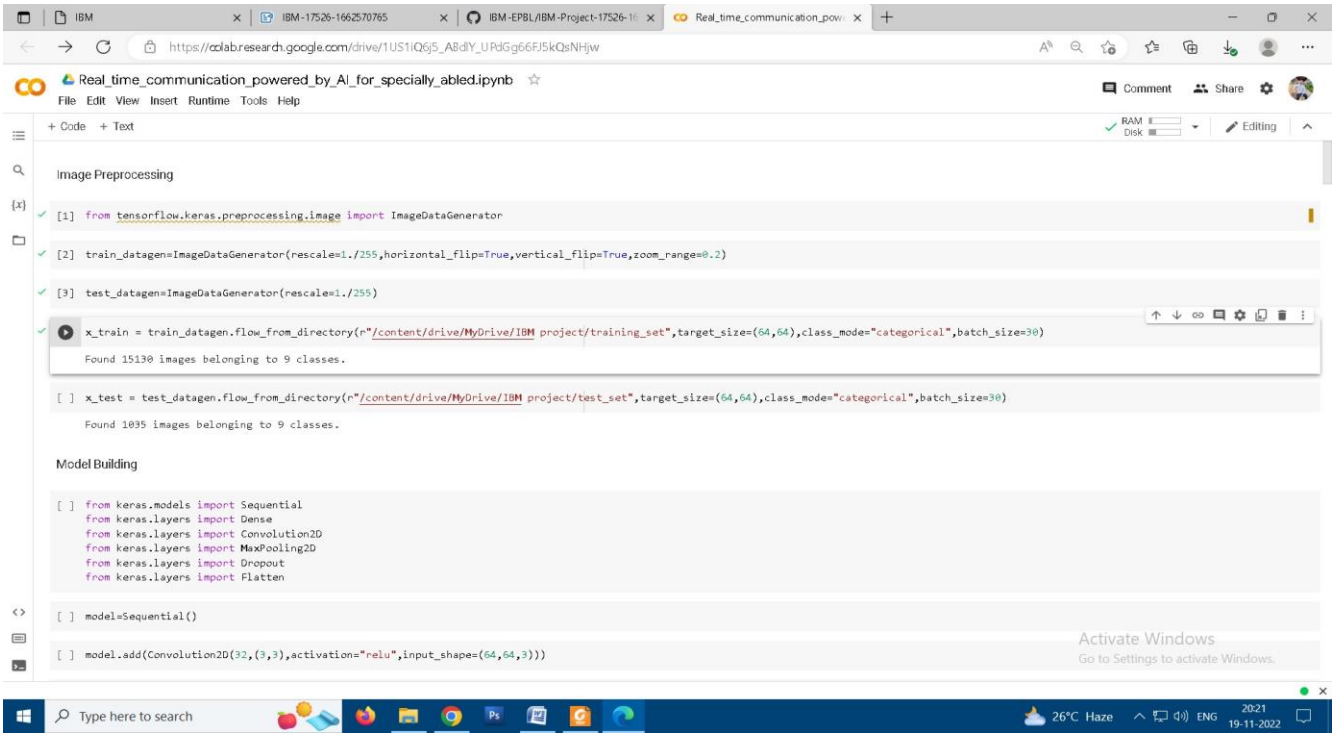
12. FUTURE SCOPE

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 the specially abledpeople such as deaf and dumb. With 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.

We can develop a model for ISL word and sentence level recognition. This will require a system that can detect changes with respect to the temporal space. We can also develop a complete product that will help the speech and hearing-impaired people, andthereby reduce the communication gap.

1 AP

S C f M T a S



Real_time_communication_powered_by_AI_for_specially_abled.ipynb

Image Preprocessing

```
[1] from tensorflow.keras.preprocessing.image import ImageDataGenerator

[2] train_datagen=ImageDataGenerator(rescale=1./255,horizontal_flip=True,vertical_flip=True,zoom_range=0.2)

[3] test_datagen=ImageDataGenerator(rescale=1./255)

x_train = train_datagen.flow_from_directory(r"/content/drive/MyDrive/IBM project/training_set",target_size=(64,64),class_mode="categorical",batch_size=30)
```

```
Found 15130 images belonging to 9 classes.
```

```
[ ] x_test = test_datagen.flow_from_directory(r"/content/drive/MyDrive/IBM project/test_set",target_size=(64,64),class_mode="categorical",batch_size=30)
```

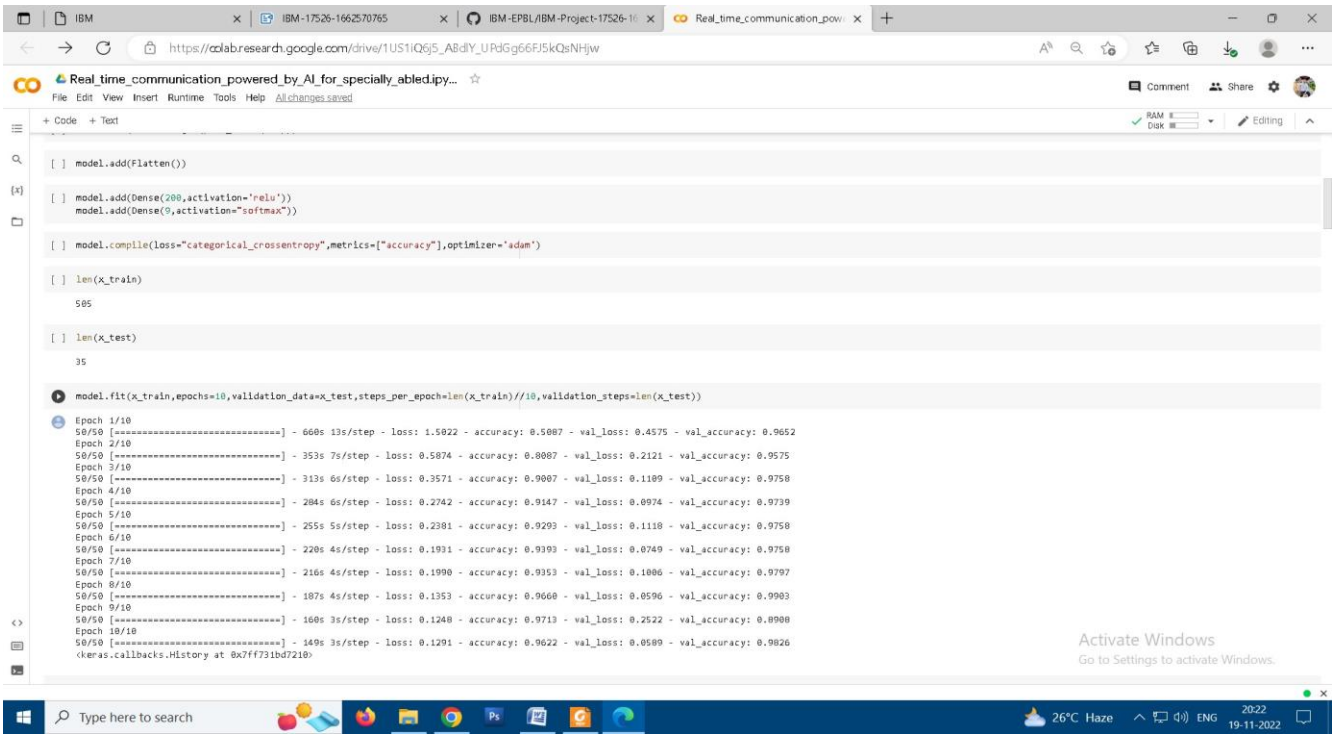
```
Found 1035 images belonging to 9 classes.
```

Model Building

```
[ ] 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

[ ] model=Sequential()

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



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

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

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

[ ] len(x_train)
```

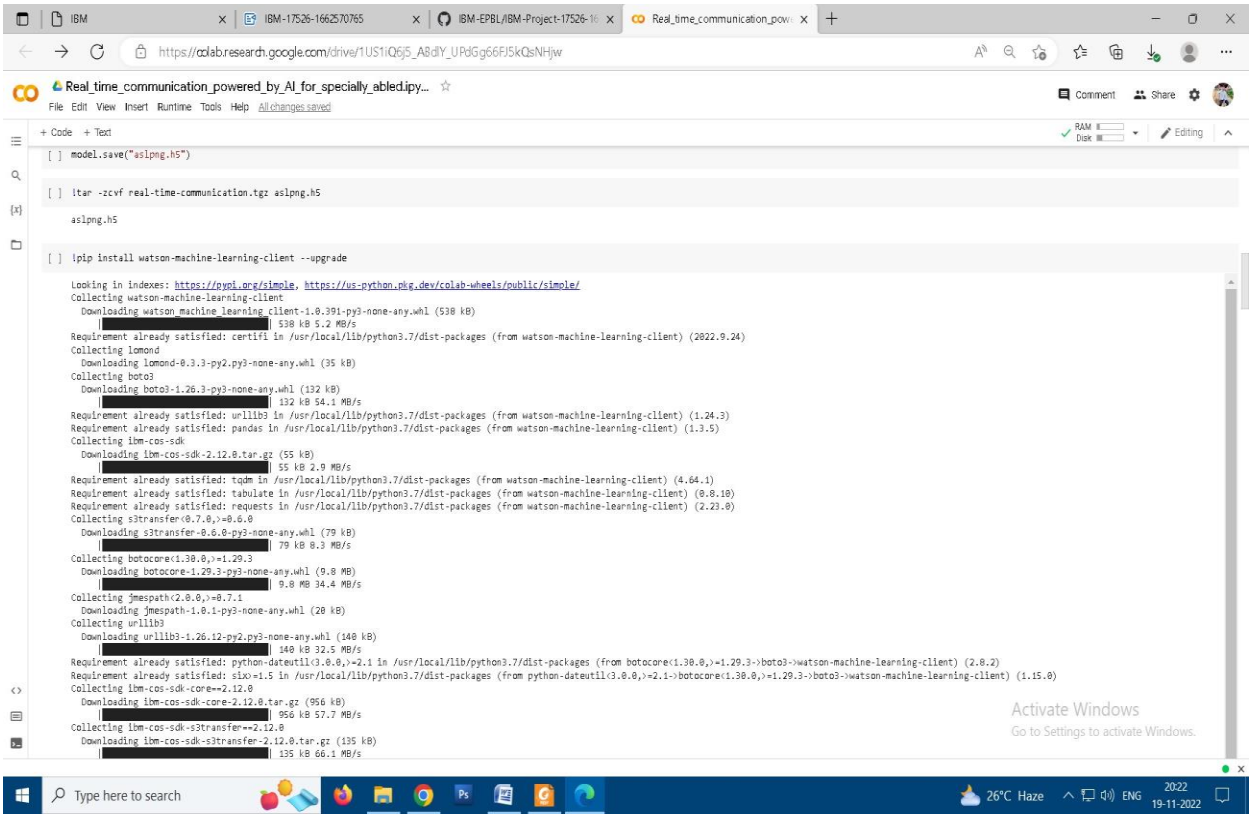
```
505
```

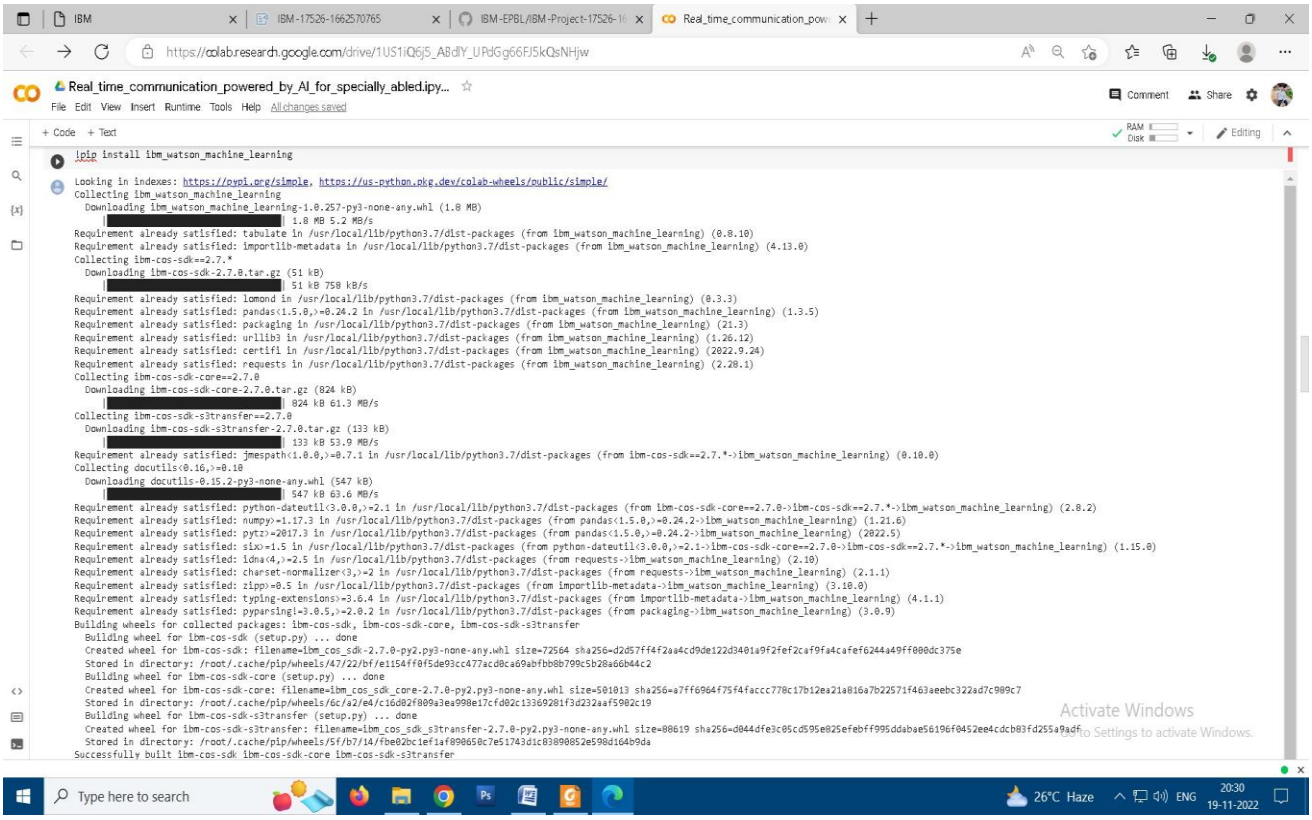
```
[ ] len(x_test)
```

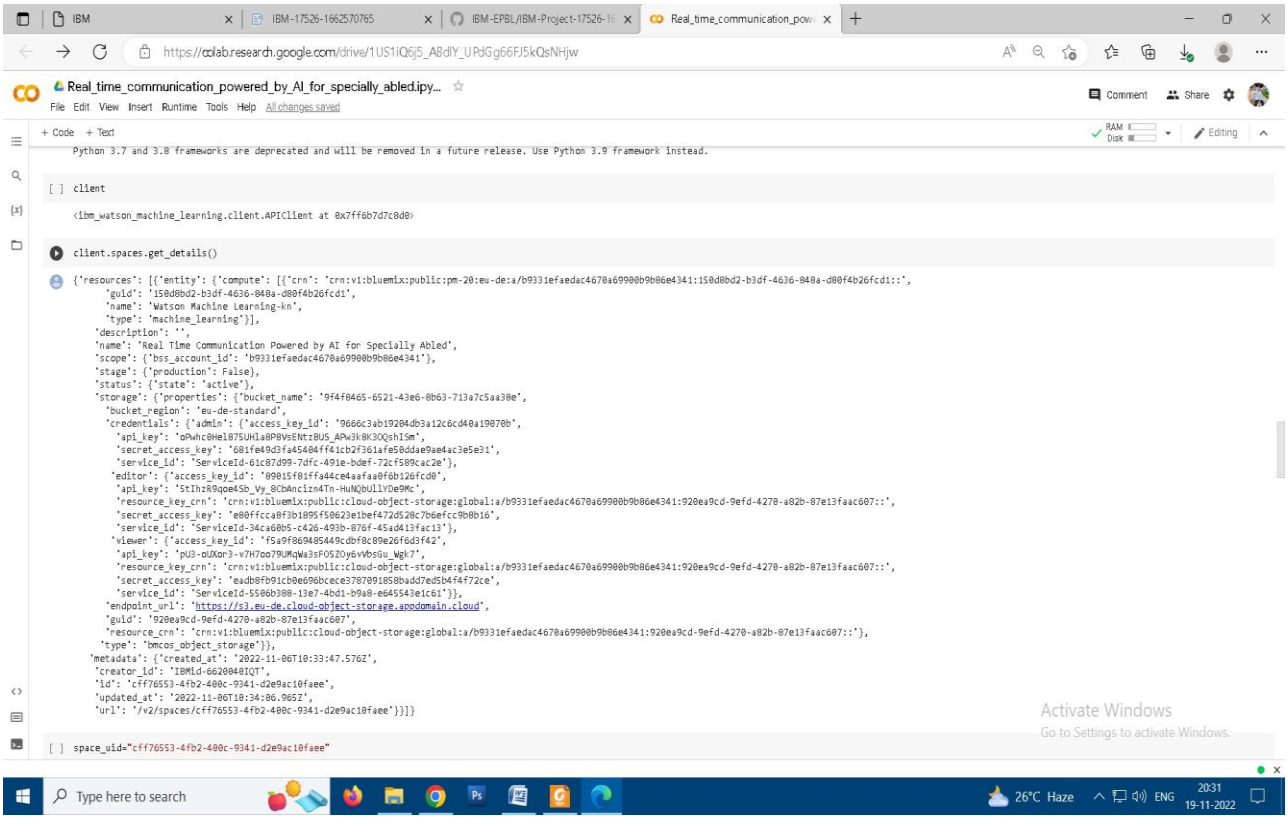
```
35
```

```
model.fit(x_train,epochs=10,validation_data=x_test,steps_per_epoch=len(x_train)//10,validation_steps=len(x_test))
```

```
Epoch 1/10
50/50 [==============================] - 660s 13s/step - loss: 1.5022 - accuracy: 0.5087 - val_loss: 0.4575 - val_accuracy: 0.9652
Epoch 2/10
50/50 [==============================] - 353s 7s/step - loss: 0.5874 - accuracy: 0.8087 - val_loss: 0.2121 - val_accuracy: 0.9575
Epoch 3/10
50/50 [==============================] - 313s 6s/step - loss: 0.3571 - accuracy: 0.9007 - val_loss: 0.1109 - val_accuracy: 0.9758
Epoch 4/10
50/50 [==============================] - 284s 6s/step - loss: 0.2742 - accuracy: 0.9147 - val_loss: 0.0974 - val_accuracy: 0.9739
Epoch 5/10
50/50 [==============================] - 255s 5s/step - loss: 0.2381 - accuracy: 0.9293 - val_loss: 0.1118 - val_accuracy: 0.9758
Epoch 6/10
50/50 [==============================] - 220s 4s/step - loss: 0.1931 - accuracy: 0.9393 - val_loss: 0.0749 - val_accuracy: 0.9758
Epoch 7/10
50/50 [==============================] - 216s 4s/step - loss: 0.1990 - accuracy: 0.9353 - val_loss: 0.1006 - val_accuracy: 0.9797
Epoch 8/10
50/50 [==============================] - 187s 4s/step - loss: 0.1353 - accuracy: 0.9660 - val_loss: 0.0596 - val_accuracy: 0.9903
Epoch 9/10
50/50 [==============================] - 160s 3s/step - loss: 0.1248 - accuracy: 0.9713 - val_loss: 0.2522 - val_accuracy: 0.8908
Epoch 10/10
50/50 [==============================] - 149s 3s/step - loss: 0.1291 - accuracy: 0.9622 - val_loss: 0.0589 - val_accuracy: 0.9826
<keras.callbacks.History at 0x7ff731bd7210>
```


Real_time_communication_powered_by_AI_for_specially_abled.ipy...
File Edit View Insert Runtime Tools Help All changes saved
+ Code + Text
[ ] model.save("aslpng.h5")
[ ] !tar -zcvf real-time-communication.tgz aslpng.h5
aslpng.h5
[ ] !pip install watson-machine-learning-client --upgrade
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Collecting watson-machine-learning-client
Downloading watson_machine_learning_client-1.0.391-py3-none-any.whl (538 kB)
538 kB 5.2 MB/s
Requirement already satisfied: certifi in /usr/local/lib/python3.7/dist-packages (from watson-machine-learning-client) (2022.9.24)
Collecting lomond
Downloading lomond-0.3.3-py2.py3-none-any.whl (35 kB)
Collecting boto3
Downloading boto3-1.26.3-py3-none-any.whl (132 kB)
132 kB 54.1 MB/s
Requirement already satisfied: urllib3 in /usr/local/lib/python3.7/dist-packages (from watson-machine-learning-client) (1.24.3)
Requirement already satisfied: pandas in /usr/local/lib/python3.7/dist-packages (from watson-machine-learning-client) (1.3.5)
Collecting ibm-cos-sdk
Downloading ibm-cos-sdk-2.12.0.tar.gz (55 kB)
55 kB 2.9 MB/s
Requirement already satisfied: tqdm in /usr/local/lib/python3.7/dist-packages (from watson-machine-learning-client) (4.64.1)
Requirement already satisfied: tabulate in /usr/local/lib/python3.7/dist-packages (from watson-machine-learning-client) (0.8.10)
Requirement already satisfied: requests in /usr/local/lib/python3.7/dist-packages (from watson-machine-learning-client) (2.23.0)
Collecting s3transfer<0.7.0,>=0.6.0
Downloading s3transfer-0.6.0-py3-none-any.whl (79 kB)
79 kB 8.3 MB/s
Collecting botocore<1.30.0,>=1.29.3
Downloading botocore-1.29.3-py3-none-any.whl (9.8 MB)
9.8 MB 34.4 MB/s
Collecting jmespath<2.0.0,>=0.7.1
Downloading jmespath-1.0.1-py3-none-any.whl (20 kB)
Collecting urllib3
Downloading urllib3-1.26.12-py2.py3-none-any.whl (140 kB)
140 kB 32.5 MB/s
Requirement already satisfied: python-dateutil<3.0.0,>=2.1 in /usr/local/lib/python3.7/dist-packages (from botocore<1.30.0,>=1.29.3->boto3->watson-machine-learning-client) (2.8.2)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/dist-packages (from python-dateutil<3.0.0,>=2.1->botocore<1.30.0,>=1.29.3->boto3->watson-machine-learning-client) (1.15.0)
Collecting ibm-cos-sdk-core==2.12.0
Downloading ibm-cos-sdk-core-2.12.0.tar.gz (956 kB)
956 kB 57.7 MB/s
Collecting ibm-cos-sdk-s3transfer==2.12.0
Downloading ibm-cos-sdk-s3transfer-2.12.0.tar.gz (135 kB)
135 kB 66.1 MB/s
Activate Windows
Go to Settings to activate Windows.
Type here to search
26°C Haze
ENG
20:22
19-11-2022


Real_time_communication_powered_by_AI_for_specially_abled.ipy...
File Edit View Insert Runtime Tools Help All changes saved
+ Code + Text
!pip install ibm_watson_machine_learning
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Collecting ibm_watson_machine_learning
Downloading ibm_watson_machine_learning-1.0.257-py3-none-any.whl (1.8 MB)
1.8 MB 5.2 MB/s
Requirement already satisfied: tabulate in /usr/local/lib/python3.7/dist-packages (from ibm_watson_machine_learning) (0.8.10)
Requirement already satisfied: importlib-metadata in /usr/local/lib/python3.7/dist-packages (from ibm_watson_machine_learning) (4.13.0)
Collecting ibm-cos-sdk==2.7.*
Downloading ibm-cos-sdk-2.7.0.tar.gz (51 kB)
51 kB 758 kB/s
Requirement already satisfied: lomond in /usr/local/lib/python3.7/dist-packages (from ibm_watson_machine_learning) (0.3.3)
Requirement already satisfied: pandas<1.5.0,>=0.24.2 in /usr/local/lib/python3.7/dist-packages (from ibm_watson_machine_learning) (1.3.5)
Requirement already satisfied: packaging in /usr/local/lib/python3.7/dist-packages (from ibm_watson_machine_learning) (21.3)
Requirement already satisfied: urllib3 in /usr/local/lib/python3.7/dist-packages (from ibm_watson_machine_learning) (1.26.12)
Requirement already satisfied: certifi in /usr/local/lib/python3.7/dist-packages (from ibm_watson_machine_learning) (2022.9.24)
Requirement already satisfied: requests in /usr/local/lib/python3.7/dist-packages (from ibm_watson_machine_learning) (2.28.1)
Collecting ibm-cos-sdk-core==2.7.0
Downloading ibm-cos-sdk-core-2.7.0.tar.gz (824 kB)
824 kB 61.3 MB/s
Collecting ibm-cos-sdk-s3transfer==2.7.0
Downloading ibm-cos-sdk-s3transfer-2.7.0.tar.gz (133 kB)
133 kB 53.9 MB/s
Requirement already satisfied: jmespath<1.0.0,>=0.7.1 in /usr/local/lib/python3.7/dist-packages (from ibm-cos-sdk==2.7.*->ibm_watson_machine_learning) (0.10.0)
Collecting docutils<0.16,>=0.10
Downloading docutils-0.15.2-py3-none-any.whl (547 kB)
547 kB 63.6 MB/s
Requirement already satisfied: python-dateutil<3.0.0,>=2.1 in /usr/local/lib/python3.7/dist-packages (from ibm-cos-sdk-core==2.7.0->ibm-cos-sdk==2.7.*->ibm_watson_machine_learning) (2.8.2)
Requirement already satisfied: numpy>=1.17.3 in /usr/local/lib/python3.7/dist-packages (from pandas<1.5.0,>=0.24.2->ibm_watson_machine_learning) (1.21.6)
Requirement already satisfied: pytz>=2017.3 in /usr/local/lib/python3.7/dist-packages (from pandas<1.5.0,>=0.24.2->ibm_watson_machine_learning) (2022.5)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/dist-packages (from python-dateutil<3.0.0,>=2.1->ibm-cos-sdk-core==2.7.0->ibm-cos-sdk==2.7.*->ibm_watson_machine_learning) (1.15.0)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.7/dist-packages (from requests->ibm_watson_machine_learning) (2.10)
Requirement already satisfied: charset-normalizer<3,>=2 in /usr/local/lib/python3.7/dist-packages (from requests->ibm_watson_machine_learning) (2.1.1)
Requirement already satisfied: zipp>=0.5 in /usr/local/lib/python3.7/dist-packages (from importlib-metadata->ibm_watson_machine_learning) (3.10.0)
Requirement already satisfied: typing-extensions>=3.6.4 in /usr/local/lib/python3.7/dist-packages (from importlib-metadata->ibm_watson_machine_learning) (4.1.1)
Requirement already satisfied: pyparsing!=3.0.5,>=2.0.2 in /usr/local/lib/python3.7/dist-packages (from packaging->ibm_watson_machine_learning) (3.0.9)
Building wheels for collected packages: ibm-cos-sdk, ibm-cos-sdk-core, ibm-cos-sdk-s3transfer
Building wheel for ibm-cos-sdk (setup.py) ... done
Created wheel for ibm-cos-sdk: filename=ibm_cos_sdk-2.7.0-py2.py3-none-any.whl size=72564 sha256=d2d57ff4f2aa4cd9de122d3401a9f2fef2caf9fa4cafef6244a49ff000dc375e
Stored in directory: /root/.cache/pip/wheels/47/22/bf/e1154ff0f5de93cc477acd0ca69abfbb8b799c5b28a66b44c2
Building wheel for ibm-cos-sdk-core (setup.py) ... done
Created wheel for ibm-cos-sdk-core: filename=ibm_cos_sdk_core-2.7.0-py2.py3-none-any.whl size=501013 sha256=a7ff6964f75f4faccc778c17b12ea21a816a7b22571f463aeebc322ad7c989c7
Stored in directory: /root/.cache/pip/wheels/6c/a2/e4/c16d02f009a3ea998e17cfd82c13369281f3d232aaf5902c19
Building wheel for ibm-cos-sdk-s3transfer (setup.py) ... done
Created wheel for ibm-cos-sdk-s3transfer: filename=ibm_cos_sdk_s3transfer-2.7.0-py2.py3-none-any.whl size=80619 sha256=d044dfe3c05cd595e825efebff995ddabae56196f0452ee4cdcb03fd255a9adf
Stored in directory: /root/.cache/pip/wheels/5f/b7/14/fbe02bc1ef1af890650c7e51743d1c83890852e590d164b9da
Successfully built ibm-cos-sdk ibm-cos-sdk-core ibm-cos-sdk-s3transfer
Activate Windows
Go to Settings to activate Windows.
Type here to search
26°C Haze
ENG
20:30
19-11-2022


IBM
IBM-17526-1662570765
IBM-EPBL/IBM-Project-17526-1
Real_time_communication_pow
https://colab.research.google.com/drive/1US1iQ6j5_A8dlY_UPdGg66FJ5kQsNHjw
Real_time_communication_powered_by_AI_for_specially_abled.ipy...
File Edit View Insert Runtime Tools Help All changes saved
Comment
Share
+ Code + Text
RAM
Disk
Editing
Python 3.7 and 3.8 frameworks are deprecated and will be removed in a future release. Use Python 3.9 framework instead.
[ ] client
<ibm_watson_machine_learning.client.APIClient at 0x7ff6b7d7c8d0>
client.spaces.get_details()
{'resources': [{'entity': {'compute': [{'crn': 'crn:v1:bluemix:public:pm-20:eu-de:a/b9331efaedac4670a69900b9b86e4341:150d8bd2-b3df-4636-848a-d80f4b26fcd1::',
'guid': '150d8bd2-b3df-4636-848a-d80f4b26fcd1',
'name': 'Watson Machine Learning-kn',
'type': 'machine_learning'}],
'description': '',
'name': 'Real Time Communication Powered by AI for Specially Abled',
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'storage': {'properties': {'bucket_name': '9f4f0465-6521-43e6-8b63-713a7c5aa30e',
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'service_id': 'ServiceId-61c87d99-7dfc-491e-bdef-72cf589cac2e'},
'editor': {'access_key_id': '89015f81ffa44ce4aafaa0f6b126fcd0',
'api_key': '5tIhzR9qoe45b_Vy_8CbAnciznATn-HuNQbUllYDe9Mc',
'resource_key_crn': 'crn:v1:bluemix:public:cloud-object-storage:global:a/b9331efaedac4670a69900b9b86e4341:920ea9cd-9efd-4270-a82b-87e13faac607::',
'secret_access_key': 'e80ffcca8f3b1095f50623e1bef472d528c7b6efcc9b8b16',
'service_id': 'ServiceId-34ca60b5-c426-493b-876f-45ad413fac13'},
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'resource_key_crn': 'crn:v1:bluemix:public:cloud-object-storage:global:a/b9331efaedac4670a69900b9b86e4341:920ea9cd-9efd-4270-a82b-87e13faac607::',
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'updated_at': '2022-11-06T10:34:06.965Z',
'url': '/v2/spaces/cff76553-4fb2-400c-9341-d2e9ac10faee'}}]}
[ ] space_uid="cff76553-4fb2-400c-9341-d2e9ac10faee"
Activate Windows
Go to Settings to activate Windows.
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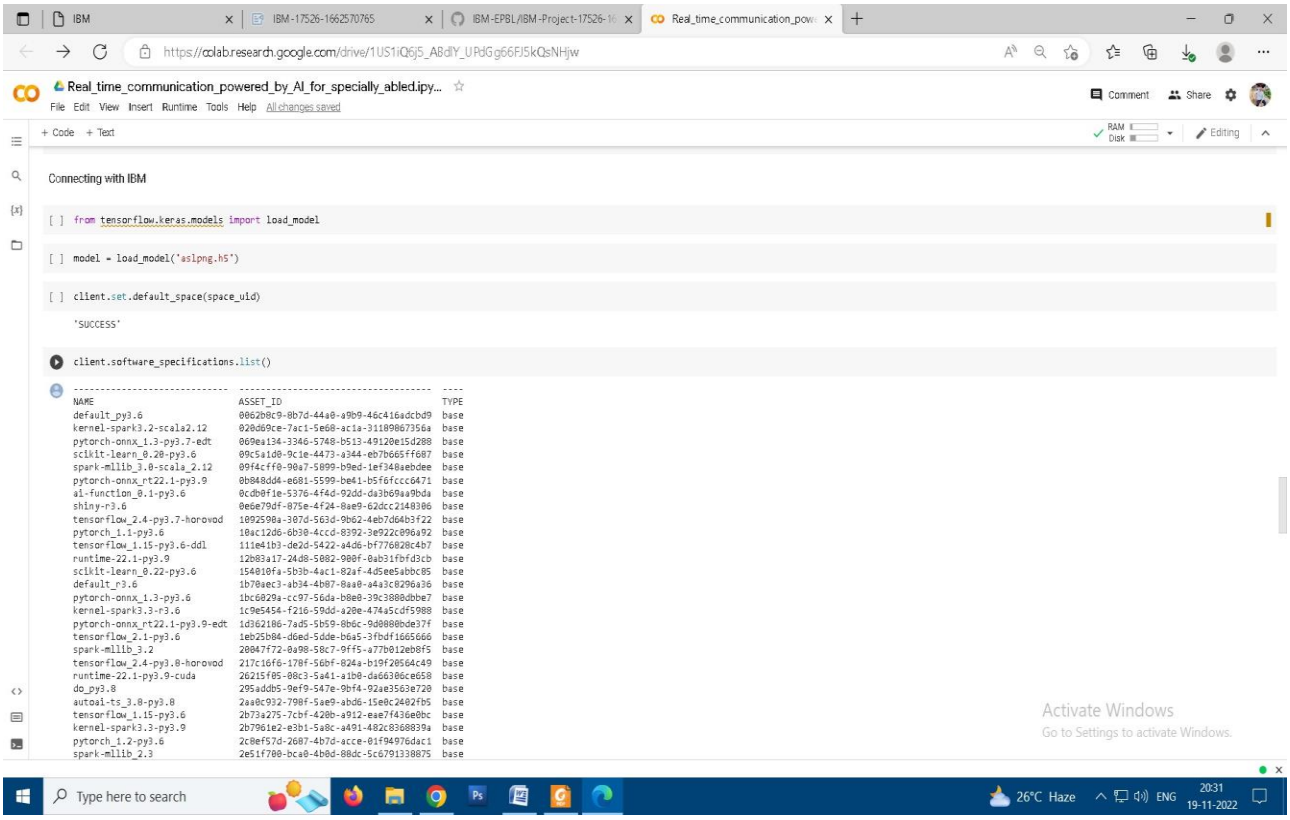
IBM
IBM-17526-1662570765
IBM-EPBL/IBM-Project-17526-1
Real_time_communication_pow
https://colab.research.google.com/drive/1US1iQ6j5_A8dlY_UPdGg66FJ5kQsNHjw
Real_time_communication_powered_by_AI_for_specially_abled.ipy...
File Edit View Insert Runtime Tools Help All changes saved
Comment
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RAM
Disk
Editing
Connecting with IBM
[ ] from tensorflow.keras.models import load_model
[ ] model = load_model('aslpng.h5')
[ ] client.set.default_space(space_uid)
'SUCCESS'
client.software_specifications.list()
NAME ASSET_ID TYPE
default_py3.6 0062b8c9-8b7d-44a0-a9b9-46c416adcbd9 base
kernel-spark3.2-scala2.12 020d69ce-7ac1-5e68-ac1a-31189867356a base
pytorch-onnx_1.3-py3.7-edt 069ea134-3346-5748-b513-49120e15d288 base
scikit-learn_0.20-py3.6 09c5a1d0-9c1e-4473-a344-eb7b665ff687 base
spark-mllib_3.0-scala_2.12 09f4cff0-90a7-5899-b9ed-1ef348aebdee base
pytorch-onnx_rt22.1-py3.9 0b848dd4-e681-5599-be41-b5f6fccc6471 base
ai-function_0.1-py3.6 0cdb0f1e-5376-4f4d-92dd-da3b69aa9bda base
shiny-r3.6 0e6e79df-875e-4f24-8ae9-62dcc2148306 base
tensorflow_2.4-py3.7-horovod 1092590a-307d-563d-9b62-4eb7d64b3f22 base
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tensorflow_1.15-py3.6-ddl 111e41b3-de2d-5422-a4d6-bf776828c4b7 base
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spark-mllib_3.2 20047f72-0a98-58c7-9ff5-a77b012eb8f5 base
tensorflow_2.4-py3.8-horovod 217c16f6-178f-56bf-824a-b19f20564c49 base
runtime-22.1-py3.9-cuda 26215f05-08c3-5a41-a1b0-da66306ce658 base
do_py3.8 295addb5-9ef9-547e-9bf4-92ae3563e720 base
autoai-ts_3.8-py3.8 2aa0c932-798f-5ae9-abd6-15e0c2402fb5 base
tensorflow_1.15-py3.6 2b73a275-7cbf-420b-a912-eae7f436e0bc base
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spark-mllib_2.3 2e51f700-bca0-4b0d-88dc-5c6791338875 base
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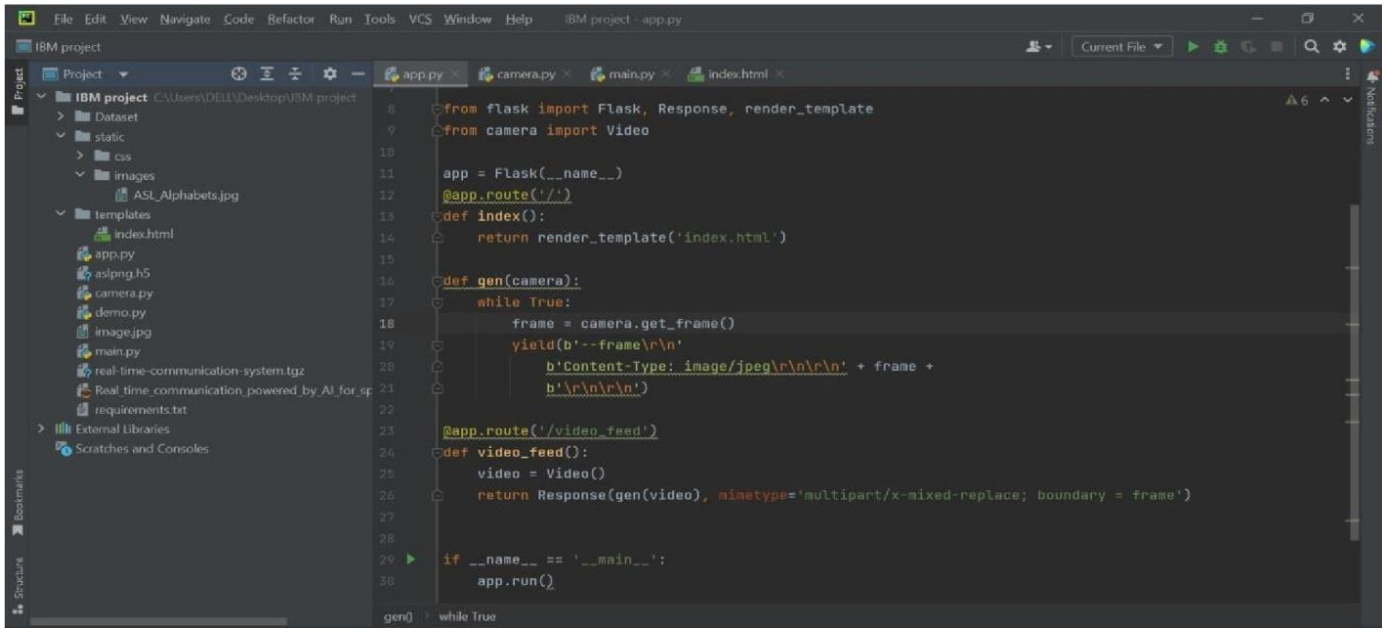
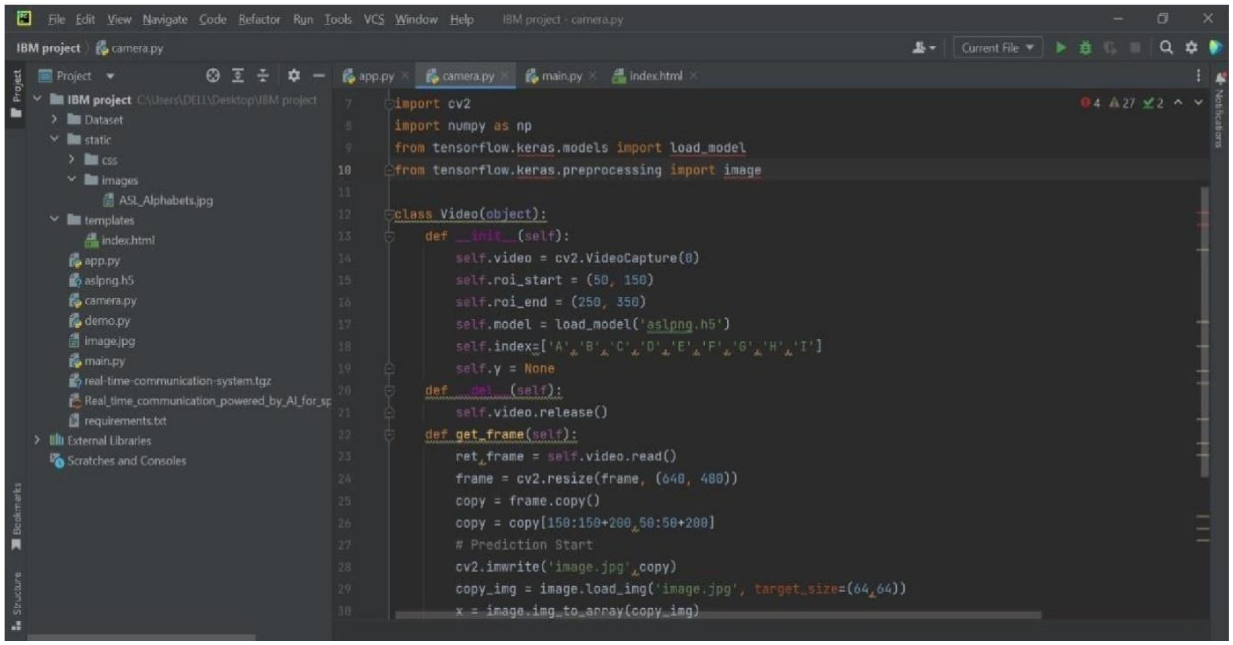

File Edit View Navigate Code Refactor Run Tools VCS Window Help
IBM project - app.py
IBM project
Current File
Project
app.py
camera.py
main.py
index.html
IBM project C:\Users\DELL\Desktop\IBM project
Dataset
static
css
images
ASL_Alphabets.jpg
templates
index.html
app.py
aslpng.h5
camera.py
demo.py
image.jpg
main.py
real-time-communication-system.tgz
Real_time_communication_powered_by_AI_for_sp
requirements.txt
External Libraries
Scratches and Consoles
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()
gen() while True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IBM project - camera.py
IBM project
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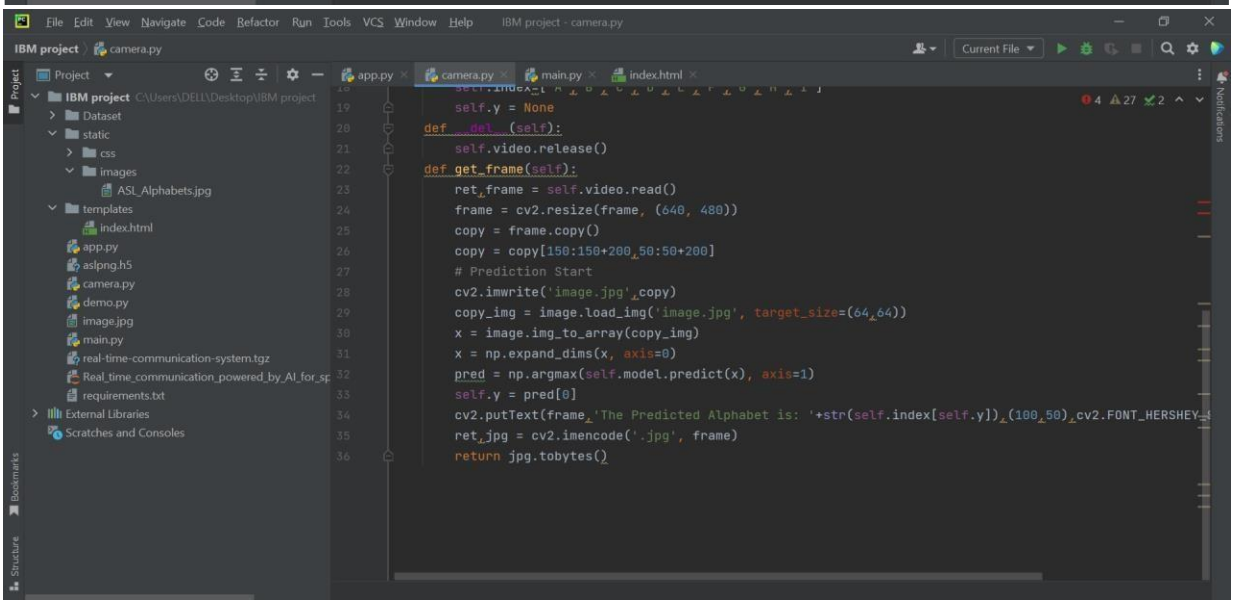
image.jpg
main.py
real-time-communication-system.tgz
Real_time_communication_powered_by_AI_for_sp
requirements.txt
External Libraries
Scratches and Consoles
import cv2
import numpy as np
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
class Video(object):
def __init__(self):
self.video = cv2.VideoCapture(0)
self.roi_start = (50, 150)
self.roi_end = (250, 350)
self.model = load_model('aslpng.h5')
self.index=['A','B','C','D','E','F','G','H','I']
self.y = None
def __del__(self):
self.video.release()
def get_frame(self):
ret,frame = self.video.read()
frame = cv2.resize(frame, (640, 480))
copy = frame.copy()
copy = copy[150:150+200,50:50+200]
# Prediction Start
cv2.imwrite('image.jpg',copy)
copy_img = image.load_img('image.jpg', target_size=(64,64))
x = image.img_to_array(copy_img)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External Libraries
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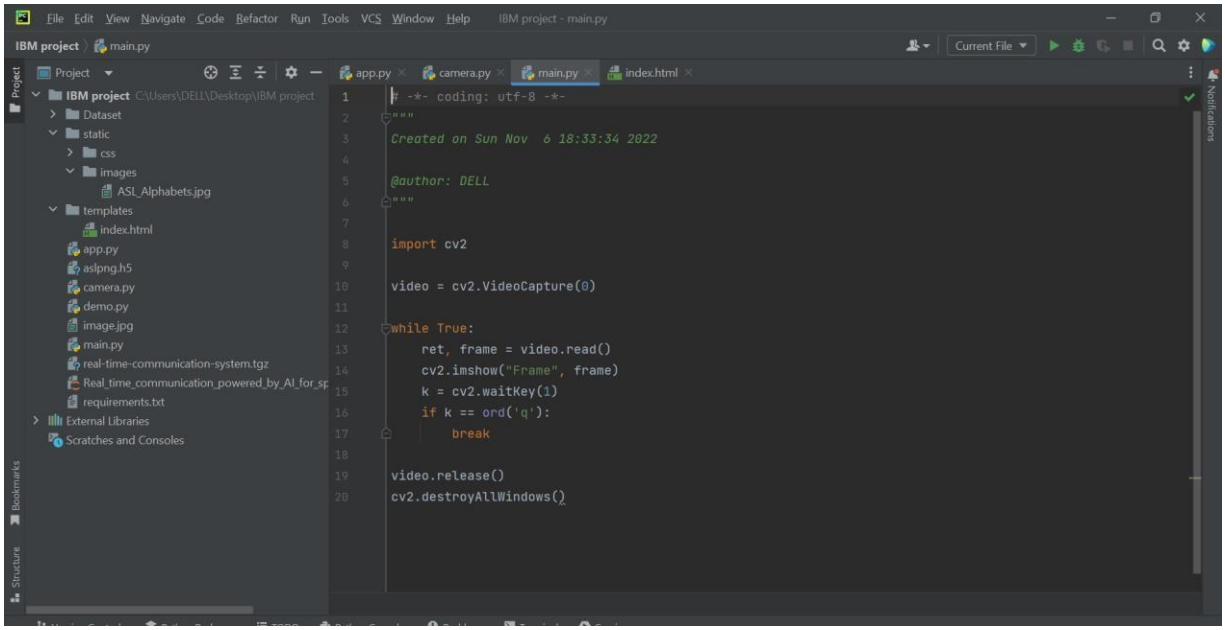
self.y = None
def __del__(self):
self.video.release()
def get_frame(self):
ret,frame = self.video.read()
frame = cv2.resize(frame, (640, 480))
copy = frame.copy()
copy = copy[150:150+200,50:50+200]
# Prediction Start
cv2.imwrite('image.jpg',copy)
copy_img = image.load_img('image.jpg', target_size=(64,64))
x = image.img_to_array(copy_img)
x = np.expand_dims(x, axis=0)
pred = np.argmax(self.model.predict(x), axis=1)
self.y = pred[0]
cv2.putText(frame,'The Predicted Alphabet is: '+str(self.index[self.y]),(100,50),cv2.FONT_HERSHEY_
ret,jpg = cv2.imencode('.jpg', frame)
return jpg.tobytes()



GITHUB LINK:

https://github.com/IBM-EPBL/IBM-Project-14863-1659591189