Real-Time Communication System Powered by AI for Specially Abled

Submitted By

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Project Report Format

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1. INTRODUCTION

1.1 Project Overview

Real-time communications (RTC) are any mode of telecommunications in which all users can exchange information instantly. Communication plays a significant role in making the world better place. It creates a bonding and relations among the people. People get to know one another by sharing their ideas, thoughts, and experiences with those around them. There are numerous ways to accomplish this, the best of which is the gift of "Speech." Everyone can very convincingly transfer their thoughts and understand each other through speech. It will be unjust if we overlook those who are denied this priceless gift: the deaf and dumb. In such cases, the human hand has remained the preferred method of communication.

1.2 Purpose

The Project's purpose is to create a system that translates sign language into a human understandable language so that ordinary people may understand it. 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.

2. **LITERATURE SURVEY**

A literature review is **a comprehensive summary of previous research on a topic**. The literature review surveys scholarly articles, books, and other sources relevant to a area of research. The review should enumerate, describe, summarize,objectively evaluate and clarify this previous research.

In our project, We have taken the literature survey on IEEE papers. An intelligent communication device is developed to assist nonverbal, motor-disabled persons in the generation of written and spoken messages. The device is centered on knowledge base of the grammatical rules and message elements. A belief reasoning scheme based on both the information from external sources and the embedded knowledge issued to optimize the process of message search

2.1 Existing problem

Some of the existing solutions for solving this problem are:

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.

Technology
One of the easiest ways to communicate is through technology such as a phone or laptop. A deaf person can type out what they want to say and a person who is blind orhas low vision can use a screen reader to read the text out loud.

A blind person can alsouse voice recognition software to convert what they are saying in to text so that a person who is Deaf can then read it.

Interpreter
If a sign language interpreter is available, this facilitates easy communication if the person who is deaf is fluent in sign language. The deaf person and person who is blindcan communicate with each other via the interpreter. The deaf person can use sign language and the interpreter can speak what has been said to the person who is blind and then translate anything spoken by the blind person into sign language for the deaf person.

However, this is often not the most effective form of communication, as it is very dependent on the individual circumstances of both people and their environment (for
example, some places may have too much background noise).

2.2 References

1.   "American Sign Language interpreter system for deaf and dumb individuals", In the Proceedings of the International Conference on Control, Instrumentation, Communication and Computational Technologies (ICCICCT), pp. 1477- 1481, 2014

2.   "UBH 3: an anthropomorphic hand with simplified endo-skeletal structure and soft continuous fingerpads", In Proceedings IEEE International Conference on Robotics and Automation, 2004 (ICRA'04), Vol.5, pp. 4736-474, IEEE, 2004.

3.   "Deaf-Mute Communication
Interpreter", International Journal of Scientific Engineering and Technology, Vol.2, No.5, pp.336-341, 2013.
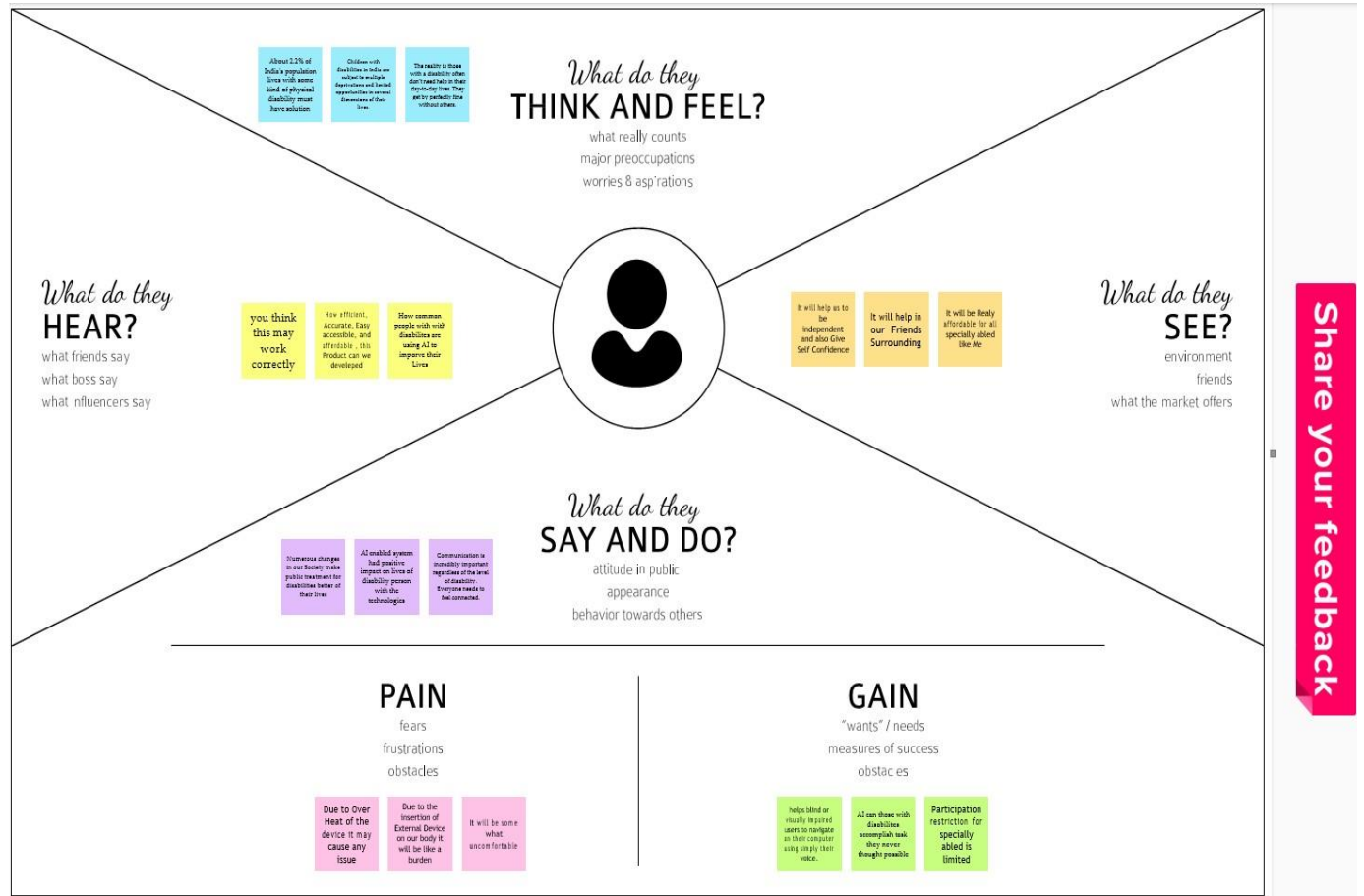
https://ieeexplore.ieee.org/document/8493808
https://ieeexplore.ieee.org/abstract/document/9396030
https://ieeexplore.ieee.org/document/8725244

2.3 Problem statement definition

Only specially abled people are taught sign language and the common person is unaware its working causing a communication gap. Under emergency situations, it is even more difficult for specially abled people to get help. Non-Emergency normal environments can also be hard for them to navigate needing special assistance. In this project we have designed and developed a system which lowers the communication gap betweenspeech hearing impaired people and normal people that is we have built a system that enables communications between deaf-dumb person and a normal person. A convolution neural network is being used to develop a model that is trained on varioushand movements. This model is used to create an app. This program allows deaf and hard of hearing persons to communicate using signs that are then translated into human readable text.
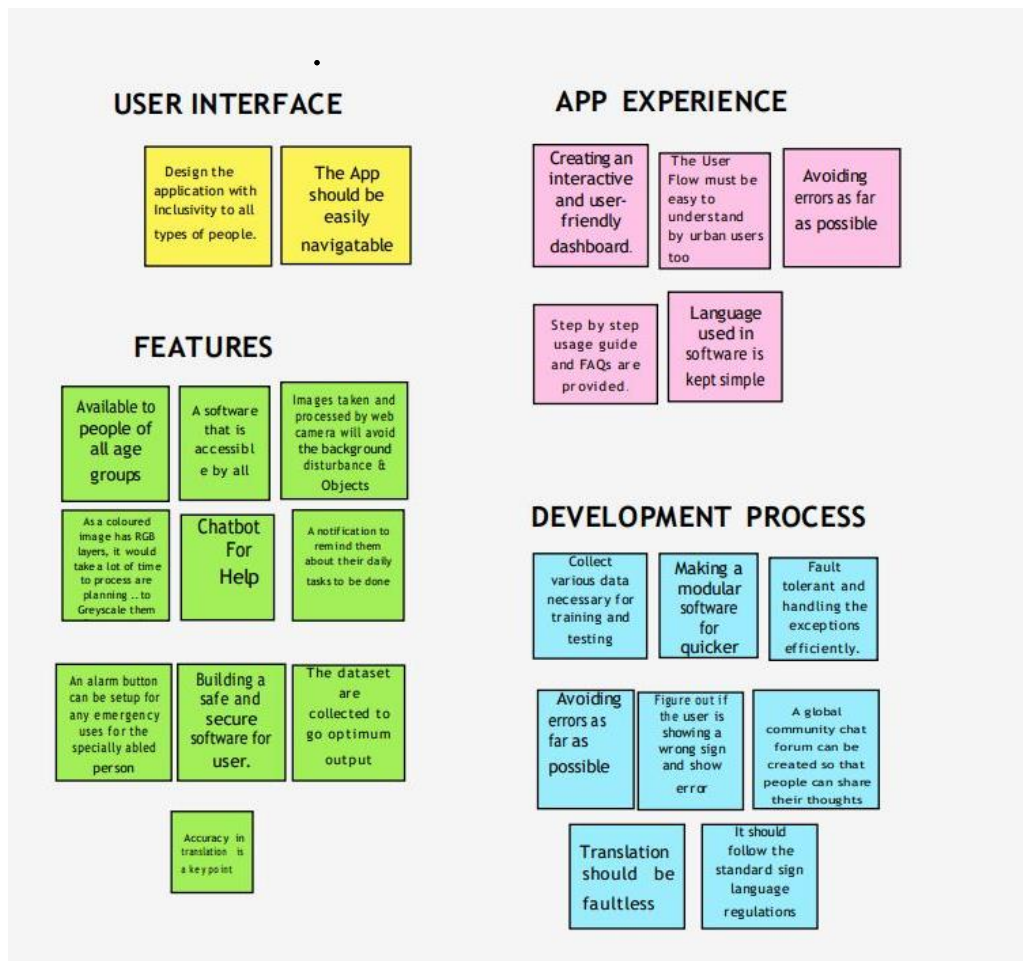
3. **IDEATION AND PROPOSED SOLUTION**

Ideation is the process where you generate ideas and solutions through techniques such as Empathy Map Canvas, Brainstorming. Ideation is also the third stage in the Design Thinking Process.

3.1 Empathy map canvas

3.2 Ideation & Brainstorming

USER INTERFACE

- Design the application with Inclusivity to all types of people.
- The App should be easily navigatable

FEATURES

- Available to people of all age groups
- A software that is accessible by all
- Images taken and processed by web camera will avoid the background disturbance & Objects
- As a coloured image has RGB layers, it would take a lot of time to process are planning ..to Greyscale them
- Chatbot For Help
- A notification to remind them about their daily tasks to be done
- An alarm button can be setup for any emergency uses for the specially abled person
- Building a safe and secure software for user.
- The dataset are collected to go optimum output
- Accuracy in translation is a key point

APP EXPERIENCE

- Creating an interactive and user-friendly dashboard.
- The User Flow must be easy to understand by urban users too
- Avoiding errors as far as possible
- Step by step usage guide and FAQs are provided.
- Language used in software is kept simple

DEVELOPMENT PROCESS

- Collect various data necessary for training and testing
- Making a modular software for quicker
- Fault tolerant and handling the exceptions efficiently.
- Avoiding errors as far as possible
- Figure out if the user is showing a wrong sign and show error
- A global community chat forum can be created so that people can share their thoughts
- Translation should be faultless
- It should follow the standard sign language regulations

♡

Importance

If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?

The App should be easily navigatable

Creating an interactive and user-friendly dashboard

A software that is accessible by all

Accuracy in translation is a key point.

Available to people of all age groups

Avoiding errors as far as possible

Making a medical software to quicker response

Translation should be faultless

Chatbot for Help

Step by step usage guide and FAQs are provided.

Avoiding errors as far as possible

Language used in software is kept simple.

TIP

Participants can use their cursors to point at where sticky notes should go on the grid. The facilitator can confirm the spot by using the laser pointer holding the **H key** on the keyboard.

Feasibility

3.3 Proposed Solution

Proposed Solution Template:

S.No	Parameter	Description
1.	Problem Statement (Problem to besolved)	Sign Language is a visual means of communicating using gestures, facial expressions, and body language with specially abled. Since normal people are not trained in sign language, in times of emergency conveyingtheir message is very difficult. Hence, there is a need for a system that recognizes different signs and empowers them in communicating with normal people
2.	Idea / Solution description	The idea is to create an end-end application that predicts the ISL signs from a live video andtranslates the same to voice such that conversing is at ease
3.	Novelty / Uniqueness	We are making use of a convolution neural network to create a model that is trained on different hand gestures.
4.	Social Impact / Customer Satisfaction	● Communication is achieved without the help of additional human intervention. ● No additional hardware support is needed to use the application ● Improve their career opportunities in the industry ● Can provide instant results to users
5.	Business Model (Revenue Model)	This business model truly revolutionizes accessibility and people with disabilities can drastically improve their everyday lives. We can associate the application with organizations to provide support for the specially abled. Creating an association withother medical applications to utilize our product in their app.
6.	Scalability of the Solution	This is a application people can access the application from any device (Mobile, Desktop, laptop, etc.), and used by everyone across the world. As it is hosted in IBM Cloud, it could be scaled up and down as per deman

Proposed solution is the one in which we are making use of a convolution neural network to create a model that is trained on different hand gestures. A website is built which uses this model. The proposed solution section should offer the solution specifically, with enough detail so that the reader understands exactly what we're proposing.

3.4 Problem solution fit:

Maximum Marks: 2 Marks   **PROBLEM SOLUTION FIT**   Team ID: PNT2022TMID25445

	1.CUSTOMER SEGMENT(CS)	6.CUSTOMERCONSTRAINTS (CC)	5.AVAILABLE SOLUTIONS (AS)	
DefineCS,fit into CC	Specially abled persons such as deaf and dumb people. The normal people who are trying to communicate with themare the customers	The sign language is not understandable to all. The difficulty in understanding the sign language by normal people	Using text type writers and AI Based devices i.e. Voice recognition.	ExploreAS differentiate
	2.JOBS-TO-BE-DONE/ PROBLEMS (J&P)	**9.PROBLEM ROOT CAUSE (RC)**	**7.BEHAVIOUR (BE)**	
Focus onJ&P,tap into BE,understand	Create a communication link between deaf dumb and normal people Understanding inputs from the user may take a lot of efforts.	The communication barrier is the root cause. During emergency the specially abled people cannot contact orexpress their feelings to others (normal people). The feeling cannot be shared with other they feel stressed.	Customers try to find a device that helps in emergency situation.	Focuson J&P,tap into BE,understand
	3.TRIGGERS (TM)	**10.YOUR SOLUTION (SL)**	**8.CHANNELS of BEHAVIOUR (CH)**	
Identify strongTR & EM	An ability of the customers to communicate efficiently at serious andnecessary situations. **4.EMOTIONS:BEFORE/AFTER (EM)** After: Customer gain a better understanding of the needs of specially abledThey feel secured and it brings confident in them . Before: Lacking of self- confidence. Feeling anxious of interacting with people .	This device helps in emergency situations to contact . The customer can share their feelings and also helps in expressingemotions and their motives .	ONLINE Using online translation OFFLINE They buy devices that helps in translating signed language to textand vice versa .	Extractionline&offline CH of BE

The Problem-Solution Fit is based on the principles of Lean Startup and User Experience design. It helps us to identify behavioral patterns and recognize what would work and why. It is used to identify solutions with higher chances of solution adoption, reduce time spent on testing.

4. REQUIREMENT ANALYSIS

4.1 Functional requirement:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	User Verification	The user should receive a verification e-mail which they have to confirm to complete the registration.
FR-4	Compliance to rules or laws	Terms and conditions, Privacy policy, End user licensing agreement.
FR-5	Authorization levels	There are two levels of authorization namely standard access level and advanced access level.
FR-6	Legal Requirements	Medical Certificate is produced

4.2 Non Functional requirement:

Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The designed system is easy to use for specially abled persons as it is portable and platform independent.
NFR-2	**Security**	Converted information using signs into speech is accessed only by the user.
NFR-3	**Reliability**	System is tested with large number of data and Provides insight into issues.
NFR-4	**Performance**	Quick Launch time of application and faster in converting signs into speech
NFR-5	**Availability**	Provides automatic recovery and User access.
NFR-6	**Scalability**	Standard network condition the device should convert information within second.

5.   PROJECT DESIGN

Project design is an early phase of the project lifecycle where ideas, processes, resources, and deliverables are planned out. A project design comes before a projectplan as it's a broad overview whereas a project plan includes more detailed information.

5.1 Data Flow Diagrams

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.
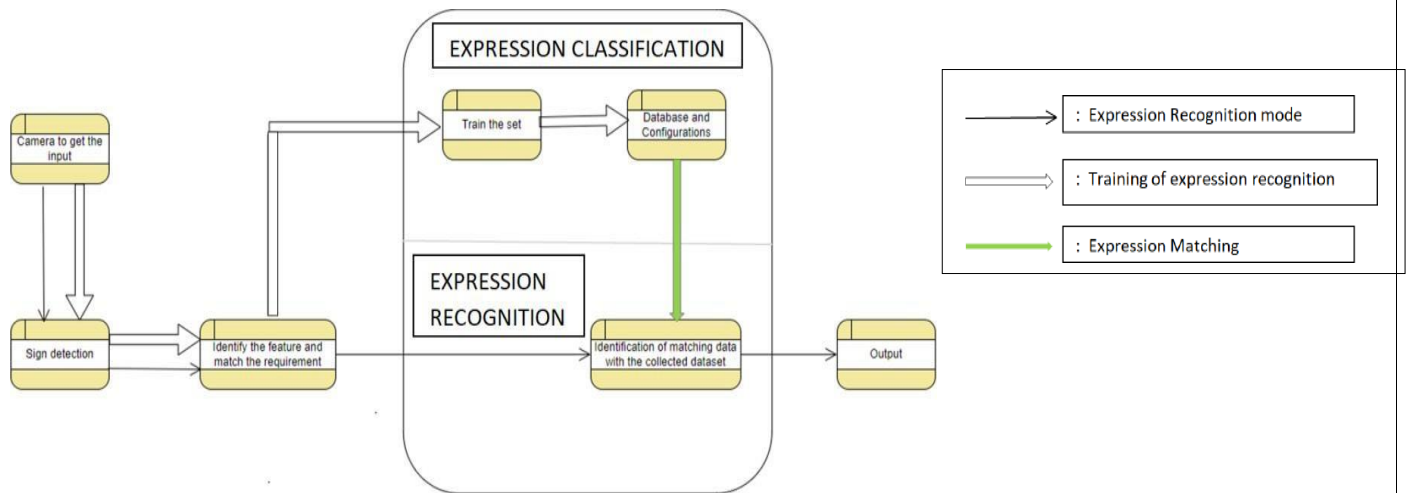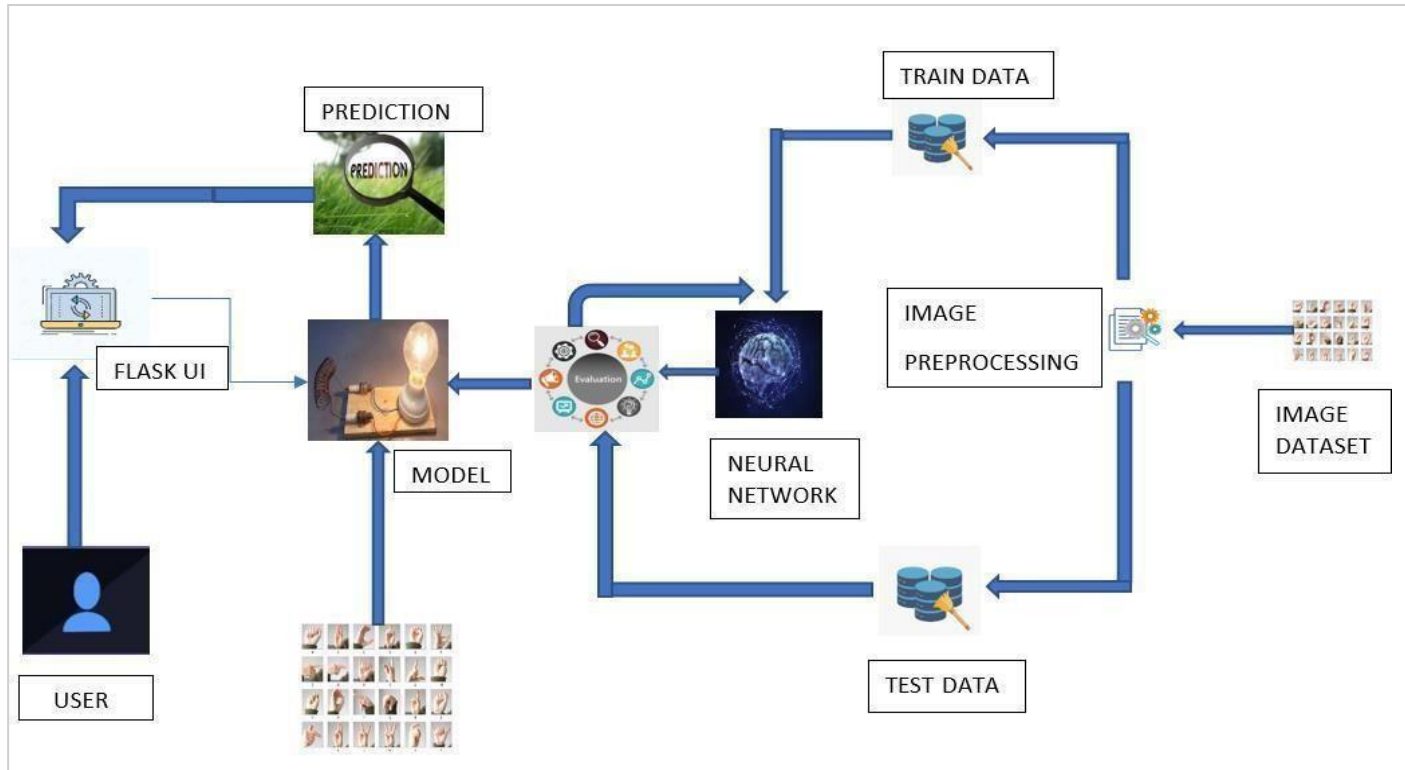
5.2 Solution Architecture & Technical Architecture

Solution Architecture:
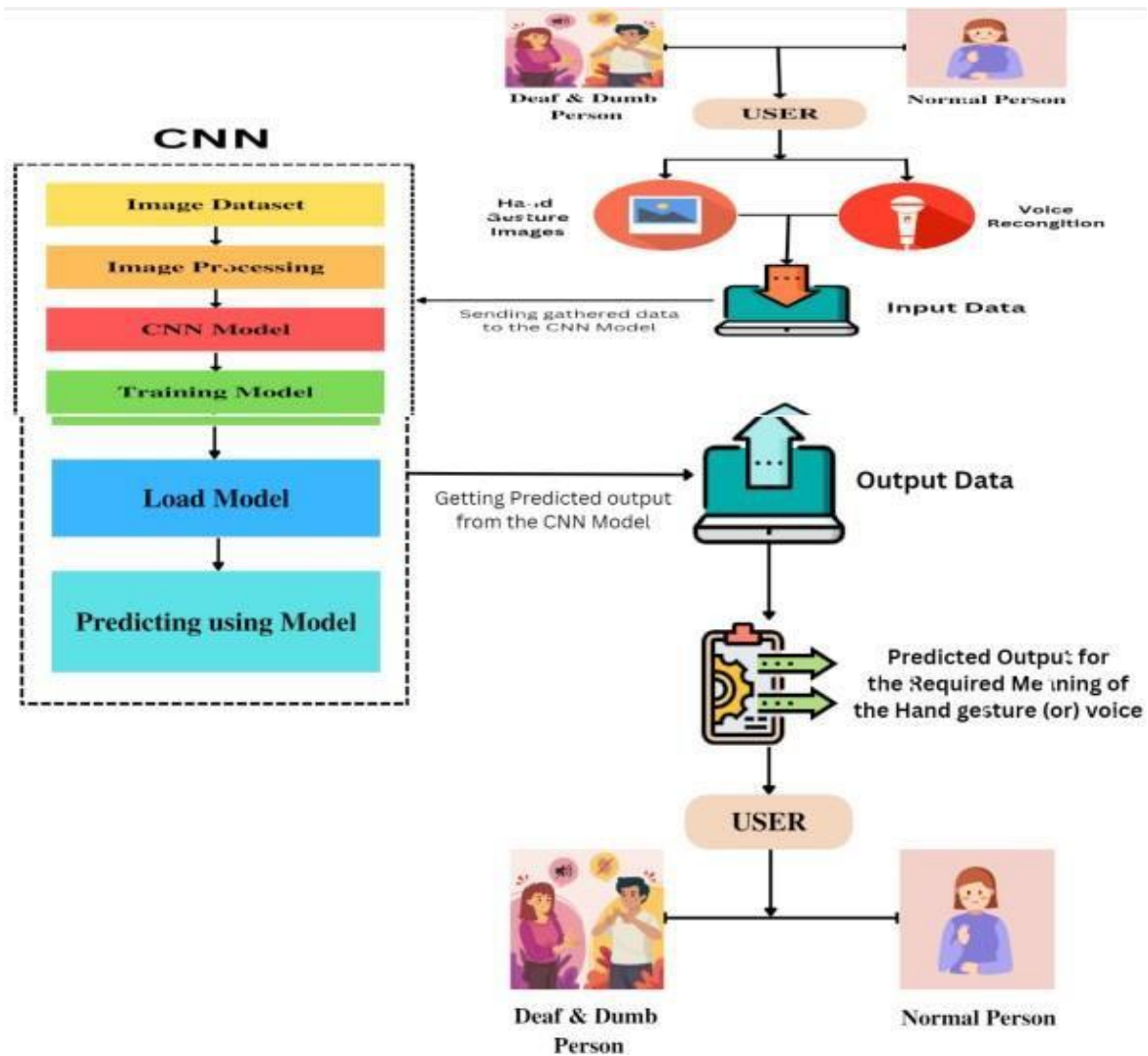
Solution architecture is the process of developing solutions based on predefined processes, guidelines and best practices with the objective that the developed solution fits within the enterprise architecture in terms of information architecture, system portfolios, integration requirements and many more.

Technical Architecture:

Technical Architecture is a form of Information Technology(IT) architecture that is used to design a system. It involves the development of a technical blueprint with regard to the arrangement, interaction, and interdependence of all elements so that system- relevant requirements are met.

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 — CNNmodel
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 informationthat 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

User Stories:

User Type	Functional Requiremen t (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Normal people and Deaf- mute people	Registration	USN-1	As a user, I can register for the application by entering my email, and password, and confirming my password	I can access my account/ dash boar d	High	Sprint-1
		USN-2	As a user, I will receive a confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1

		USN-3	Give access to camera to recognize the gestures Give access to microphone to give our message through voice	I can access messages given by the Deaf- mute people	High	Sprint-1
Normal people						
Deaf- mute peopl e			Give access to display to view the message sent by normal people.	I can access messages given by the Norma l people	High	Sprint-1
Administrator		USN-4	Admin side in the company should take care	all the requireme nts are there.	High	Sprint 1
Sign up		USN-5	Need to sign up to use it.	Need valid credentials.	High	Sprint-1
Wish list		USN-6	Before availing the service can be kept aside.	As a user can review anduse the service.	Low	Sprint-2

A user story is an informal, general explanation of a design feature written from the perspective of the end user. Its purpose is to articulate how a design will provide value to the end user. A key component of agile software development is putting people first, and a user story puts end users at the center of the conversation. These stories use non-technical language to provide context for the development team and their efforts.

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 plans for scope, time cost and quality into anoperating timetable.

6.1 Sprint Planning & Estimation

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	Logesh Lingakumar
Sprint-1	Registration	USN-2	As a user, I will receive confirmation emailonce I have registered for the application	1	High	Balaji Harish
Sprint-2	Registration	USN-3	As a user, I can register for the application through phone number	2	Mediu m	Lingakumar
Sprint-2	User interface	USN-4	Professional responsible for user requirements & needs	2	Mediu m	Balaji Harish
Sprint-3	Login	USN-5	As a user, I can log into the applicationby entering email & password	1	High	Logesh
Sprint-3	Dashboard	USN-6	As a user, I must receive any updates orpop ups in my dashboard	2	High	Lingakumar Balaji
Sprint-4	Details	USN-7	As a user, I should get notification about the progress and any updates via email orsms	1	Mediu m	Harish
Sprint-4	Privacy	USN-8	The developed application should be secure forthe users	2	High	Lingakumar Logesh

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	15 NOV2022	20NOV2022	20	26 NOV 2022
Sprint-2	20	6 Days	20 NOv 2022	25 Nov 2022	20	26 Nov 2022
Sprint-3	20	6 Days	20 Nov 2022	25 Nov 2022	20	26 Nov 2022
Sprint-4	20	6 Days	20 NOv 2022	250Nov 2022	20	26 Nov 2022

Since sprints take place over a fixed period of time, it's critical to avoid wasting time during planning and development.
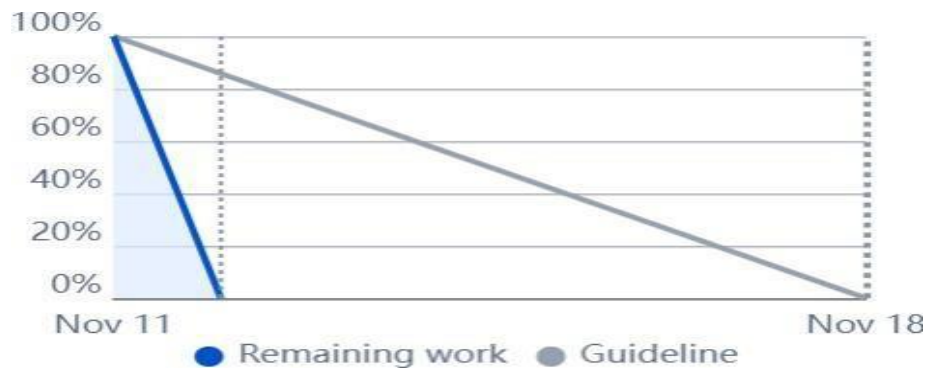
6.3 Reports from JIRAROADMAP
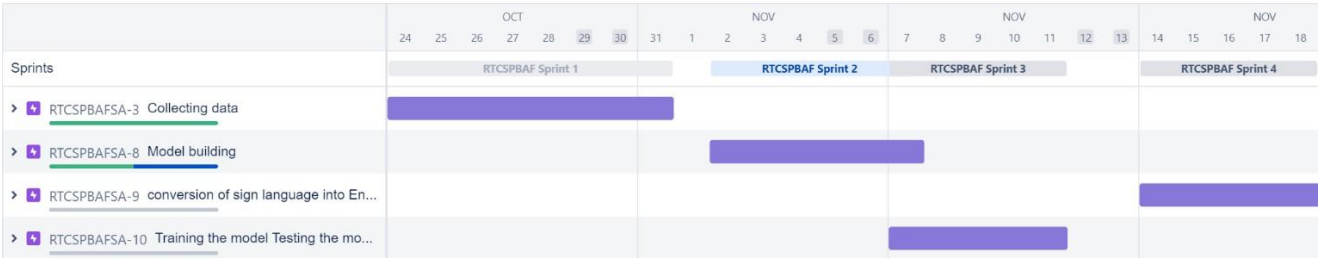
Sprint-1

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.],
                 [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.]]], 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.   <u>**TESTING**</u>

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						
Testcase 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
LoginPage_TC_001	Functional	HomePage	Verify user is able to see the homepage	Mozilla Firefox Browser	Enter URL in browser and click go	http://127.0.0.1:5003	Homepage should be displayed	Working as expected	Pass	Steps are clear to follow	NO	NA	SHALINI.A.NAGA NANDHINI.R.NIVEDHA .M.SNEKA.PRATHA.S
LoginPage_TC_002	UI	HomePage	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://127.0.0.1:5003	Application should show below UI elements: 1.Reference 2.camera access display 3.Introduction to project	Working as expected	Pass	Steps are clear to follow	NO	NA	SHALINI.A.NAGA NANDHINI.R.NIVEDHA .M.SNEKA.PRATHA.S
LoginPage_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://127.0.0.1:5003	User should navigate to reference page where asl alphabet images is displayed	working as expected	Pass	Steps are clear to follow	Yes	NA	SHALINI.A.NAGA NANDHINI.R.NIVEDHA .M.SNEKA.PRATHA.S
LoginPage_TC_004	Functional	HomePage	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.PRATHA.S
LoginPage_TC_004	Functional	HomePage	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.PRATHA.S
LoginPage_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.PRATHA.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

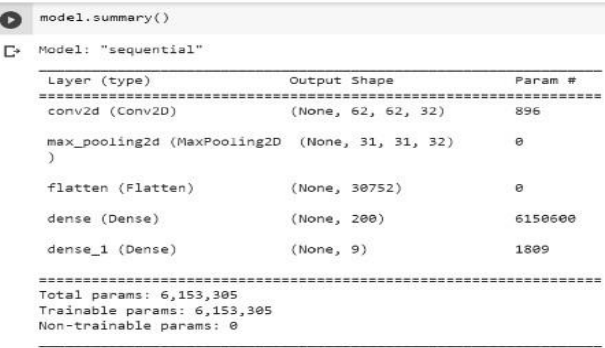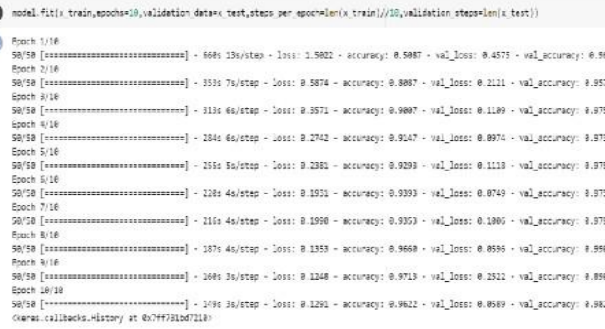| Section	Total Cases	Not Tested	Fail	Pass
View Home Page	7	0	1	6
Click Reference	15	0	3	12
Image displayed	12	0	0	12
Allow camera access	11	0	2	9
PrintEngine	8	0	0	8
ClientApplication	49	0	0	49
Security	4	0	0	4
OutsourceShipping	4	0	0	4
ExceptionReporting	11	0	0	11
FinalReportOutput	2	0	0	2
VersionControl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

1. Create a mobile application to bridge the communication gap between deaf and dumb persons and the general public.
2. Sign language standards exist, their dataset can be added, and the user can 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 people can use their hands to perform sign language, which will then be converted into alphabets, thanks to this project.
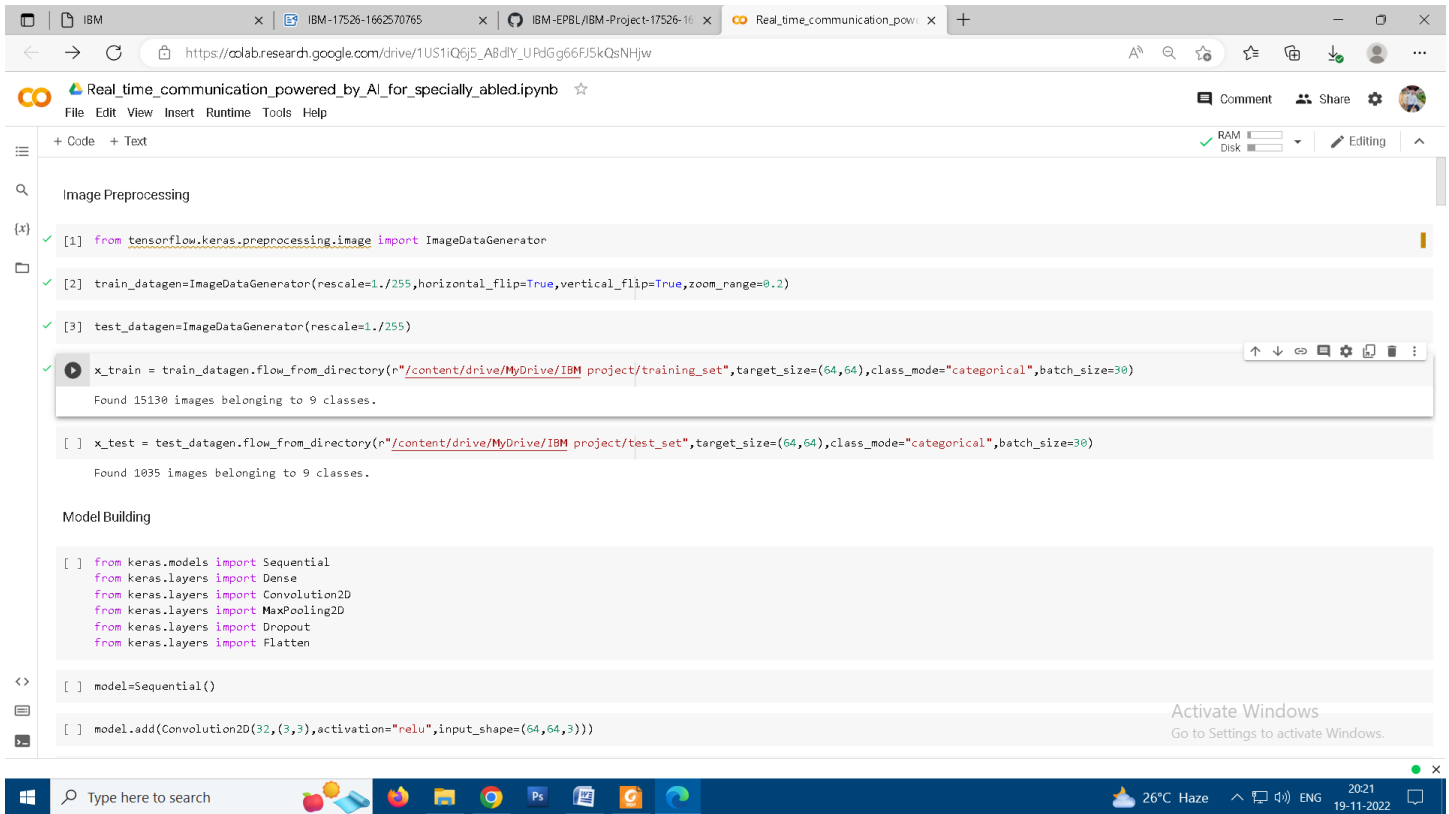
12. FUTURE SCOPE

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 abled people 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, and thereby reduce the communication gap.

13.   APPENDIX

Source Code for Model Training and Saving:

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.
```
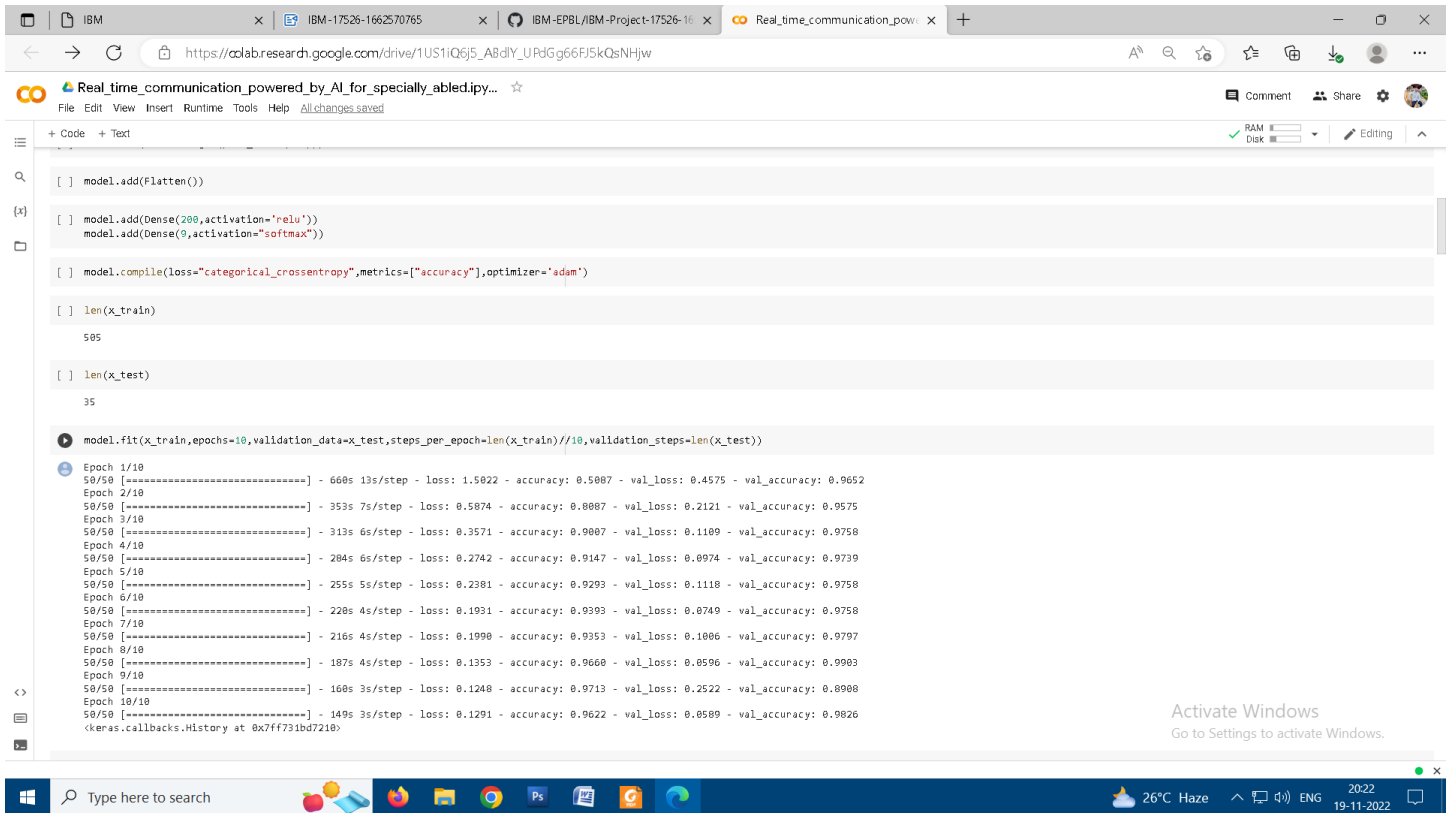
Model Building

```
[ ]  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)))
```

Activate Windows
Go to Settings to activate Windows.

```
[ ]  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: 0.5007 - 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>
```

Activate Windows
Go to Settings to activate Windows.

```
[ ] 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
```

```
!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=a7ff6964f75f4faccc778c17b12ea21a016a7b22571f463aeebc322ad7c909c7
  Stored in directory: /root/.cache/pip/wheels/6c/a2/e4/c16d02f809a3ea998e17cfd02c13369281f3d232aaf5902c19
  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=d044dfe3c05cd595e825efebff995ddabae56196f0452ee4cdcb83fd255a9adf
  Stored in directory: /root/.cache/pip/wheels/5f/b7/14/fbe02bc1ef1af890650c7e51743d1c83890852e598d164b9da
Successfully built ibm-cos-sdk ibm-cos-sdk-core ibm-cos-sdk-s3transfer
```

Real_time_communication_powered_by_AI_for_specially_abled.ipy...

File   Edit   View   Insert   Runtime   Tools   Help   All changes saved

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-4636-840a-d80f4b26fcd1::',
    'guid': '150d8bd2-b3df-4636-840a-d80f4b26fcd1',
    'name': 'Watson Machine Learning-kn',
    'type': 'machine_learning'}],
   'description': '',
   'name': 'Real Time Communication Powered by AI for Specially Abled',
   'scope': {'bss_account_id': 'b9331efaedac4670a69900b9b86e4341'},
   'stage': {'production': False},
   'status': {'state': 'active'},
   'storage': {'properties': {'bucket_name': '9f4f0465-6521-43e6-8b63-713a7c5aa38e',
     'bucket_region': 'eu-de-standard',
     'credentials': {'admin': {'access_key_id': '9666c3ab19204db3a12c6cd40a19070b',
       'api_key': 'oPwhc0Hel075UHla0P8VsENtzBUS_APw3k0K3OQshI5m',
       'secret_access_key': '681fe49d3fa45404ff41cb2f361afe50ddae9ae4ac3e5e31',
       'service_id': 'ServiceId-61c87d99-7dfc-491e-bdef-72cf589cac2e'},
      'editor': {'access_key_id': '89015f01ffa44ce4aafaa0f6b126fcd0',
       'api_key': '5tIhzR9qae45b_Vy_8CbAncizn4Tn-HuNQbUllVDe9Mc',
       'resource_key_crn': 'crn:v1:bluemix:public:cloud-object-storage:global:a/b9331efaedac4670a69900b9b86e4341:920ea9cd-9efd-4270-a82b-87e13faac607::',
       'secret_access_key': 'e00ffcca8f3b1095f50623e1bef472d528c7b6efcc9b0b16',
       'service_id': 'ServiceId-34ca60b5-c426-493b-076f-45ad413fac13'},
      'viewer': {'access_key_id': 'f5a9f869485449cdbf8c89e26f6d3f42',
       'api_key': 'pU3-oUXor3-v7H7ao79UMqWa3sFO5ZOy6vVbsGu_Wgk7',
       'resource_key_crn': 'crn:v1:bluemix:public:cloud-object-storage:global:a/b9331efaedac4670a69900b9b86e4341:920ea9cd-9efd-4270-a82b-87e13faac607::',
       'secret_access_key': 'eadb8fb91cb0e696bcece3787091858badd7ed5b4f4f72ce',
       'service_id': 'ServiceId-5506b388-13e7-4bd1-b9a0-e645543e1c61'}},
     'endpoint_url': 'https://s3.eu-de.cloud-object-storage.appdomain.cloud',
     'guid': '920ea9cd-9efd-4270-a82b-87e13faac607',
     'resource_crn': 'crn:v1:bluemix:public:cloud-object-storage:global:a/b9331efaedac4670a69900b9b86e4341:920ea9cd-9efd-4270-a82b-87e13faac607::'},
    'type': 'bmcos_object_storage'}},
   'metadata': {'created_at': '2022-11-06T10:33:47.576Z',
    'creator_id': 'IBMid-6620040IQT',
    'id': 'cff76553-4fb2-400c-9341-d2e9ac10faee',
    'updated_at': '2022-11-06T10:34:06.965Z',
    'url': '/v2/spaces/cff76553-4fb2-400c-9341-d2e9ac10faee'}}]}

```
[ ] space_uid="cff76553-4fb2-400c-9341-d2e9ac10faee"
```

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                  0062b0c9-8b7d-44a0-a9b9-46c416adcbd9  base
kernel-spark3.2-scala2.12      020d69ce-7ac1-5e60-ac1a-31109067356a  base
pytorch-onnx_1.3-py3.7-edt     069ea134-3346-5748-b513-49120e15d288  base
scikit-learn_0.20-py3.6        09c5a1d0-9c1e-4473-a344-eb7b665ff607  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-075e-4f24-0ae9-62dcc2148306  base
tensorflow_2.4-py3.7-horovod   1092590a-307d-563d-9b62-4eb7d64b3f22  base
pytorch_1.1-py3.6              10ac12d6-6b30-4ccd-8392-3e922c096a92  base
tensorflow_1.15-py3.6-ddl      111e41b3-de2d-5422-a4d6-bf776020c4b7  base
runtime-22.1-py3.9             12b03a17-24d8-5082-900f-0ab31fbfd3cb  base
scikit-learn_0.22-py3.6        154010fa-5b3b-4ac1-82af-4d5ee5abbc85  base
default_r3.6                   1b70aec3-ab34-4b07-8aa0-a4a3c8296a36  base
pytorch-onnx_1.3-py3.6         1bc6029a-cc97-56da-b8e0-39c3800dbbe7  base
kernel-spark3.3-r3.6           1c9e5454-f216-59dd-a20e-474a5cdf5988  base
pytorch-onnx_rt22.1-py3.9-edt  1d362106-7ad5-5b59-8b6c-9d0080bde37f  base
tensorflow_2.1-py3.6           1eb25b04-d6ed-5dde-b6a5-3fbdf1665666  base
spark-mllib_3.2                20047f72-0a98-58c7-9ff5-a77b012eb0f5  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
kernel-spark3.3-py3.9          2b7961e2-e3b1-5a8c-a491-482c8368839a  base
pytorch_1.2-py3.6              2c8ef57d-2607-4b7d-acce-01f94976dac1  base
spark-mllib_2.3                2e51f700-bca0-4b0d-08dc-5c6791338075  base
```
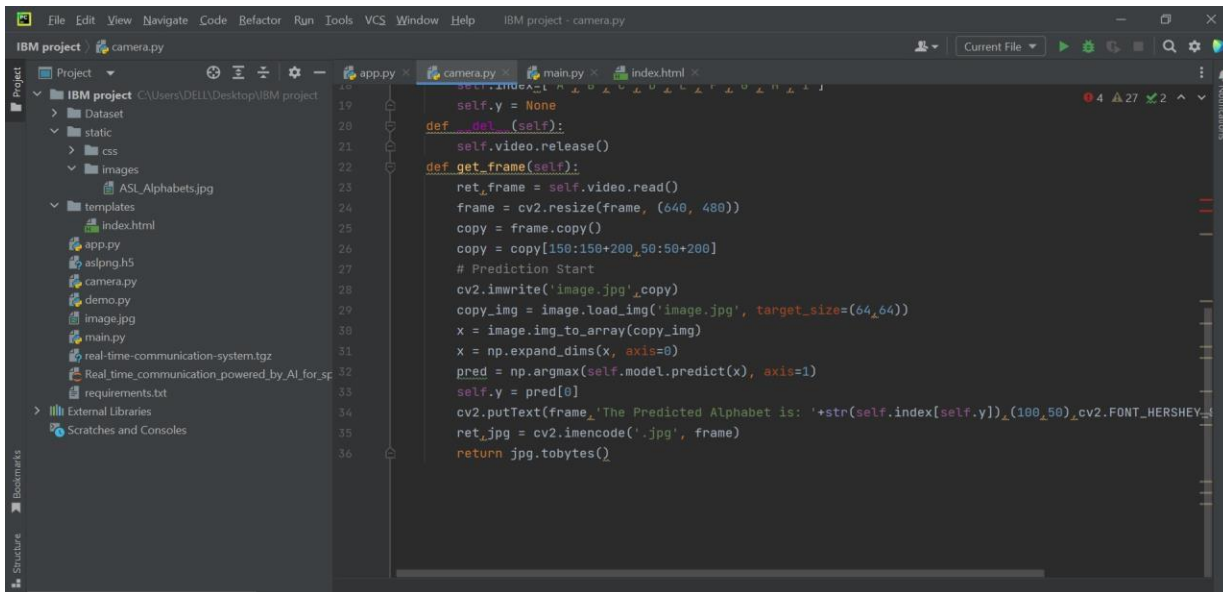
```python
from flask import Flask, Response, render_template
from camera import Video

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()
```



```python
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)
```

GITHUB LINK - https://github.com/IBM-EPBL/IBM-Project-37396-1660307026

DEMO LINK-https://drive.google.com/file/d/1khohpmSUjQOTUH3nXRvbTV8fJPRfcAP0/view?usp=sharing