CHRIST THE KING ENGINEERING COLLEGE

KARAMADAI-COIMBATORE-641104
Approved by AICTE,New Delhi &
Affiliated to Anna University,Chennai

PROFESSIONAL READINESS FOR

INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP

REAL-TIME COMMUNICATION SYSTEM POWERED BY AI FOR SPECIALLY ABLED

IBM-Project-5797-1658816374

TEAM ID-PNT2022TMID42383

Submitted By

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PROJECT REPORT

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. Upendran, S., and Thamizharasi, A., "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. Lotti, F.,Tiezzi, P., Vassura, G.,Biagiotti, L., and Melchiorri, C., "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. Rajamohan, A., Hemavathy, R., andDhanalakshmi, M., "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

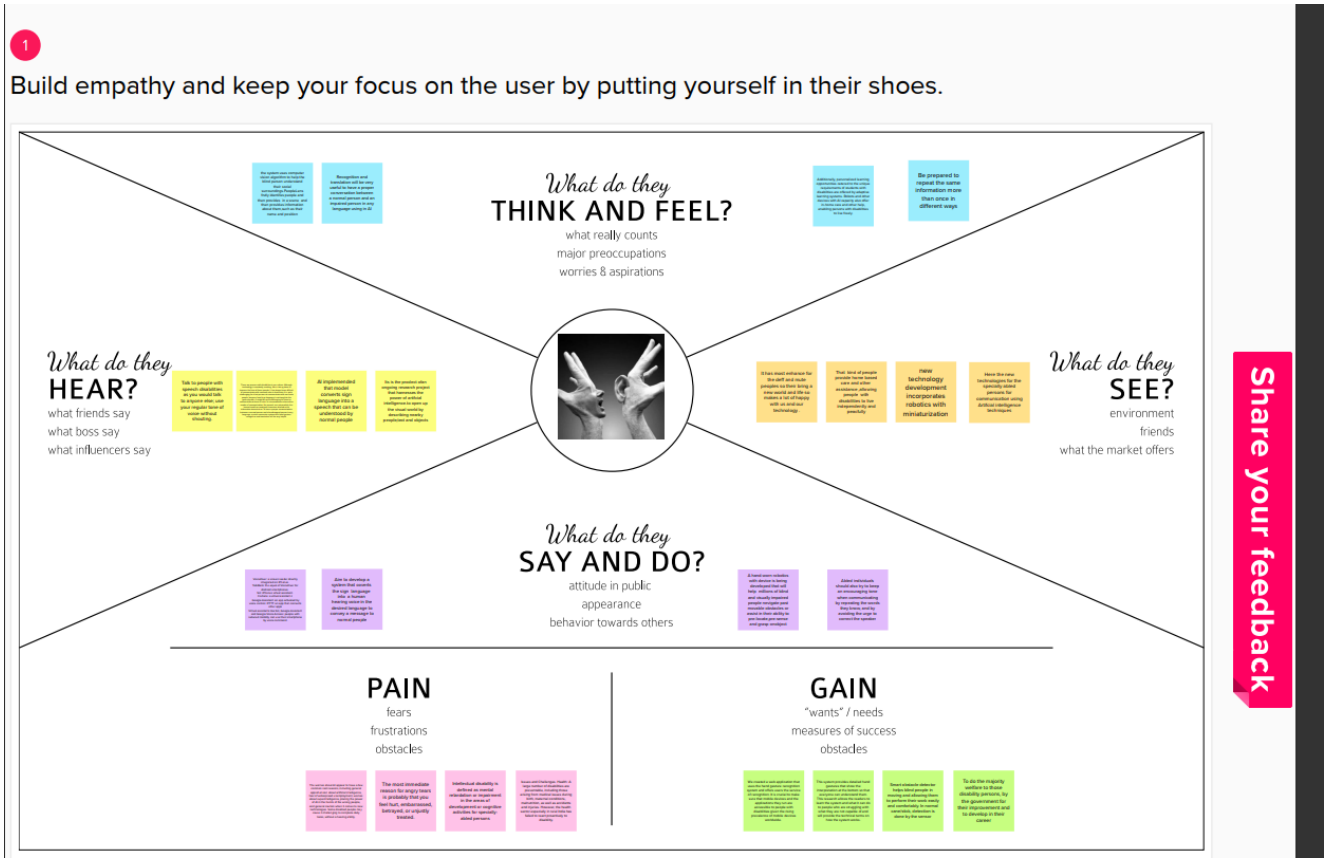
2.3 Problem statement definition

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

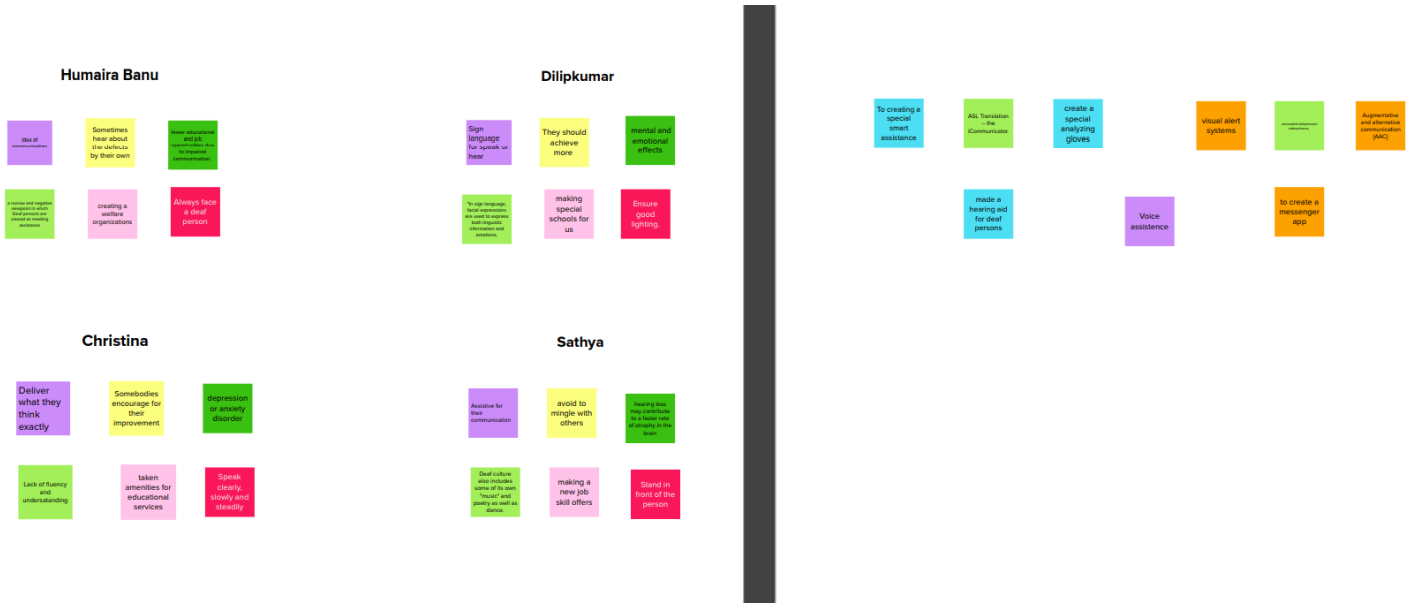
program allows deaf and hard of hearing persons to communicate using signs that are then translated into used to develop a model that is trained on varioushand movements. This model is used to create an app.

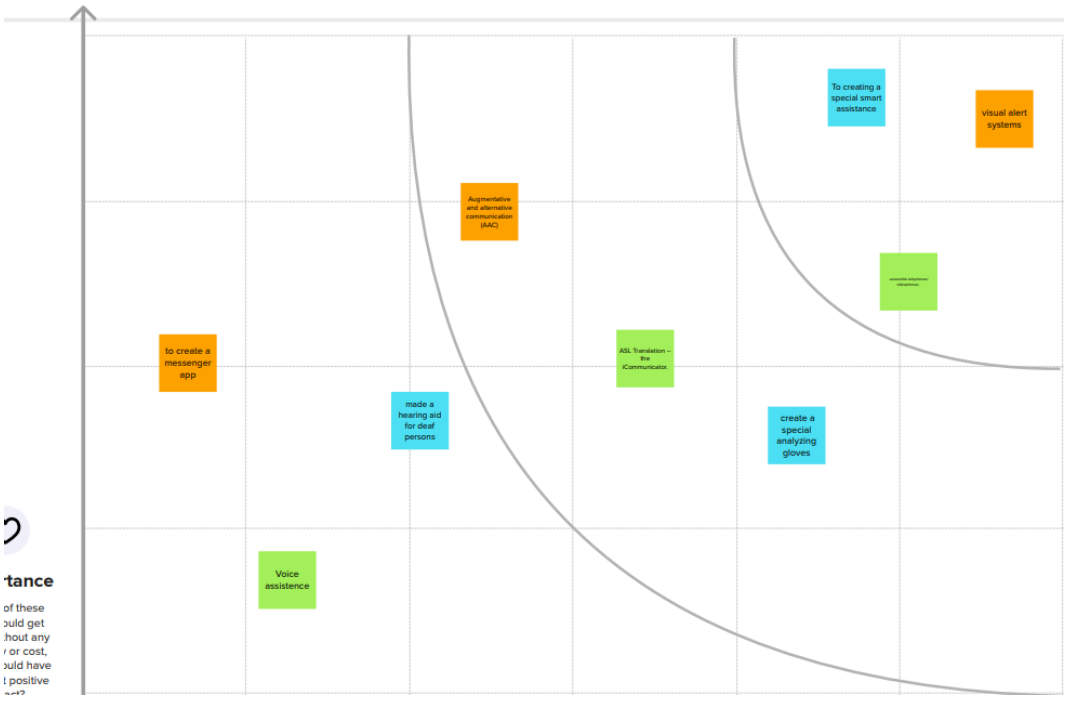
3. IDEATION & PROPOSED SOLUTION:

3.1. Empathy Map Canvas



3.2 Ideation & Brainstorming





3.3 Proposed Solution

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.

S. NO:	PARAMETER	DESCRIPTION
1.	Problem Statement (Problem to be solved)	This initiative can help people communicate between people with special needs and people without them and the other way around.
2.	Idea / Solution description	These issues can be resolved by importing the necessary libraries into the Python code using AI technology. To narrow the communication gap with hearing persons, a prototype assistive gadget for Deaf-mute people is shown in this paper. This gadget may hang around your neck and is portable. With the aid of this device, a person can express himself through hand gestures to identify various signs that are based on gestures. This assistive device's controller was created to process gesture photos using a variety of image processing techniques and deep learning models to identify the sign. Using a text-to-speech module, this sign is translated into speech in real time.
3.	Novelty / Uniqueness	This project was put forth to address the need to translate many modalities into a common language that deaf and blind people can understand and exchange, such as translating photos into Natural Language (NL) text. This research produced a prototype that included cameras mounted to dark-coloured glasses, coupled with a portable computer, speaker, and microphone. We discovered a variety of technologies that can make it easier for people with disabilities to communicate among themselves and with the rest of society International Journal of Pure and Applied Mathematics Special Issue, but all of the technologies we looked into up until this point were only focused on one

		parameter or degree of disability among the three: blindness, deafness, and dumbness. None of the available technologies is sufficiently advanced to serve as a universal strategy for dealing with any combination of these three limitations. Therefore, in order to achieve this goal, we put forth a strategy that can be applied as a generic method by which people with any kind of mix of these three disabilities might imagine themselves as a member of this lovely environment.
4.	Social Impact / Customer Satisfaction	The issues facing Deaf people in various areas of daily life, such as work, higher education, healthcare, mental health services, emergency preparedness, technology, and government benefits, stem from society's lack of proficiency in ASL and lack of understanding of the Deaf population. It hinders the growth of receptive and expressive communication abilities (speech and language). Learning issues brought on by the language barrier lower academic attainment. Social isolation and a negative self-image are frequently consequences of communication problems.
5.	Business Model (Revenue Model)	In a climate where the pace is constantly accelerating, a firm must maintain a constant focus on its clients in order to keep them satisfied and, in turn, loyal. The case company focuses on offering ICT-based services to people with intellectual disabilities. Since the case company has already significantly increased its market share and expanded its operations in its core client categories, it has now decided that in order to sustain and increase its revenue, it is imperative to improve the customer experience. The issue the company is currently experiencing is to create a business plan and keep providing consumers with acceptable service in order to sustain and increase the company's returns.

6.	Scalability of the Solution	In the Deaf community, this is usually accepted, but hearing individuals might not understand it. One characteristic of the Deaf culture is thought to be directness in communicating. Touch and physical proximity are two more communication cues.

3.4. Problem Solution fit

Define CS, fit into CC	1.CUSTOMER SEGMENT(S) CS	6.CUSTOMER CONSTRAINTS CC	5.AVAILABLE SOLUTIONS AS	Explore AS, differentiate
	My client is an everyday person who makes an effort to comprehend sign language.	The client understands sign language, which cannot be done quickly	With some effort, the average person can anticipate sign language. The ordinary individual can comprehend sign language at some time	

Focus on J&P, tap into BE, understand RC	2 .JOBS-TO-BE-DONE/PROBLEMS J&P	9. PROBLEM ROOT CAUSE RC	7.BEHAVIOUR BE	Focus on J&P, tap into BE, understand RC
	Ordinary people hardly recognize a disabled person's expressions and what they told.	The problem emerges when an abled person starts a conversation with a normal person that they are unable to understand due of their knowledge.	When a customer says anything, an abled person cannot comprehend it properly . Ask Before You Help: The first step is to treat persons with disabilities as equals. Don't assume they constantly need assistance with daily activities.	

Identify strong TR & EM	3. TRIGGERS TR	10. YOUR SOLUTION SL	8. CHANNELS of BEHAVIOUR CH	Identify strong TR & EM
	Lack of appropriate assistive technology (assistive, adaptive, and rehabilitative devices), an inaccessible physical environment, unfavorable attitudes about disability,	If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality. If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behavior.	The ADA offers some useful advice, such as treating everyone with respect and avoiding patronizing them. After offering assistance, pay attention to the reactions. Follow the guidelines provided, or if your offer of help is declined, respect the decision and refrain from offering it again.	
	4. EMOTIONS: BEFORE / AFTER EM Be genuine and converse with someone who has a disability in the same way you would with anyone else. Be respectful in both your inquiries and your behavior. Additionally, refrain from posing queries that you wouldn't pose to someone who is not disabled. Not every person with a handicap wants to talk about their particular skills or limits. The entire family is affected by disabilities.			

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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.	User Verification The user should receive a verification e-mail which they have to confirm to complete the registration.
FR-4	User Verification The user should receive a verification e-mail which they have to confirm to complete the registration.	User Verification The user should receive a verification e-mail which they have to confirm to complete the registration.
FR-5	Requirements Proper Medical Certificate is produced to ensure the integrity of the users.	Requirements Proper Medical Certificate is produced to ensure the integrity of the users.

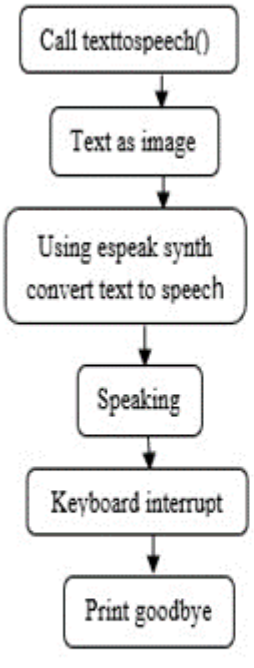
4.2 Non Functional Requirement:

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

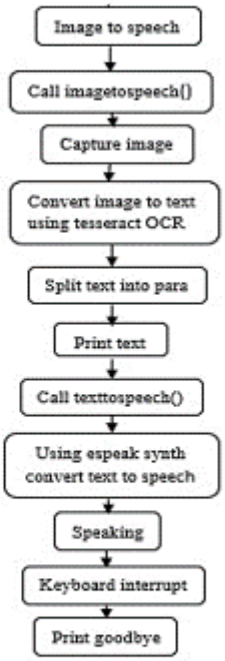
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The designed system is easy to use for specially abled persons as it is portable and platform independent.
NFR-2	**Security**	The system should protect the users data in a secure manner and avoid eavesdropping and such activities by means of encryption and decryption. The users will have a password which helps in secure login.
NFR-3	**Reliability**	The system is tested with large number of data in order to maintain the reliability of the users which is needed most on now a days.
NFR-4	**Performance**	The response time should be faster that improves the performance which is essential to cope up with the challenging world.
NFR-5	**Availability**	The system is available on 24/7 to use only the internet is needed for effective communication.
NFR-6	**Scalability**	The designed system should need to increase it's performance whenever need is more and response to changes in processing demands

5. PROJECT DESIGN:

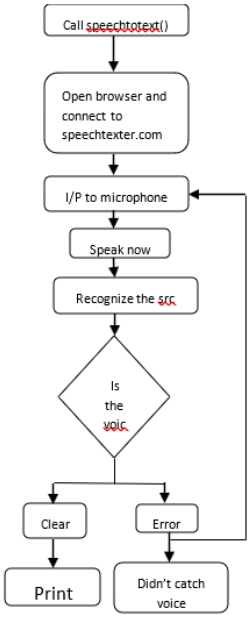
5.1. Data Flow Diagrams



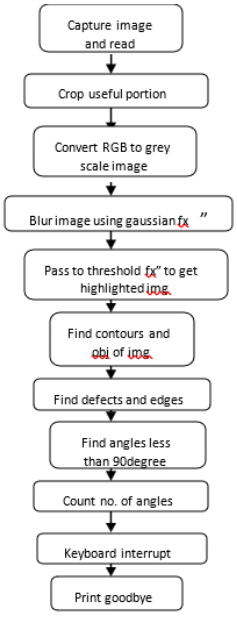
Data flow diagram of the text-to-speech



Data flow diagram of the image-to-speech



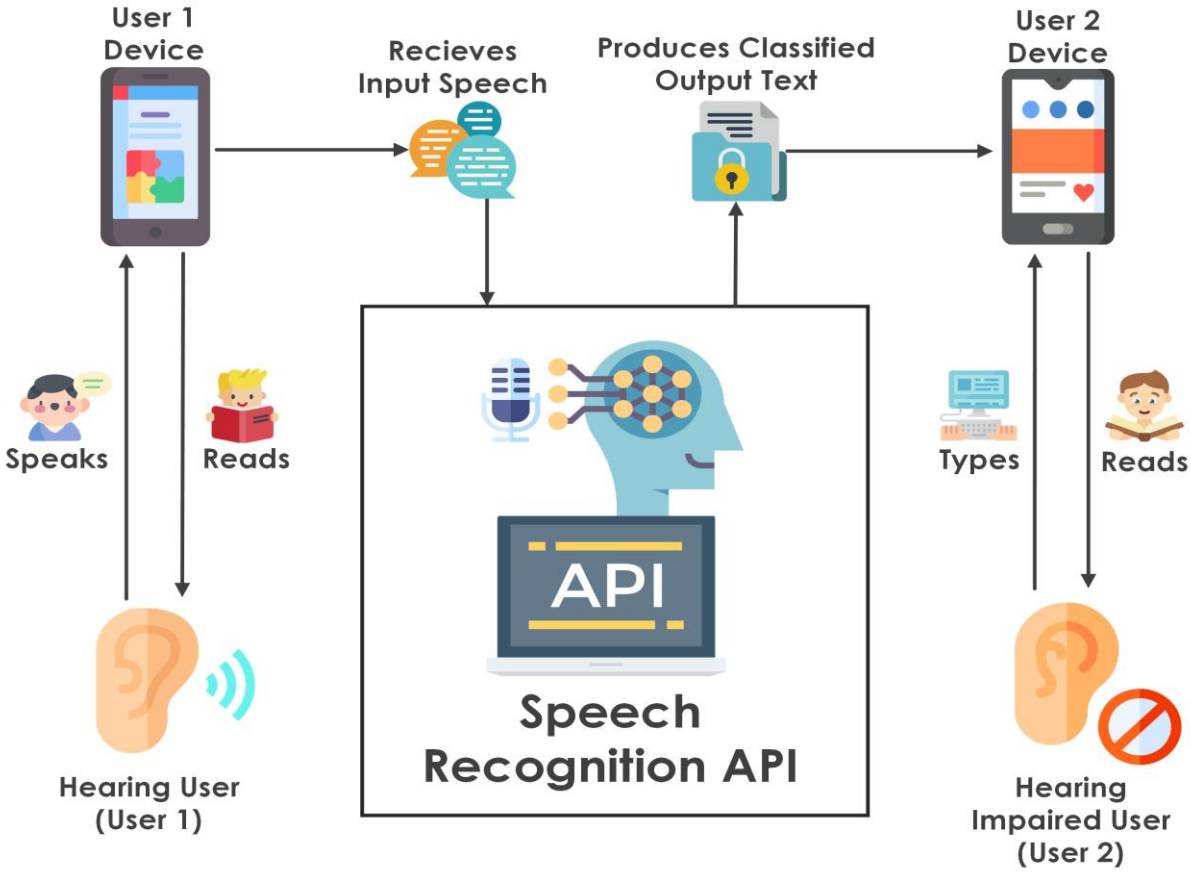
Data flow diagram of the speech-to-text



Data flow diagram of the image-to-text

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:

Table-1 : Components & Technologies:

S.NO	COMPONENT	DESCRIPTION	TECHNOLOGY
1.	User Interface	How user interacts with application e.g. Web UI, Mobile App, Chatbot etc.	HTML, CSS, JavaScript / Angular Js / React Js etc.
2.	Application Logic-1	Logic for a process in the application	Java / Python
3.	Application Logic-2	Logic for a process in the application	IBM Watson STT service
4.	Application Logic-3	Logic for a process in the application	IBM Watson Assistant
5.	Database	Data Type, Configurations etc.	MySQL, NoSQL, etc.
6.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
7.	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local Filesystem
8.	External API-1	Purpose of External API used in the application	IBM Weather API, etc.
9.	External API-2	Purpose of External API used in the application	Aadhar API, etc.
10.	Machine Learning Model	Purpose of Machine Learning Model	Object Recognition Model, etc.
11.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: Cloud Server Configuration :	Local, Cloud Foundry, Kubernetes, etc.

Table-2: Application Characteristics:

S. No		Characteristics	Description	Technology
1.		Open-Source Frameworks	List the open-source frameworks used	Technology of Opensource framework
2.		Security Implementations	List all the security / access controls implemented, use of firewalls etc.	e.g. SHA-256, Encryptions, IAM Controls, OWASP etc.
3.		Scalable Architecture	Justify the scalability of architecture (3 – tier, Micro-services)	Technology used
4.		Availability	Justify the availability of application (e.g. use of load balancers, distributed servers etc.)	Technology used
5.		Performance	Design consideration for the performance of the application (number of requests per sec, use of Cache, use of CDN's) etc.	Technology used

User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard.	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application.	I can receive confirmation email & click confirm.	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook.	I can register & access the dashboard with Facebook Login.	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail.	I can register the application using gmail with details linked to the gmail.	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password.	Can enter these credentials either by manual or by auto filling depends on the case.	High	Sprint-1
	Dashboard	USN-6	As a user, I want to know about my data which I have given to see them visually appealing.	Can see the user data after successfully logging onto the application.	Medium	Sprint-1
Customer (Web user)	Registration	USN-7	As a User, I can register for the application through web by entering mobile number / gmail, password and confirming it.	I can access my account / dashboard through web.	High	Sprint-1
Customer Care Executive		USN-8	As a user , I Can get any support if needed by dialing the call or clicking the support.	After completing the registration the user can avail this service.	Medium	Sprint-1
Administrator		USN-9	The company should take care of the admin functionalities.	Admin should have access to each information registered by the user.	High	Sprint-1
Sign Up		USN-10	As a User, I should need to sign up if I don’t haven’t registered for the account earlier.	The credentials used for signing up should be unique.It is not used by	High	Sprint-1

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
				any other users.		
Wishlist		USN-11	As a user, I am before avail for the service which can be kept aside.	As a User, I can review and use the services if needed.	Low	Sprint-2
Enrolled		USN-12	As a user, I can use the service after enrolling.So that the user can know and use.	As a user, it is quite appealing.	Low	Sprint-2

6. PROJECT PLANNING & SCHEDULING :

6.1. Sprint Planning & Estimation

SPRINT	FUNCTIONAL REQUIREMENTS	USE STORY/ NUMBER	USER STORY/TASK	STORY POINT	PRIORITY
Sprint-1	Project Structure, Data Collection	USN-1	The project structure is the blueprint on how to build a system. The goal of data collection is to generate the data that will be used for training and testing. Data collection means that you need to collect meaningful data samples from different perspectives, so every project has its own needs.	2	Moderate

Sprint-2	Image Processing, Model Building	USN-2	The process of image processing begins with the inputting of an image that needs to be processed. After inputting the image, we need to find features of interest within the picture and extract data from these features using algorithms.	2	High
Sprint - 3	Test the model, Train CNN Model	USN-3	The goal of this project is to train a Convolutional Neural Network (CNN) model for the purposes of recognizing handwritten digits. There are three main tasks that must be completed in order to train a CNN model: testing the model, training the model, and testing the trained model. First, we must test the accuracy of our CNN so that we can determine which dataset will work best with our data. There are many ways to test a neural network, but before we move on to testing our models, it is necessary for us to create datasets that have images of handwritten numbers from zero through nine.	2	High

Sprint-4	Application Building, Creating Application model	USN-4	Application Building is the process of developing an application. It might also be defined as the design and implementation of a working program, service or site. The model for Artificial Intelligence in this section is created in Python programming language. The Communication for deaf and dumb is a special mode which in order to communicate with someone who cannot hear or speak uses sign language, gesture, speech reading and/or lip reading.	2	High

6.2 Sprint Delivery Schedule

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

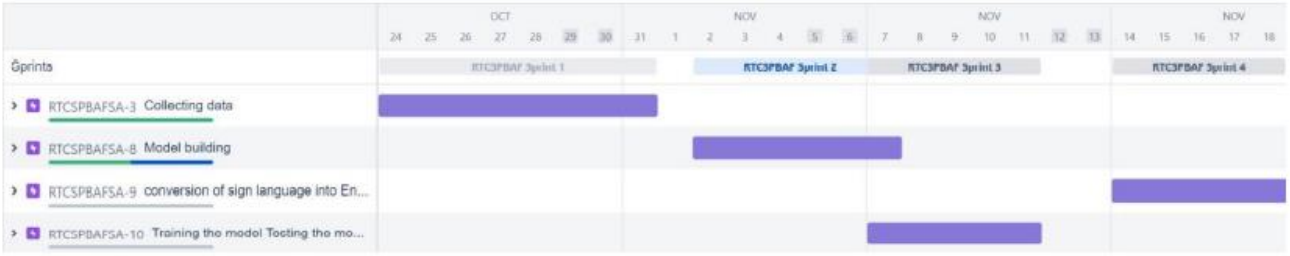
SPRINT	TOTAL STORY POINT	DURATION	SPRINT START DATE	SPRINT END DATE(PLANNED)	STORY POINT COMPLETED (AS SOON AS END DATE)	SPRINT RELEAS DATE(ACT
Sprint-1	20	5 Days	24-Oct-2022	28-Oct-2022	20	27-Oct-20
Sprint-2	20	5 Days	29-Oct-2022	03-Nov-2022	20	03-Oct-20
Sprint-3	20	6 Days	04-Nov-2022	09-Nov-2022	20	09-Nov-20
Sprint-4	20	9 Days	10-Nov-2022	18-Nov-2022	20	18-Nov-20

BURN DOWN CHART

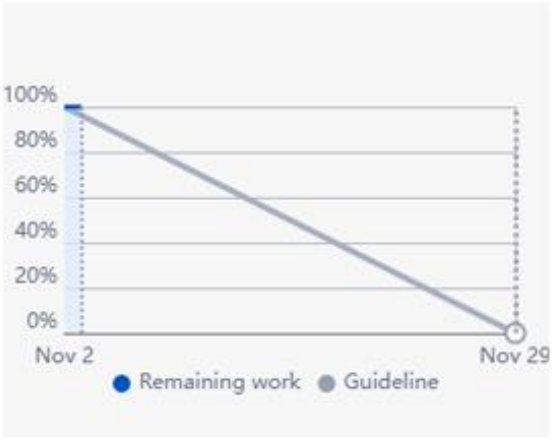
SPRINT	DATE	ESTIMATED EFFORT	ACTUAL EFFORT
SPRINT-1	24-Oct-2022	20	19
	25-Oct-2022	20	19
	26-Oct-2022	19	18
	27-Oct-2022	18	17
	28-Oct-2022	17	16
SPRINT-2	29-Oct-2022	18	17
	30-Oct-2022	17	16
	31-Oct-2022	16	15
	01-Nov-2022	16	15
	02-Nov-2022	15	14
	03-Nov-2022	15	14
SPRINT-3	04-Nov-2022	17	16
	05-Nov-2022	16	15
	06-Nov-2022	15	14
	07-Nov-2022	14	13
	08-Nov-2022	12	11
	09-Nov-2022	15	14
SPRINT-4	10-Nov-2022	12	11
	11-Nov-2022	11	10
	12-Nov-2022	10	9
	13-Nov-2022	9	8
	14-Nov-2022	8	7
	15-Nov-2022	11	10
	16-Nov-2022	8	7
	17-Nov-2022	9	8
	18-Nov-2022	7	6

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



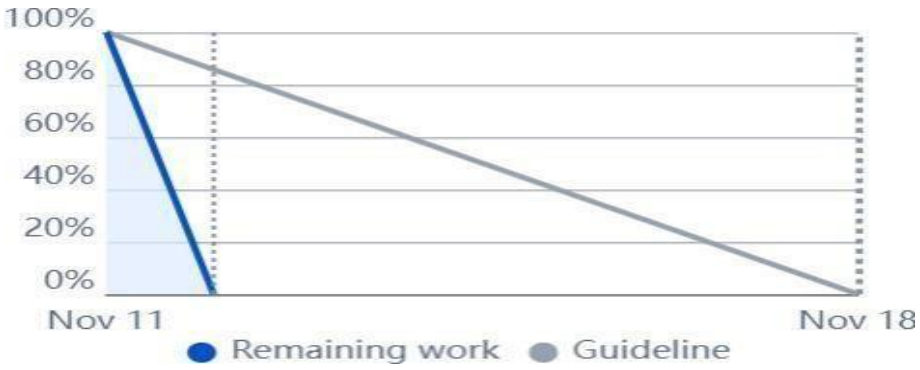
Sprint-1



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
```

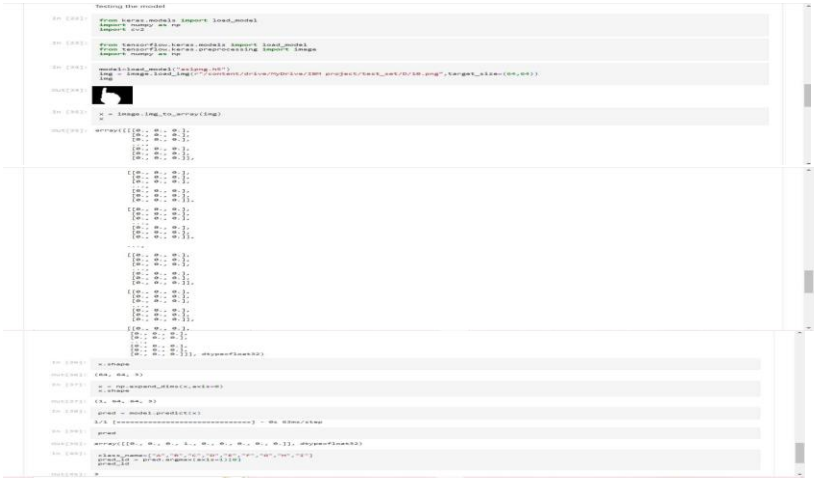
In [20]:
```
model.fit(x_train,epochs=10,validation_data=x_test,steps_per_epoch=len(x_train)//10,validation_steps=len(x_test))
```

```
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:



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								
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	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 JAGA NANDHINI.R.NIVEDHA MUNIKKA PRABHA.S
LoginPage_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 JAGA NANDHINI.R.NIVEDHA MUNIKKA PRABHA.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://127.0.0.1:5000/	User should navigate to reference page where all_alphabet image is displayed	working as expected	Pass	Steps are clear to follow	Yes	NA	SHALINI A JAGA NANDHINI.R.NIVEDHA MUNIKKA PRABHA.S
LoginPage_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 JAGA NANDHINI.R.NIVEDHA MUNIKKA PRABHA.S
LoginPage_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 JAGA NANDHINI.R.NIVEDHA MUNIKKA PRABHA.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 JAGA NANDHINI.R.NIVEDHA MUNIKKA 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

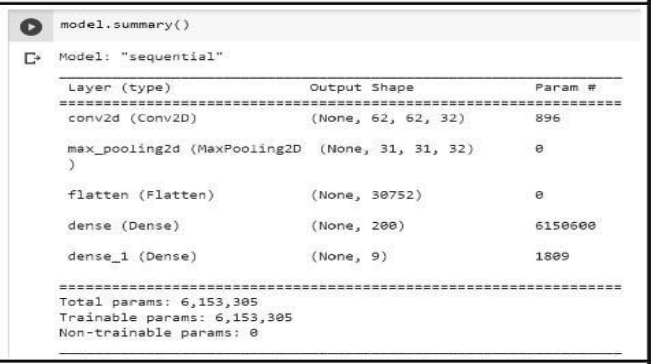
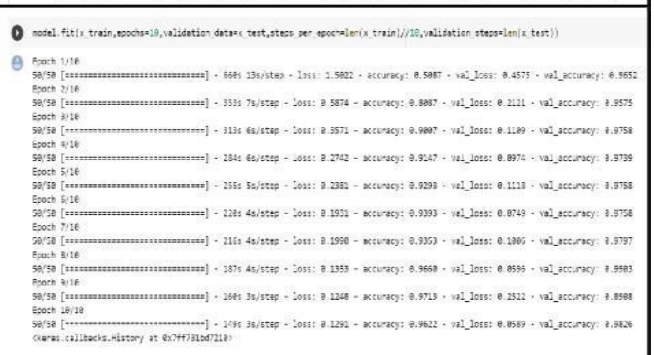
9. RESULT:

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:

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 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 :

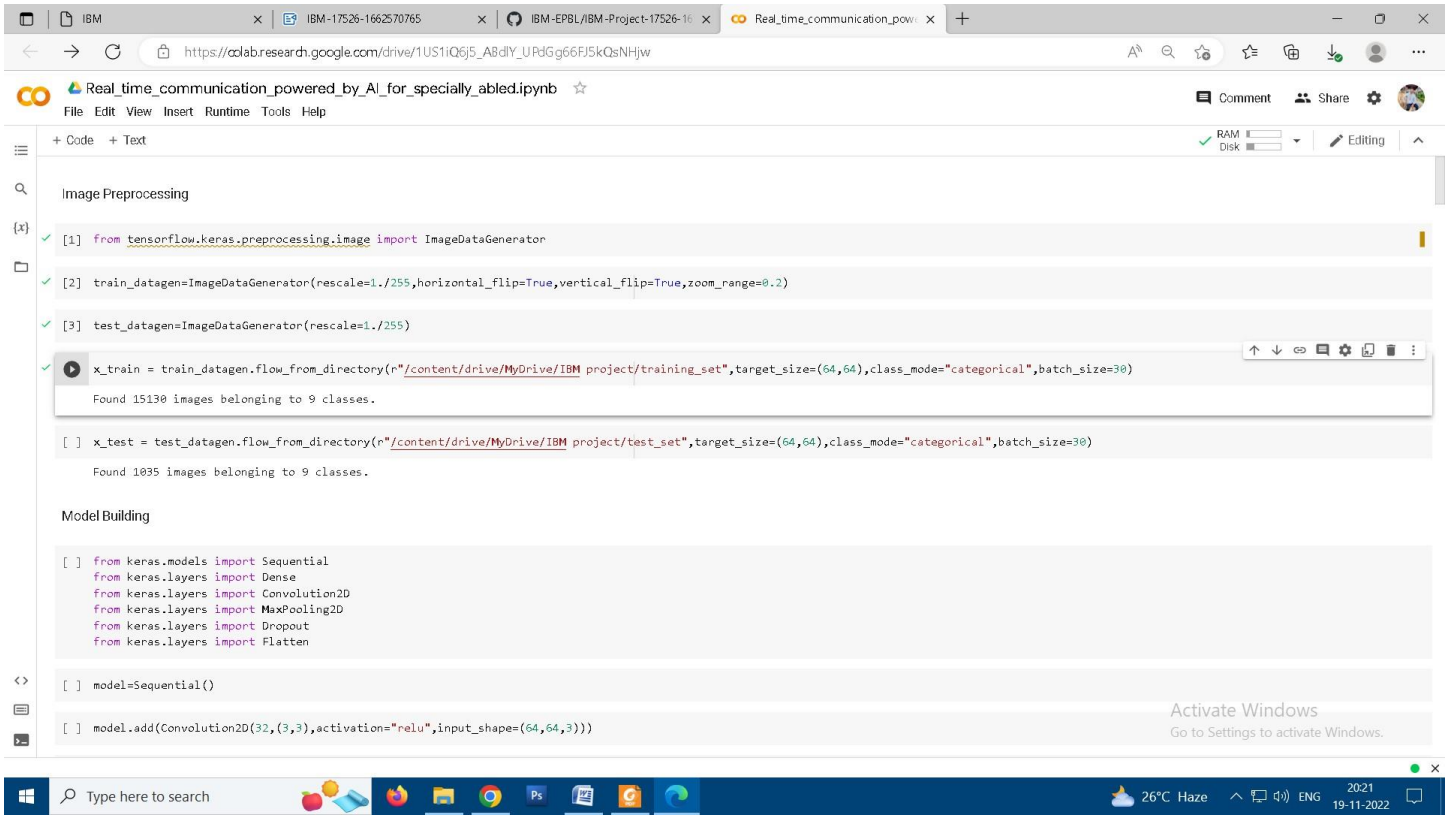
Sign language is a useful tool for facilitating communication between deaf and hearing people. Because it allows for two-way communication, the system aims to bridge the communication gap between deaf people and the rest of society.The proposed methodology translates language into English alphabets that 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.

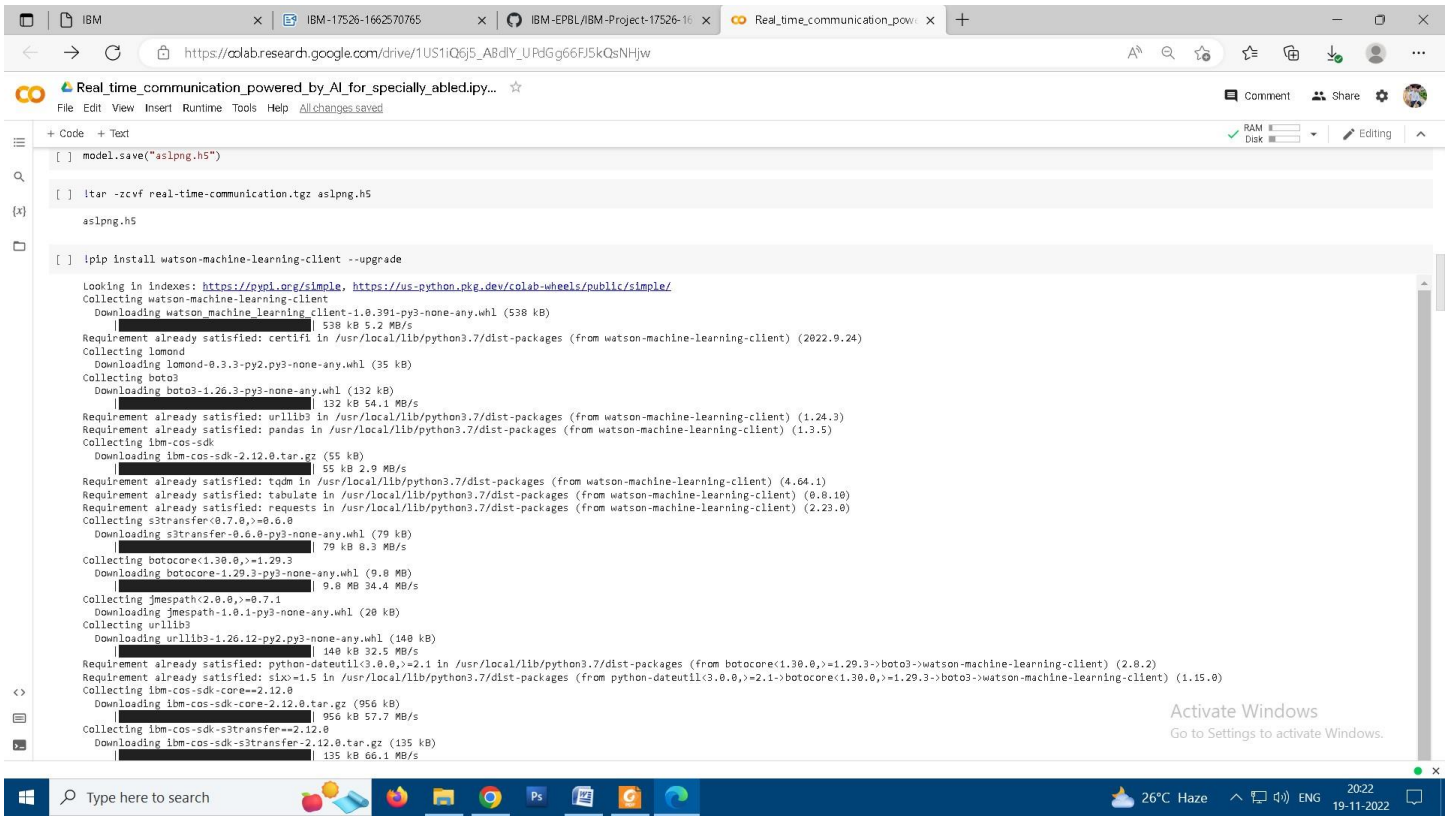
12. FUTURE SCOPE:

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.

13. APPENDIX:

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IBM-EPBL/IBM-Project-17526-16
Real_time_communication_pow
https://colab.research.google.com/drive/1US1iQ6j5_ABdlY_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
[ ] 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
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132 kB 54.1 MB/s
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Requirement already satisfied: pandas in /usr/local/lib/python3.7/dist-packages (from watson-machine-learning-client) (1.3.5)
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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)
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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)
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Downloading ibm-cos-sdk-s3transfer-2.12.0.tar.gz (135 kB)
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Activate Windows
Go to Settings to activate Windows.
Type here to search
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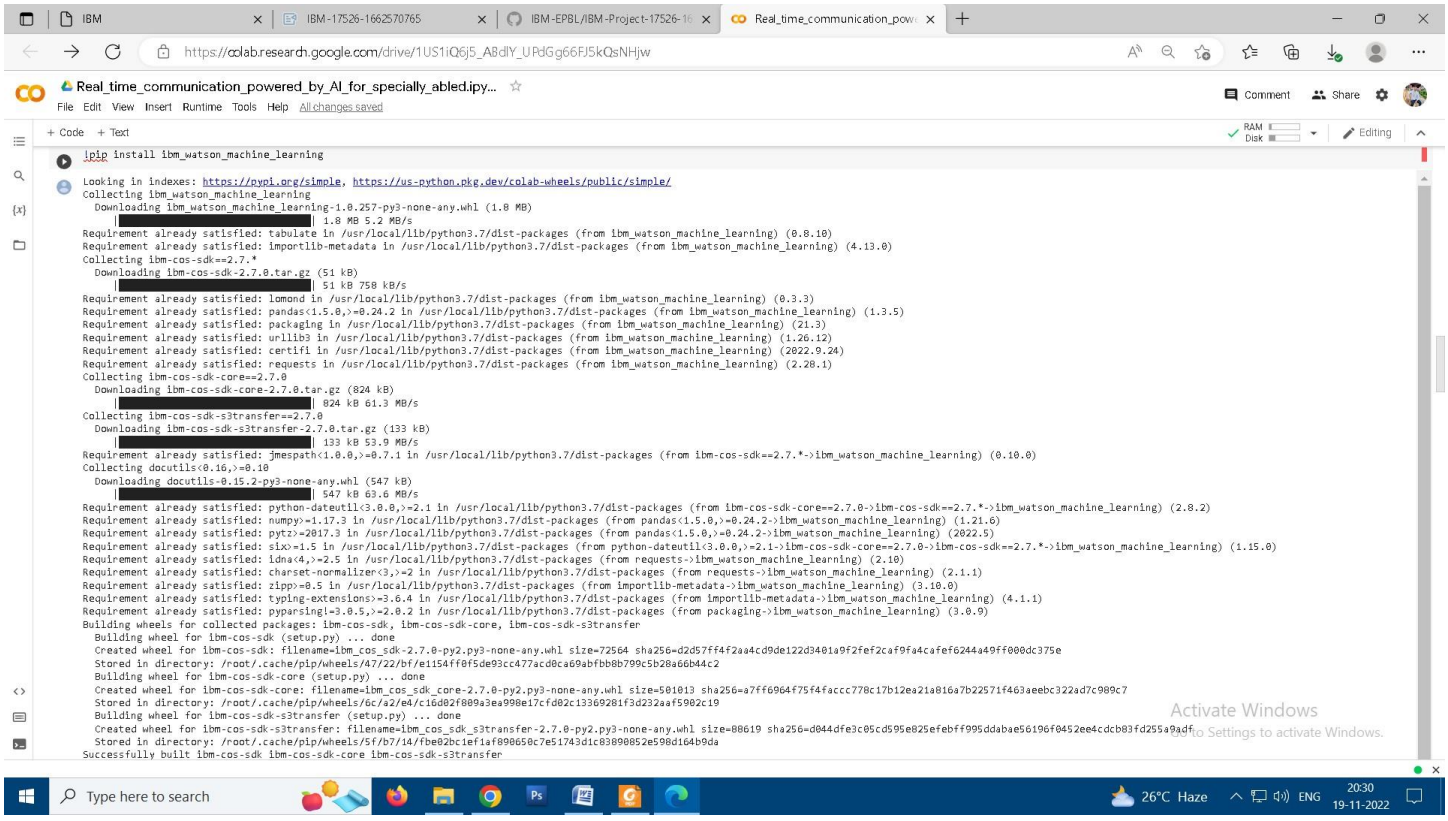
ENG
20:22
19-11-2022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IBM-17526-1662570765
IBM-EPBL/IBM-Project-17526-16
Real_time_communication_pow
https://colab.research.google.com/drive/1US1iQ6j5_ABdlY_UPdGg66FJ5kQsNHjw
Real_time_communication_powered_by_AI_for_specially_abled.ipy...
File Edit View Insert Runtime Tools Help All changes saved
Comment
Share
+ Code + Text
RAM
Disk
Editing
!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)
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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)
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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
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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
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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
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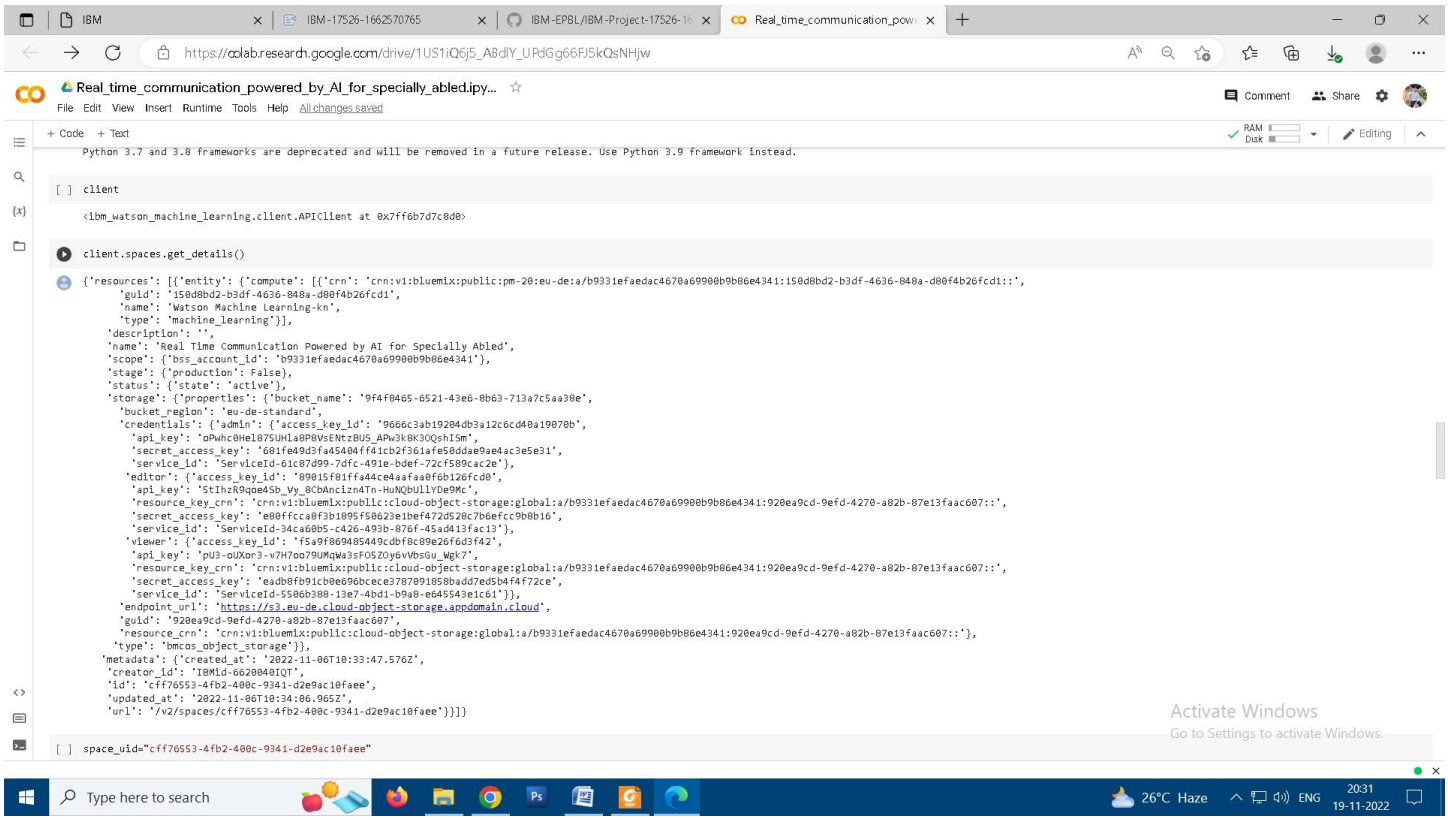
19-11-2022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Real_time_communication_powered_by_AI_for_specially_abled.ipy...
File Edit View Insert Runtime Tools Help All changes saved
Comment
Share
+ Code + Text
RAM
Disk
Editing
Python 3.7 and 3.8 frameworks are deprecated and will be removed in a future release. Use Python 3.9 framework instead.
client
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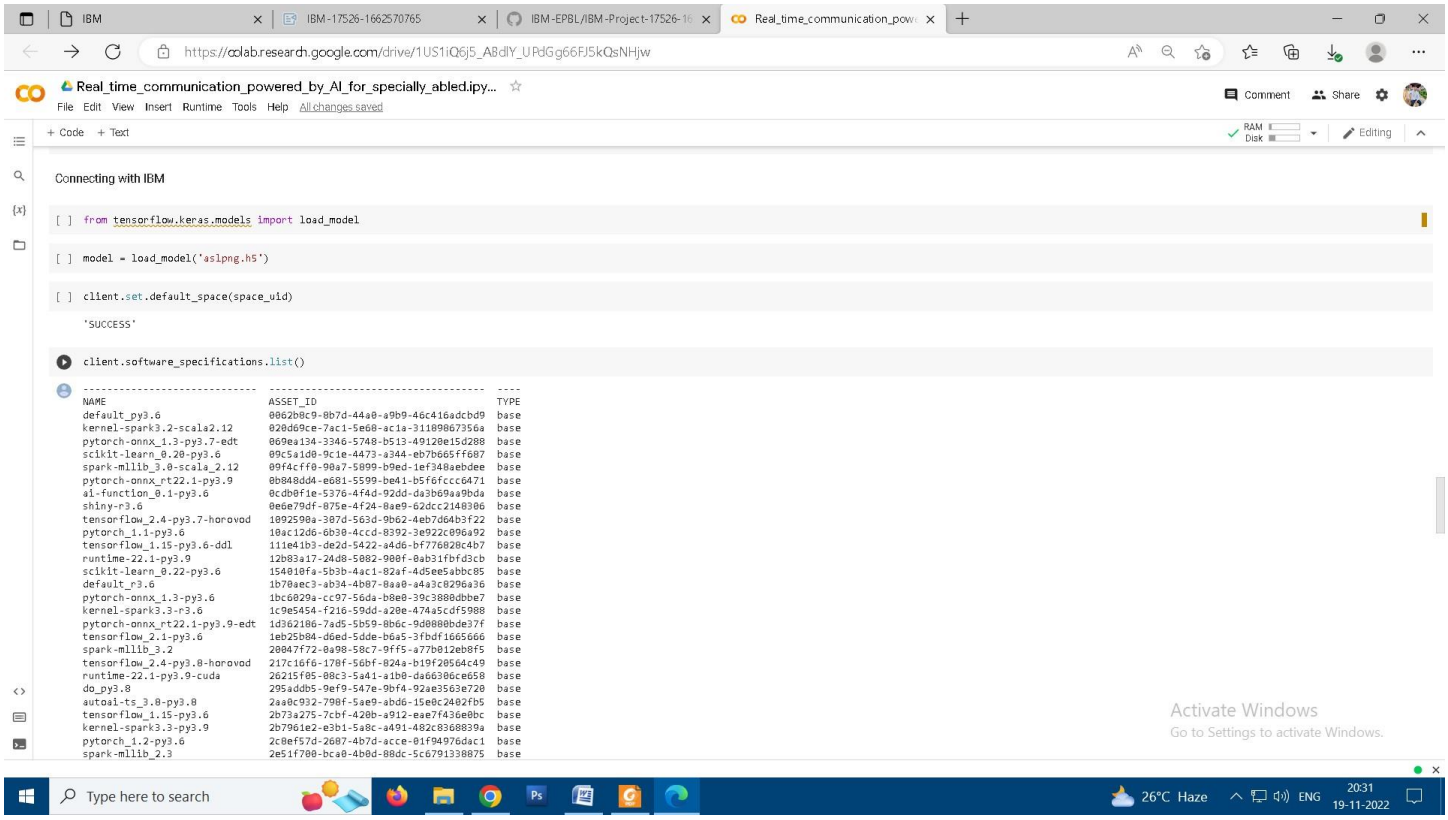
Activate Windows
Go to Settings to activate Windows.
Type here to search
26°C Haze
ENG
20:31
19-11-2022


IBM
IBM-17526-1662570765
IBM-EPBL/IBM-Project-17526-16
Real_time_communication_pow
https://colab.research.google.com/drive/1US1iQ6j5_ABdlY_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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+ Code + Text
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
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tensorflow_2.4-py3.7-horovod 1092590a-307d-563d-9b62-4eb7d64b3f22 base
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autoai-ts_3.8-py3.8 2aa0c932-798f-5ae9-abd6-15e0c2482fb5 base
tensorflow_1.15-py3.6 2b73a275-7cbf-420b-a912-eae7f436e0bc base
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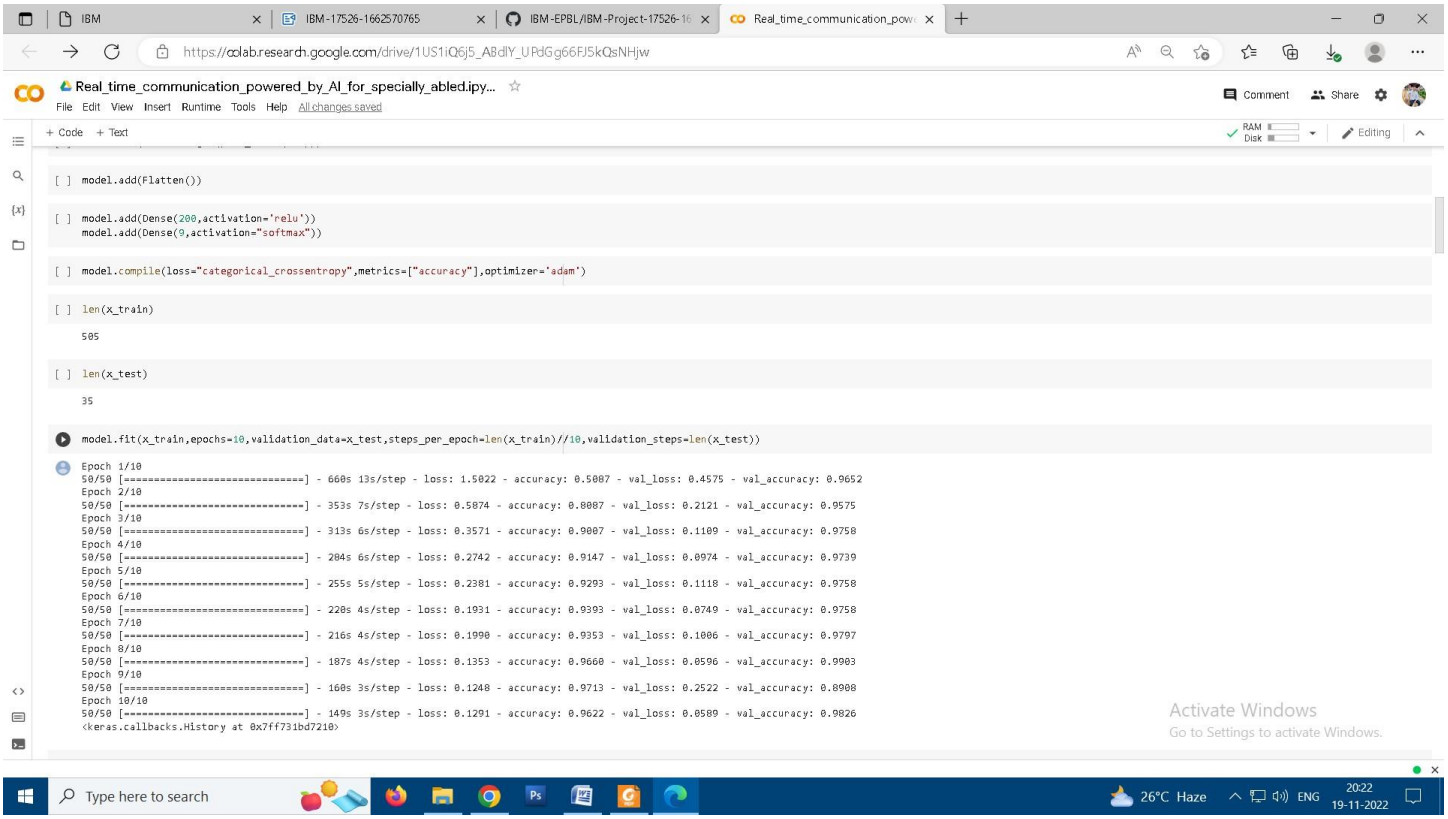
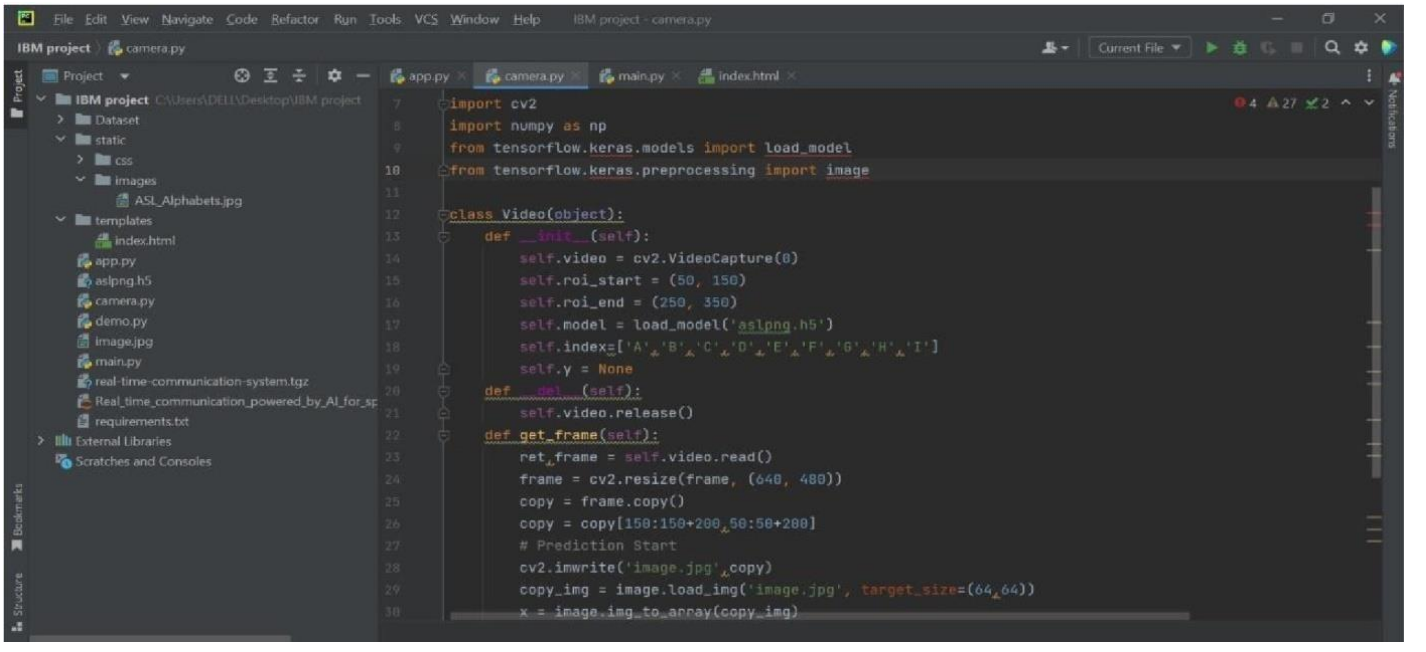
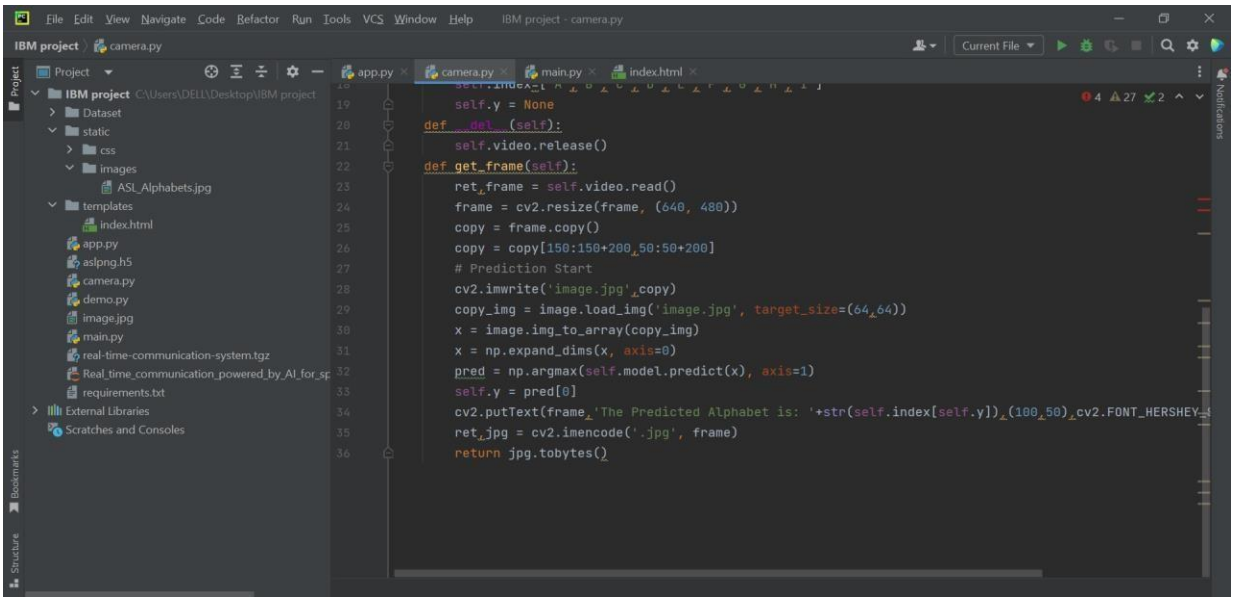
Activate Windows
Go to Settings to activate Windows.
Type here to search
26°C Haze
ENG
20:31
19-11-2022

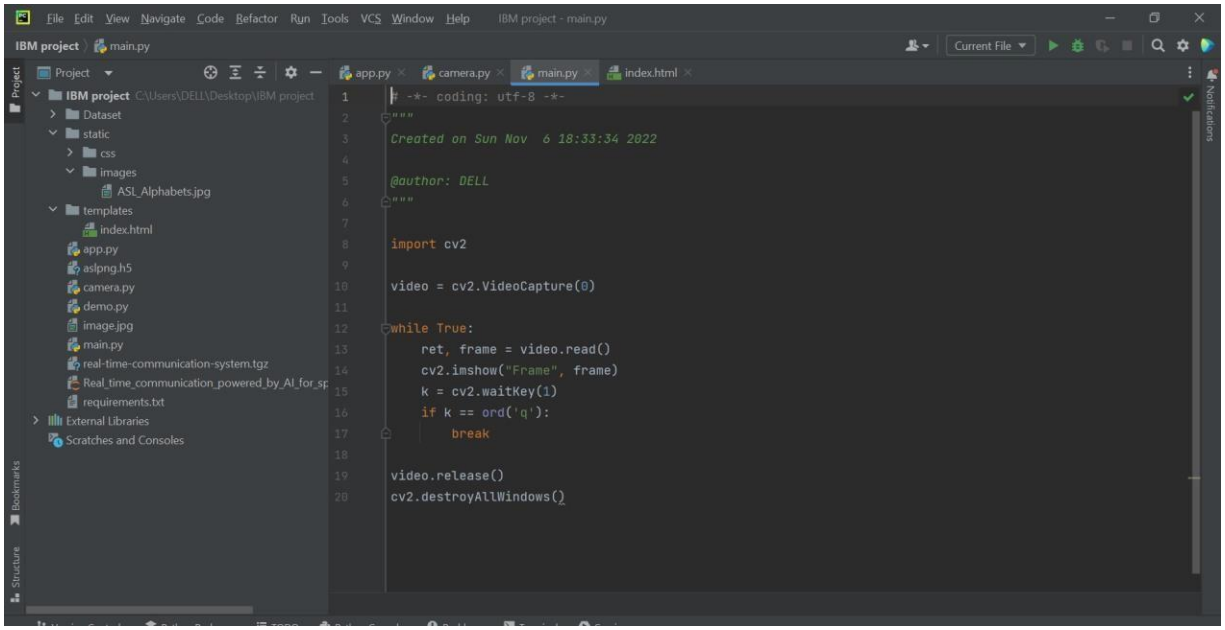


```
[ ] model.add(Flatten())

[ ] 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 [==============================] - 204s 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>
```



```
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-5797-1658816374.git