

Real-Time Communication System Powered by AI for Specially Abled

Submitted by

MANIKANDAN S

JAYACHANDIRAN M

GUNASEELAN MSV

HARSHAN J

TEAM ID: PNT2022TMID01339

TABLE OF CONTENTS

CHAPTER NO	TITLE
	1 INTRODUCTION
1	1.1 PROJECT OVERVIEW
	1.2 PURPOSE
	2 LITERATURE SURVEY
2	2.1 EXISTING PROBLEM
	2.2 REFERENCES
	2.3 PROBLEM STATEMENT DEFINITION
	3 IDEATION & PROPOSED SOLUTION
	3.1 EMPATHY MAP CANVAS
3	3.2 IDEATION & BRAINSTORMING
	3.3 PROPOSED SOLUTION
	3.4 PROBLEM SOLUTION FIT
	4 REQUIREMENT ANALYSIS
4	4.1 FUNCTIONAL REQUIREMENT
	4.2 NON FUNCTIONAL REQUIREMENT
	5 PROJECT DESIGN
5	5.1 DATA FLOW DIAGRAM
	5.2 SOLUTION & TECHNICAL ARCHITECTURE
	5.3 USER STORIES
	6 PROJECT PLANNING & SCHEDULING
6	6.1 SPRINT PLANNING & ESTIMATION
	6.2 SPRINT DELIVERY SCHEDULE
	6.3 REPORTS FROM JIRA
7	7 CODING & SOLUTIONING
	7.1 FEATURE 1
	8 TESTING
8	8.1 TEST CASES
	8.2 USER ACCEPTANCE TESTING

9	9 RESULTS
	9.1 PERFORMANCE METRICS
10	10 ADVANTAGES & DISADVANTAGES
11	11 CONCLUSION
12	12 FUTURE SCOPE
	13 APPENDIX
13	13.1 SOURCE CODE
	13.2 GITHUB & PROJECT DEMO LINK

1 INTRODUCTION

1.1 PROJECT OVERVIEW

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 time 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 are converted, to human-understandable language and speech is given as output.

1.2 PURPOSE

People with restricted physical mobility can benefit from AI technology. AI for Accessibility is a Microsoft program committed to empowering people living with disabilities. In order to support social inclusion for disabled people, Microsoft's AI for Accessibility program makes advantage of artificial intelligence's potential to create solutions to a variety of physical and mental obstacles that handicapped people encounter at work and in daily life. On the basis of this model, an app is created. With the help of this app, persons who are deaf or dumb can communicate using signs that are translated into speech and human-understandable words

2 LITERATURE SURVEY

2.1 EXISTING PROBLEM

Communication is the process of exchanging information from one person to another. It acts as the base for civilization in human beings. However, there are some people with disabilities, which affect their ability to communicate.

Some of the existing solutions for solving this problem are:

Technology

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

Just Speaking

Depending on the deaf person's level of hearing loss, they may be able to communicate with a blind person who is using speech. For example, a deaf person may have enough residual hearing (with or without the use of an assistive hearing device such as a hearing aid) to be able to decipher the speech of the person who is blind or has low vision. 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. Rajamohan, A., Hemavathy, R., and Dhanalakshmi, M., "Deaf-Mute Communication Interpreter", International Journal of Scientific Engineering and Technology, Vol.2, No.5, pp.336-341, 2013.
3. Verma, P., Shimi S. L. and Priyadarshani, R., "Design of Communication Interpreter for Deaf and Dumb Person", Vol.4, no.1, 2013

4. Van Rossum, G., "Python Programming Language", In Proceedings of USENIX Annual Technical Conference, Vol.41, No.36,2007.
5. Potdar, K., and Kinnerkar, R., "A Comparative Study of Machine Learning Algorithms applied to Predictive Breast Cancer Data", International Journal of Science and Research, Vol.5, No.9, pp. 1550-1553, 2016.
6. Havalagi, P., and Nivedita, S.U., "The Amazing Digital Gloves That Give Voice To The Voiceless", International Journal of Advances in Engineering & Technology, Vol.6, No.1, pp.471-480, 2013
7. 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.

2.3 PROBLEM STATEMENT DEFINITION

Why do we need a real time communication system for the specially-abled?

According to times new survey, they have mentioned that in the Indian population there are 30 percent of disabled people, and of that there are 20 percent of deaf and dumb. The only chance for their communication is through signed language but it is not possible that everyone studies the signed language. Technology has risen to unprecedented rates, which also comes with a leeway for the disabled people. With the help of Voice Conversion System with Hand Gesture and Translation Technology it will be very useful to have a proper conversation between a normal person and an impaired person in any language.

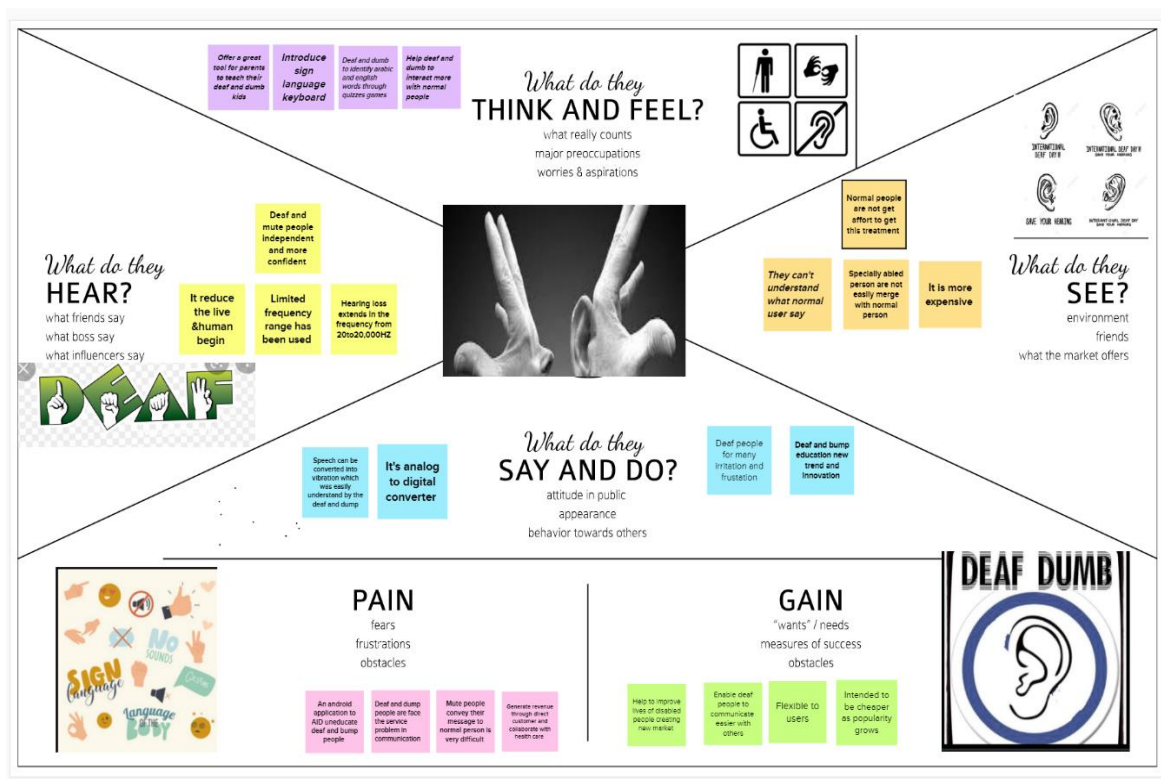
Our plan:

The aim of this project is to create the technology that does convert the sign language into text in real time so that the especially-abled people can easily understand the conversation between the normal person and the impaired person. We will be using deep learning model like CNN for this project. CNN is used for image classification and classifies that image into respective classes and does the object detection accordingly. An app is built which uses this model. This app enables the communication between normal people and deaf and dumb people using sign which converts the sign into human understandable language which gives the understanding between those people.

3 IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

Teams can utilize an empathy map as a collaborative tool to learn more about their clients. Below is the empathy map for our project.



3.2 IDEATION & BRAINSTORMING

Brainstorm, Idea Listing and Grouping:

Brainstorm is nothing but to suggest idea for the project before starting the project. The process of brainstorming can assist the group focus its ideas and find solutions.

You can start drafting proposals for upcoming research funding applications using project ideas. In this phase, you're gathering crucial project-related information and looking for collaborators, potential funders, budget information, and metadata linked to the project. You may also create tasks and distribute them to participants in the project.

A project group is an organizational grouping of projects. Administrative actions can affect multiple projects and users at once thanks to project groups.

2

Brainstorm

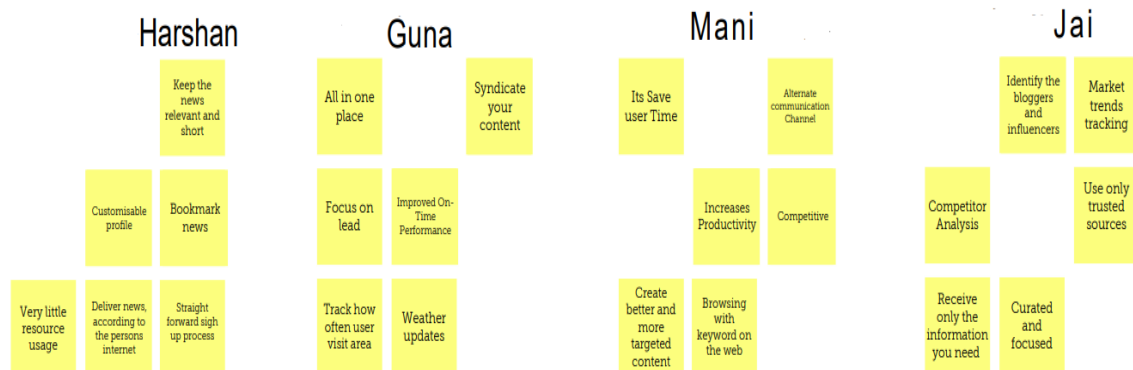
Write down any ideas that come to mind that address your problem statement.

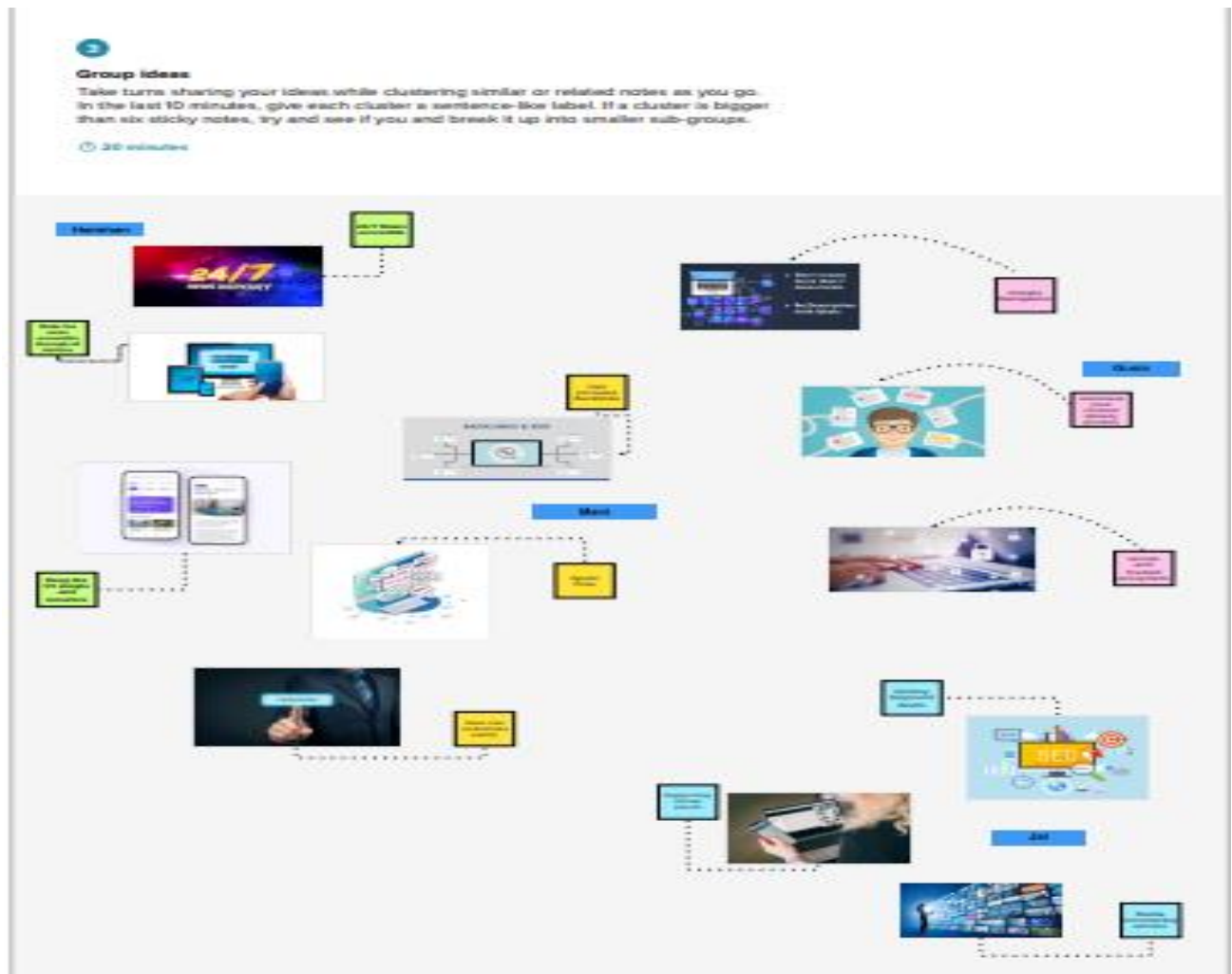
🕒 10 minutes

TIP



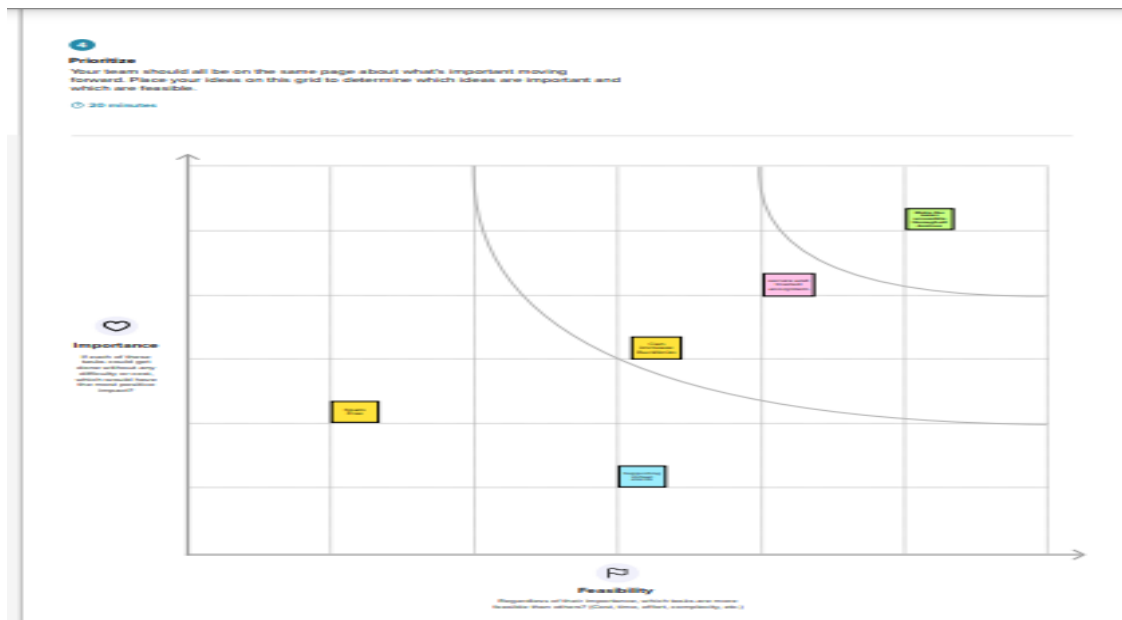
You can select a sticky note and hit the pencil [switch to sketch] icon to start drawing!





3.2.1 Idea prioritization

Idea prioritization only plays a little role in the idea management process. A methodical methodology to gathering, analyzing, and prioritizing new ideas as well as an organized idea management strategy take time to create.



3.3 PROPOSED SOLUTION

The technical solution that the implementation agency will present in response to the requirements and goals of the project is referred to as the proposed solution. The following is the project's suggested solution:

Proposed Solution:

S.NO.	PARAMETER	DESCRIPTION
1.	Problem Statement(problem to be solved)	<p>Statement-Communication between deaf-mute and a normal person has always been a challenging task.</p> <p>Description :It is very difficult for mute people to convey their message to normal people in emergency times as well as in normal times.</p>
2.	Idea/Solution Description	1.The ideas consisted of designing and implement a system using artificial intelligence, image processing and data mining concepts to take input as hand gestures.

		2. It generates recognizable outputs in the form of text and voice with 91% accuracy.
3.	Novelty/Uniqueness	<p>1.Artificial Intelligence developed the app called GnoSys uses neural networks and computer.</p> <p>2.It recognizes the video of sign language speaker,and then smart algorithms translate it into speech.</p>
4.	Social Impact/Cutomer Statisfication	<p>1.About two thirds of People with a mobility and dexterity disability are most likely to experience a great deal of difficulty with everyday activities.</p> <p>2.The main purpose of this application is to make deaf-mute people feel independent and more confident.</p>
5.	Business Model (Revenue Model)	1.AI can generate revenue through direct customers and collobrate with health care sector and generate revenue from their customers.
		2.B2B setting uses to employ deaf and mute employees can use to convey messages according to the company.

6.	Scalability Solution	<p>1.AI technology helping disabled people opens up new opportunities for accessibility inclusion in societyand independent living.</p> <p>2.It could unlock more advanced and innovative solutions for addressing the most complex challenges faced by disbled peoples.</p>
----	----------------------	--

3.4 PROBLEM SOLUTION FIT

Proposed solution fit is nothing but identify an existing problem and to solve it in with a solution that customers find useful and satisfying.

Define CS, fit into CC	1.CUSTOMER SEGMENT(S) Specially abled persons	6.CUSTOMER CONSTRAINTS A cochlear implant is an implanted electronic medical device that can produce useful hearing sensation by electrically stimulating nerves inside the inner ear.	5.AVAILABLE SOLUTIONS AI-voice-assisted technologies, like Echo, Google Home, Alexa, have created new means of accessibility for disabled people. As Artificial Intelligence takes an important role in communication and interaction, the use of this technology enables individuals with disabilities to access information much easier, all just by speaking to their devices.	Explore & S, differentiate
	2.JOBS-TO-BE-DONE / PROBLEMS Any denial of opportunity is not simply a result of bodily limitations. It is also down to the attitudinal, social, and environmental barriers facing disabled people.	9.PROBLEM ROOT CAUSE Disabilities affect the entire family. Meeting the complex needs of a person with a disability can put families under a great deal of stress — emotional, financial, and sometimes even physical. However, finding resources, knowing what to expect, and planning for the future can greatly improve overall quality of life.	7.BEHAVIOUR Directly related : D-Talk, sign language, message conversion, hand gesture, mental damage, difficulty to communicate. Indirectly associated : Empowered technology, completely paralyzed, noble cause, using sensors in day to day life, environmental threats affect their life difficulty in society.	Focus on J&P, tap into BE, understand RC
Identify strong TR & EM	3.TRIGGERS Persons using sensors, vibrators, neural networks are the things used for developing their communication, for the accessible language and to avoid long words that might be hard to understand.	10. YOUR SOLUTION AI powered solution stand to make a real difference for people with disabilities, supporting them in activities of daily living and enabling them to gain new skills. AI technology helping disabled people opens up new opportunities for accessibility, inclusion in society, and independent living that would otherwise be difficult or impossible to achieve.	8.CHANNELS of BEHAVIOURS 8.1 ONLINE Providing special Equipment to augment Educational services for them to improve their mind and mental health. They affected by social medias by using their part of things mostly.	Extract online & offline CHOICE
	4.EMOTIONS: BEFORE /AFTER They loss their confidence and they feel unlike whose have the inferiority complex to own		8.2 OFFLINE They mostly affected by going into our direct society i.e schools, colleges and workplace such things affect their life directly.	

4 REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

In software development and systems engineering, the desired operations of a program or system are referred to as functional requirements. Users cannot do their tasks without developers implementing certain features or functions into a product. Making them clear is essential for both the development team and the stakeholders. Functional requirements frequently describe the behaviour of a system in specific situations.

Functional Requirements:

Following are the functional requirements of the proposed solution.

FRNo.	Functional requirement(Epic)	Sub Requirement(Story/Sub-Task)
FR-1	User communication	User Must Know the Sign Language
FR-2	User communication	The user Has to communicate in Front of the Camera

4.2 NON-FUNCTIONAL REQUIREMENTS

Non-functional requirements list the core attributes of a system. Sometimes, people refer to them as characteristics. The system's usability, scalability, maintainability, and performance are among the characteristics that are defined. They serve as restrictions or limitations on how the system is built for the different backlogs.

Non-functional Requirements:

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

FRNo	Non-Functional Requirement	Description
NFR-1	Usability	The camera captures all expressions including facial expressions and hand gestures which can be easily used by all age groups.
NFR-2	Reliability	The system is very liable, it can last for long amounts of time if well maintained.
NFR-3	Performance	The cost-effective nature of the system makes it extremely liable and thus, efficient.
NFR-4	Availability	The solution fits all the sign languages when we train the model for all the sign languages. So, it is used by all the countries with different languages.
NFR-5	Scalability	The system gives output rapidly. It also predicts quickly when it gets so many inputs at a time. It predicts different types of sign language at a time.

5 PROJECT DESIGN

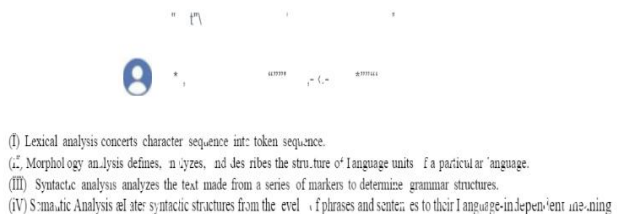
5.1 DATA FLOW DIAGRAMS

Data Flow Diagrams It demonstrates the many types of data that will be input into and exported from the system, as well as where the data will be stored. A DFD is frequently an expansion of a context diagram to reveal more of the system's finer details that were initially depicted by the context diagram.

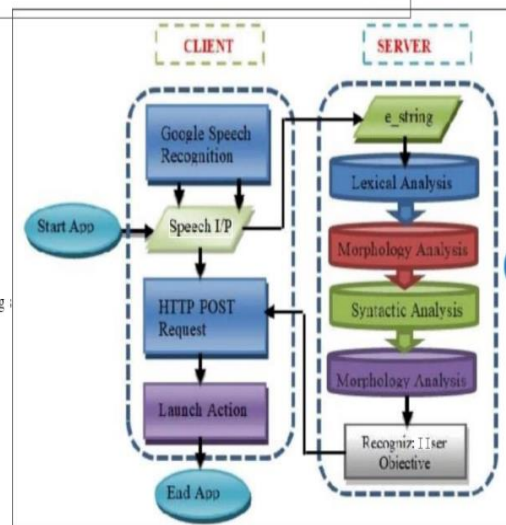
Data Flow Diagrams:

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

Example: [Simplified](#)



Example: Real time communication



5.2 SOLUTION & TECHNICAL ARCHITECTURE

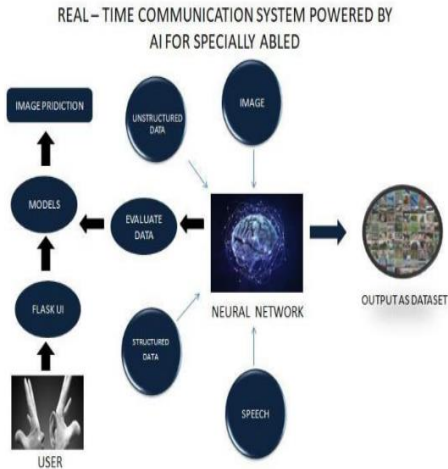
Technical Architecture:

The main system components, their connections, and the agreements that specify how the components interact are all included in the technical architecture. The objective of technical architects is to fulfil all business requirements with an application that is both performance- and security-optimized. creating the framework for technological systems. controlling the execution of programs. collaborating with the software development group to make sure the system functions properly.

Technical Architecture:

The Deliverable shall include the architectural diagram as below and the information as per the table 1 & table 2

Example: Specially Abled person convey their message to others

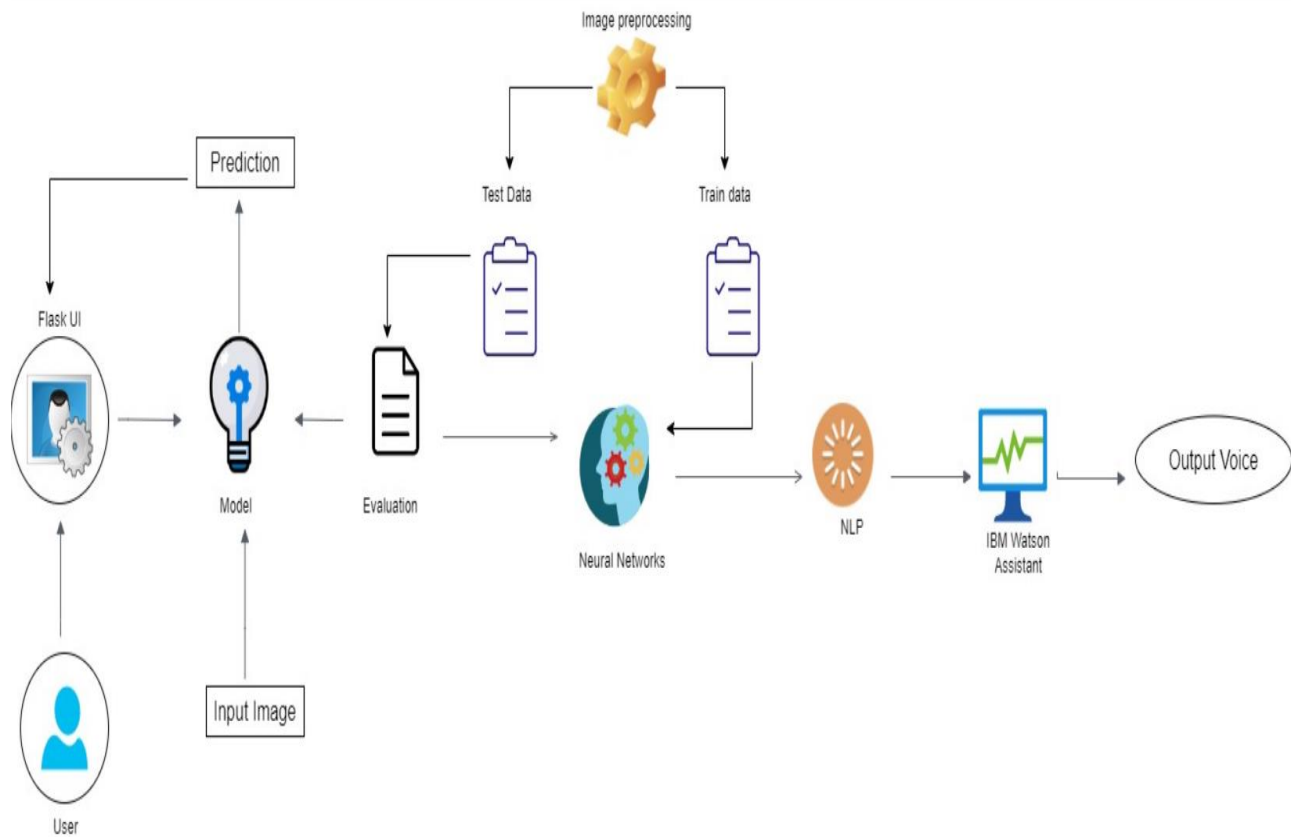


Guidelines:

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

Solution architecture:

Solution architecture lays the groundwork for software development activities by specifying the functional requirements and implementation phases of IT systems and tailoring them to specific business objectives. It is broken down into a variety of subprocesses, each of which is influenced by a distinct viewpoint on corporate architecture. It is possible to ensure that a new system will function properly in the existing business environment thanks to the solution architecture. In order to perform this function, a solution architect must be aware of how operating systems, application structures, and processes interact. The following describes the solution architecture for our project:



5.3 USER STORIES

An informal, comprehensive description of a software feature written from the client's or end user's perspective is known as a "user story." The purpose of a user story is to explain how a piece of work will give the client a particular value. The main benefit of employing user stories in agile product development may be that they are not designed to stand alone, unlike requirements or use cases. Instead, each user narrative serves as a pending topic for discussion with the development team.

User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Deaf people)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can registered my account.	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can received confirmation mail & click confirm.	High	Sprint-2
	Login	USN-3	As a user, I can log into the application through gmail.	I can registered & access the dashboard with gmail Login.	Low	Sprint-1
		USN-4	As a user, I can see my application and made change in any browsers.	I can login and see my Account at anywhere.	Medium	Sprint-2
	Dashboard	USN-5	As a user, I can create my account in a given dashboard.	I can access my account / Dashboard.	High	Sprint-1
Customer (Dumb people)	Registration	USN-6	As a User, I can register my application through gmail.	I can registered my account	High	Sprint-2
		USN-7	As a User, I can receive confirmation mail and get verification code from OTP and gmail.	I can received confirmation mail & click confirm.	Low	Sprint-2
	Login	USN-8	As a User, I can log into my account by any web browsers.	I can login and see my account.	Medium	Sprint-1
	Dashboard	USN-9	As a User, I can create my account in a given Dashboard.	I can created my account & access into dashboard.	High	Sprint-2

6 PROJECT PLANNING & SCHEDULING

6.1 SPRINT PLANNING & ESTIMATION

In the scrum process, sprint planning marks the beginning of the sprint. Sprint planning's goal is to specify what can be completed in a sprint and how it will be done. The entire scrum team collaborates on sprint planning.

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

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	10	6 Days	24 Oct 2022	29 Oct 2022	8	29 Oct 2022
Sprint-2	10	6 Days	31 Oct 2022	04 Nov 2022	5	04 Nov 2022
Sprint-3	10	6 Days	07 Nov 2022	11 Nov 2022	7	11 Nov 2022
Sprint-4	10	6 Days	14 Nov 2022	18 Nov 2022	5	18 Nov 2022

Velocity:

$$AV = \frac{\text{sprint duration}}{\text{velocity}}$$

$$AV = 6/10 = 0.6$$

6.2 SPRINT DELIVERY SCHEDULE

A sprint schedule is a written description of the entire sprint planning process. It's one of the initial steps in the agile sprint planning process, and it calls for sufficient investigation, preparation, and coordination. It centres on a product backlog, which is a list of open requests for development and iteration.

A burndown chart, which displays how rapidly a team is progressing through a customer's user stories, is a project management chart. This agile tool records the description of a feature from the viewpoint of the end user and compares the overall effort to the quantity of work for each agile sprint.

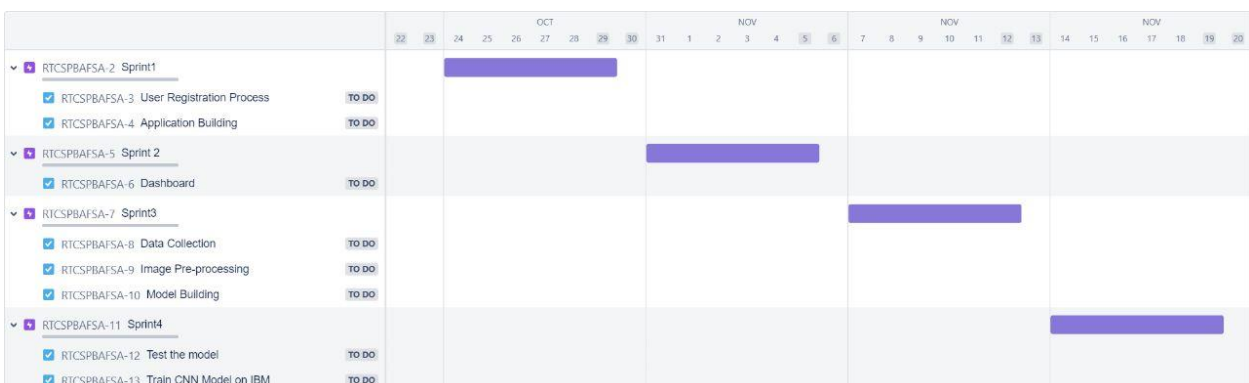
Product Backlog, Sprint Schedule, and Estimation

Team Lead: Manikandan S

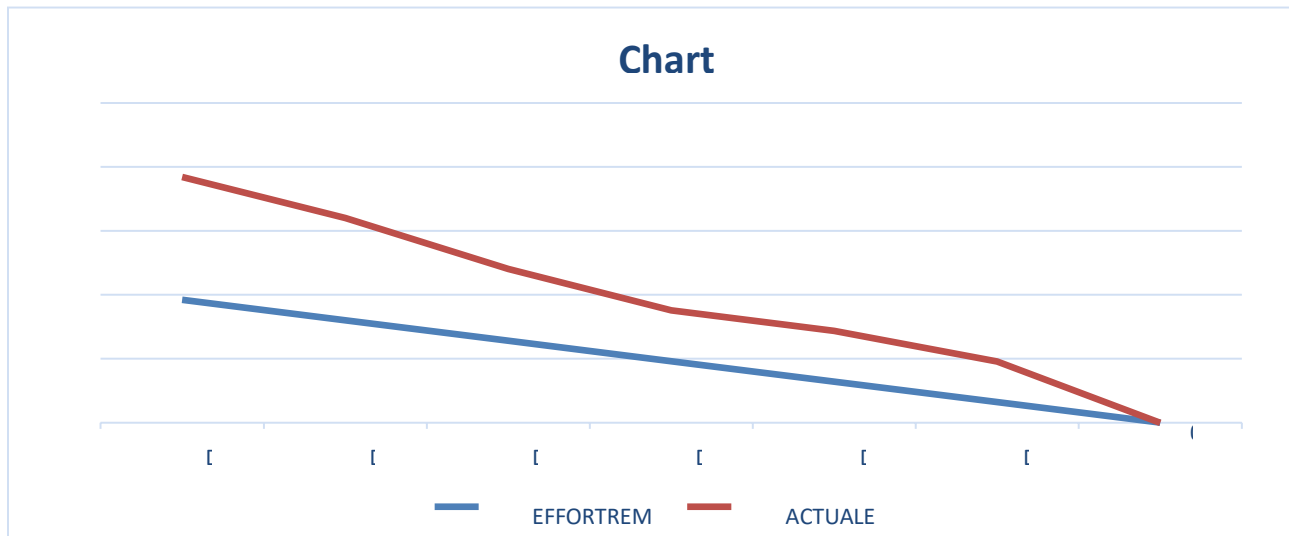
Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data Collection	USN-1	Collect Dataset	9	High	Manikandan S Gunaseelan MSV
Sprint-1		USN-2	Image preprocessing	8	Medium	Harshan J Jayachandiran M
Sprint-2	Model Building	USN-3	Import the required libraries, add the necessary layers and compile the model	10	High	Manikandan S Gunaseelan MSV
Sprint-2		USN-4	Training the image classification model using CNN	7	Medium	Manikandan S Gunaseelan MSV
Sprint-3	Training and Testing	USN-5	Training the model and testing the model's performance	9	High	Harshan J Jayachandiran M
Sprint-4	Implementation of the application	USN-6	Converting the input sign language images into English alphabets	8	Medium	Manikandan S Gunaseelan MSV

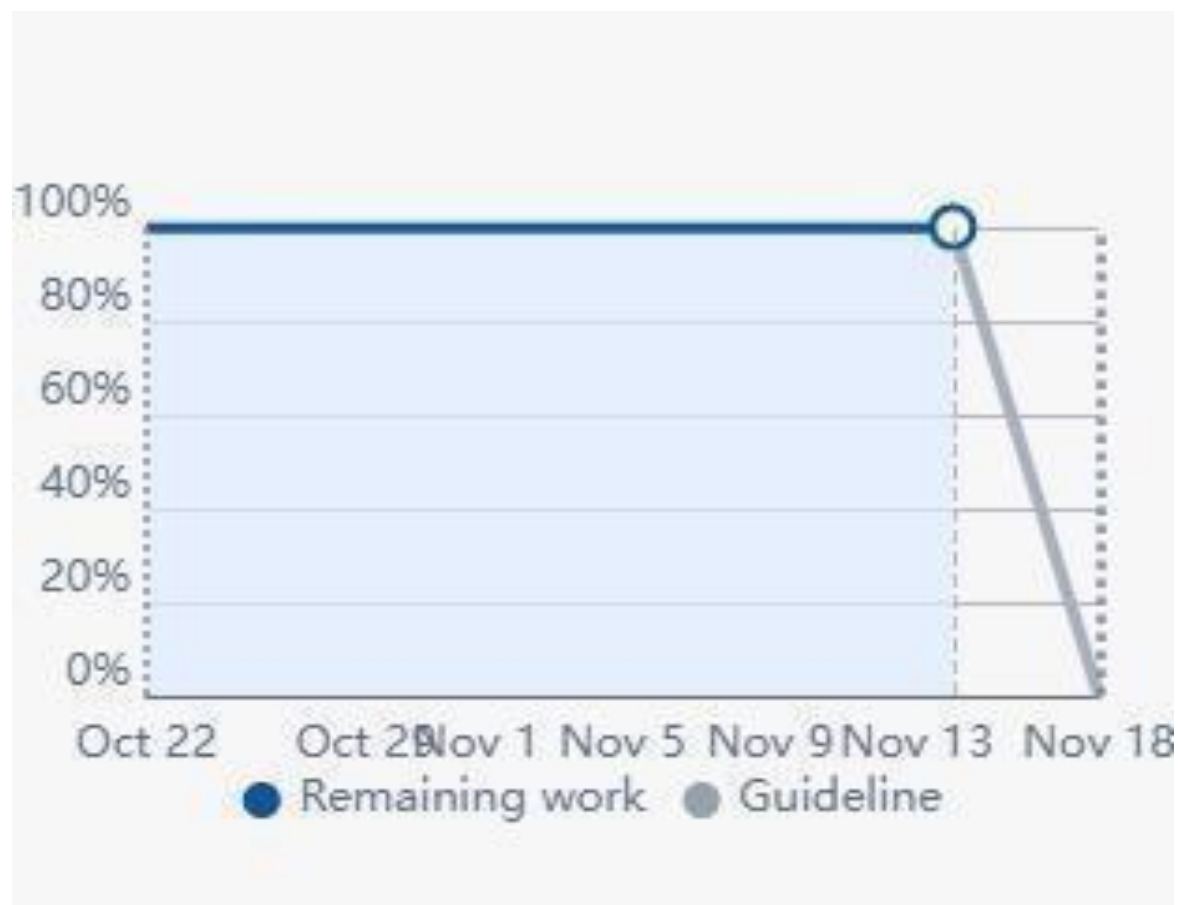
6.3 REPORTS FROM JIRA



Burn down Chart



Sprint Burn down chart



7 CODING & SOLUTIONING (Explain the features added in the project along with code)

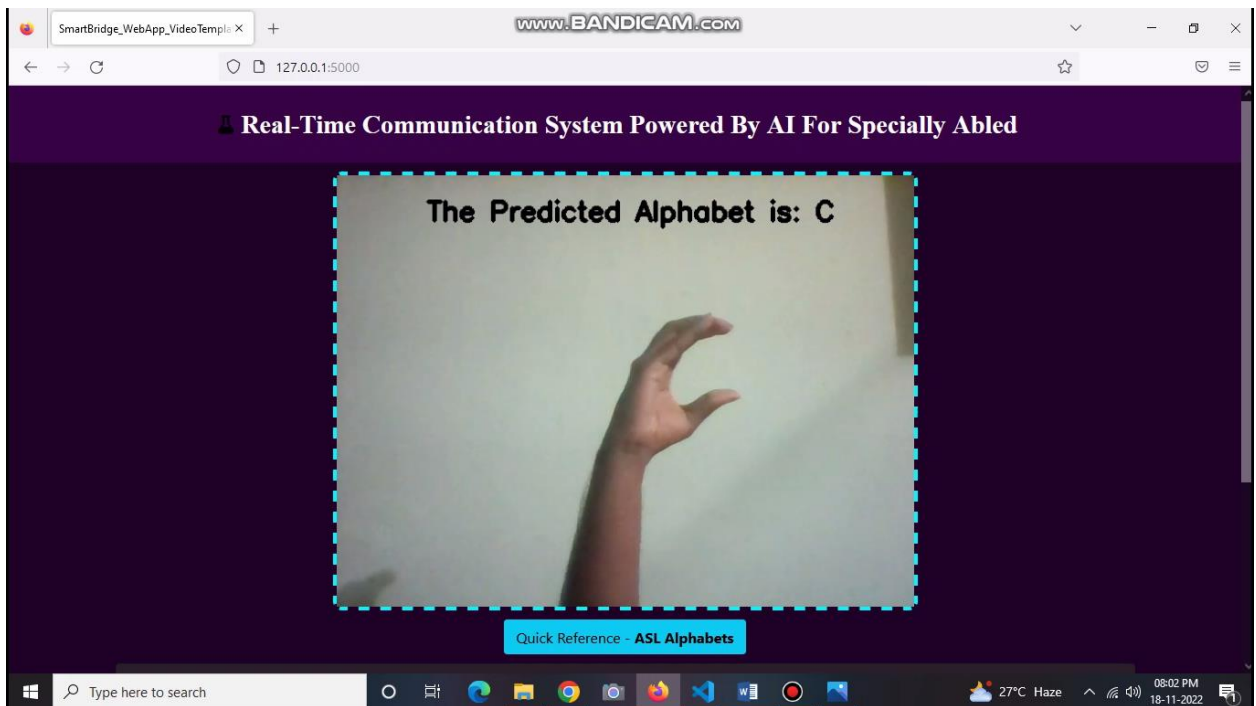
7.1 FEATURE

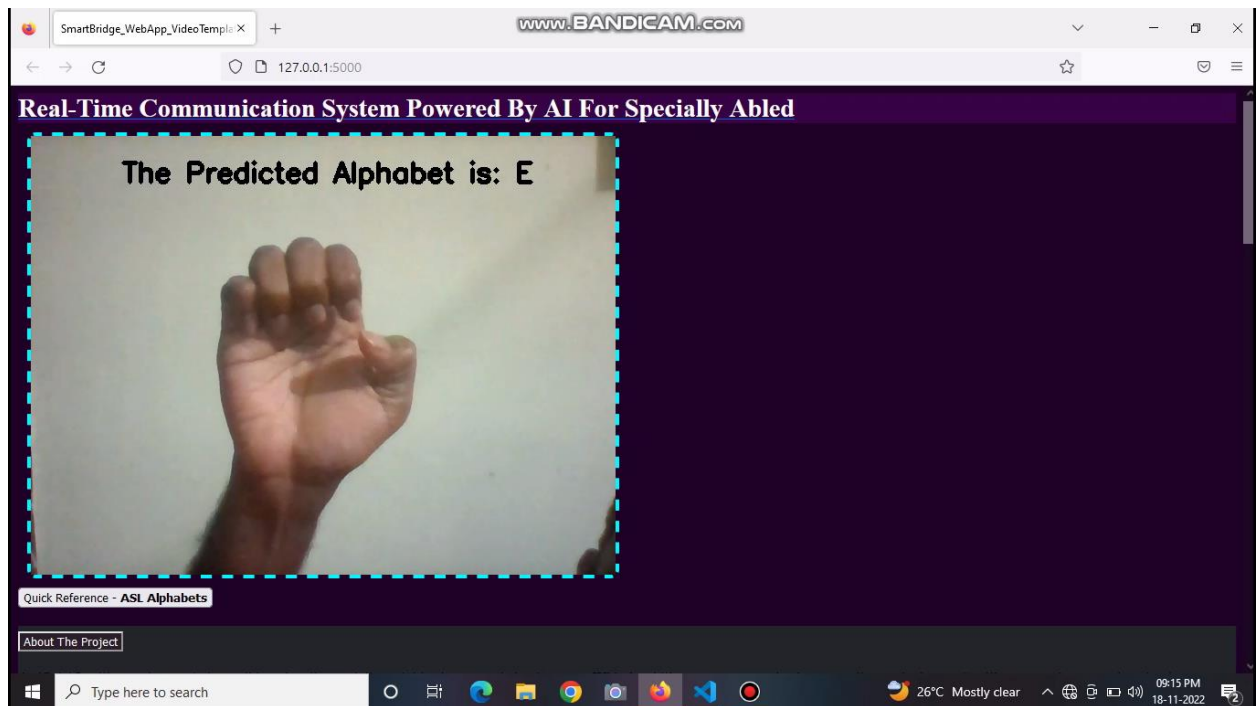
Language plays a vital role in the communication of ideas, thoughts, and information to others. Hearing-impaired people also understand our thoughts using a language known as sign language. Every country has a different sign language, which is based on their native language. In our research paper, our major focus is on Indian Sign Language, which is mostly used by hearing, and speaking-impaired communities in India. While communicating our thoughts and views with others, one of the most essential factors is listening. What if the other party is not able to hear or grasp what you are talking about? Nearly every hearing-impaired person in our society faces this situation. This led to the idea of introducing an audio to Indian Sign Language translation system, which can erase this gap in communication between hearing-impaired people and society. The system takes a live video feed as input, then retrieves the input image from the video and then trains the model using CNN and ANN. Here, the input image goes through a convolution layer, then it goes through a pooling layer and a flattening layer in the process of CNN. Then it goes through the fully connected layer or ANN for mathematical calculation. Here, we use relevant activation functions to get the output. The heart of the system is natural language processing, which equips the system with tokenization, parsing, lemmatization, and part-of-speech tagging.

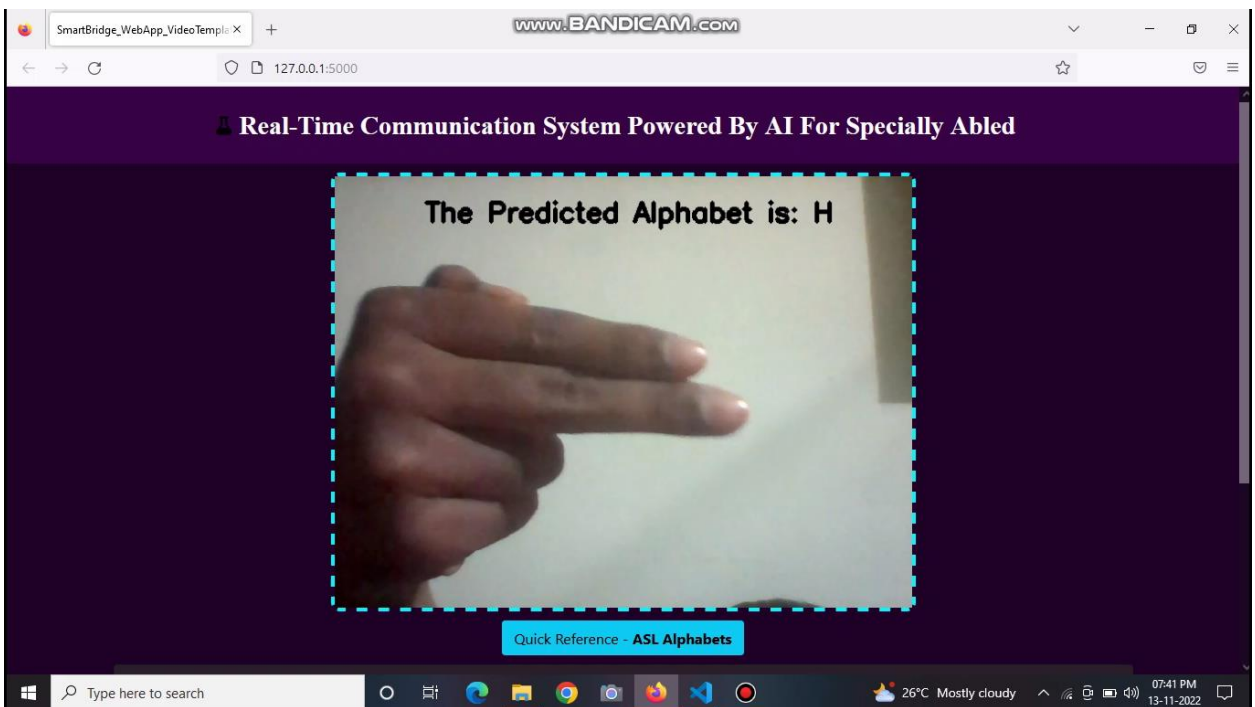
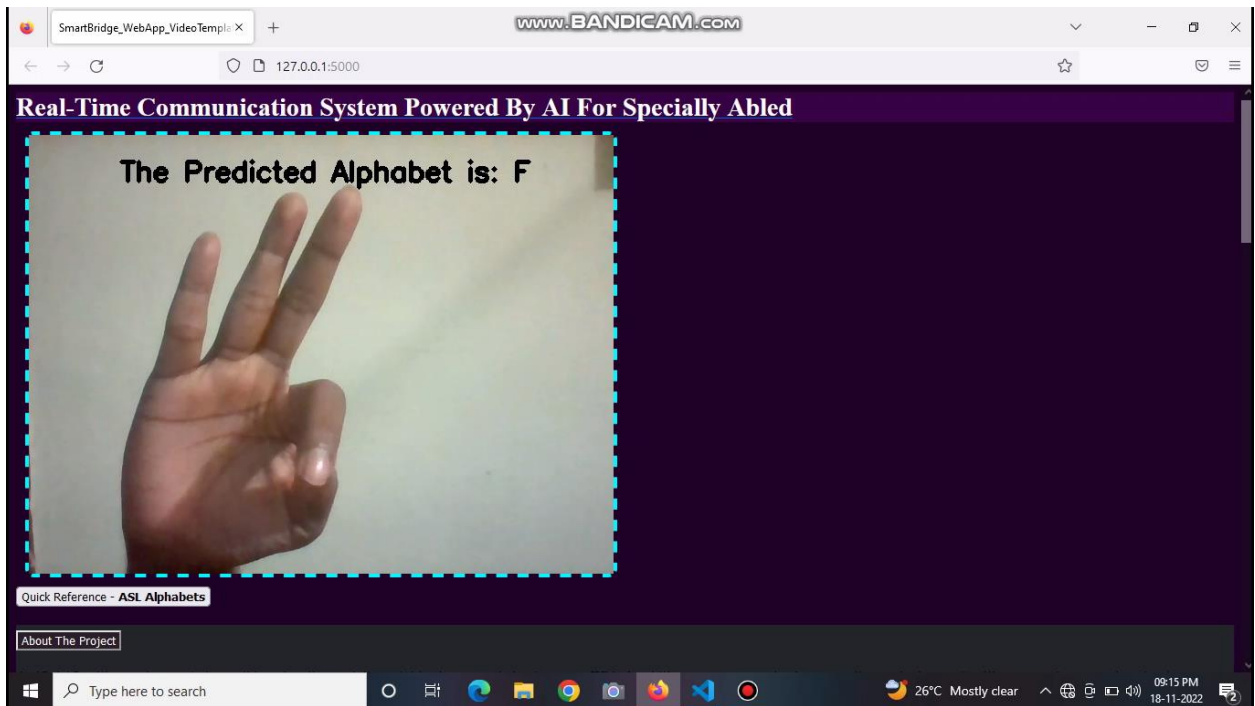
8 TESTING

8.1 TEST CASES

Here are some of the sample screenshots provided below whether this software has predicted the output and successfully run the test cases.







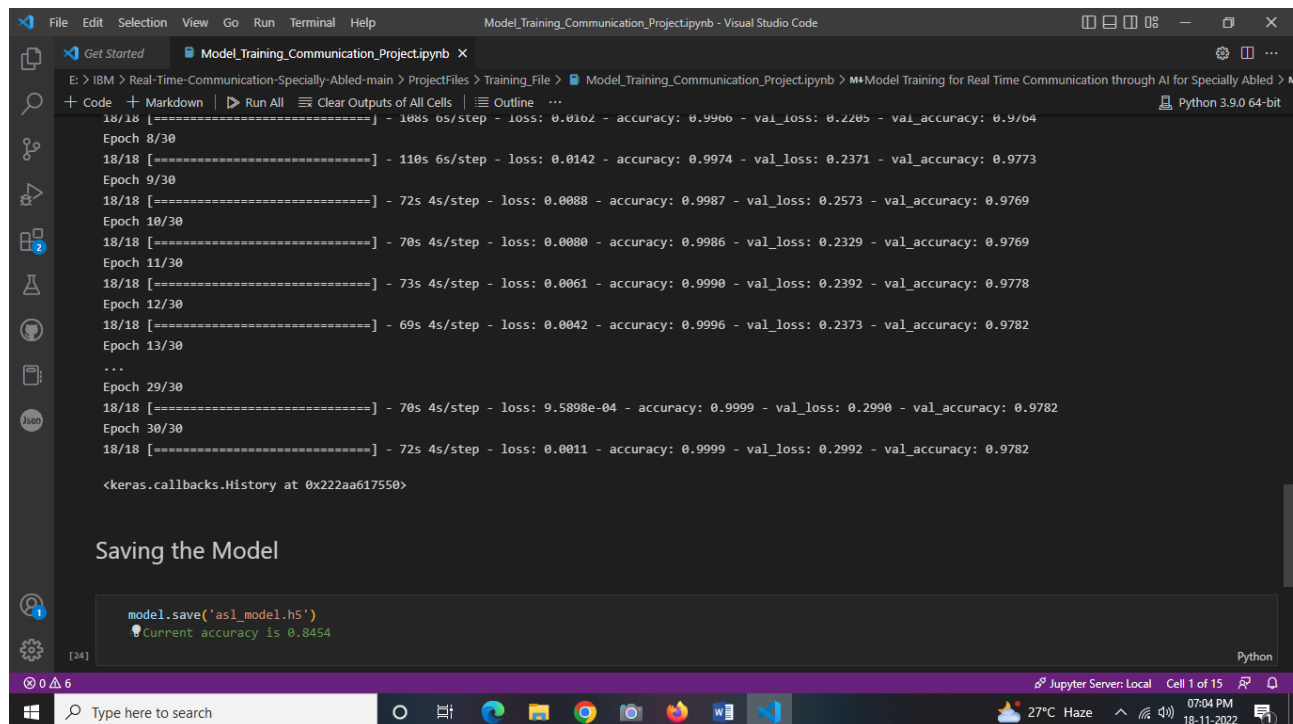
8.2 USER ACCEPTANCE TESTING

User Acceptance Testing (UAT), which is performed on most UIT projects, sometimes called beta testing or end-user testing, is a phase of software development in which the intended audience or business representative tests the software in the “real world”.

9 RESULTS

9.1 PERFORMANCE METRICS

The dataset is provided for the alphabets A to I. The accuracy of the model is 84.5% approx. is an improvement of the existing models as the performance of the model can be improved in such a way that the model predicts the alphabets more accurately and thus the performance of the model is improved.



The screenshot displays a Jupyter Notebook interface within a Visual Studio Code environment. The notebook is titled 'Model_Training_Communication_Project.ipynb'. The main content area shows the output of a training process, including epoch numbers, loss, accuracy, and validation loss/accuracy. The training progress is as follows:

Epoch	Loss	Accuracy	Val Loss	Val Accuracy
8/30	0.0102	0.9900	0.2205	0.9704
9/30	0.0142	0.9974	0.2371	0.9773
10/30	0.0088	0.9987	0.2573	0.9769
11/30	0.0080	0.9986	0.2329	0.9769
12/30	0.0061	0.9990	0.2392	0.9778
13/30	0.0042	0.9996	0.2373	0.9782
29/30	9.5898e-04	0.9999	0.2990	0.9782
30/30	0.0011	0.9999	0.2992	0.9782

Below the training output, the text 'Saving the Model' is visible. The final cell of the notebook contains the code `model.save('as1_model.h5')` and a message indicating the current accuracy is 0.8454. The bottom status bar shows the Jupyter Server is running locally, and the system clock indicates 07:04 PM on 18-11-2022.

10 ADVANTAGES & DISADVANTAGES

Advantages:

1 It is possible to create a mobile application to bridge the communication gap between deaf and dumb persons and the public.

2.As different sign language standards exist, their dataset can be added, and the user can choose which sign language to read.

Disadvantages:

- 1.The current model only works from alphabets A to I.
- 2.In absence of gesture recognition, alphabets from J cannot be identified as they require some kind of gesture input from the user.
- 3.As the quantity/quality of images in the dataset is low, the accuracy is not great, but that can easily be improved by change in dataset.

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. A convolution neural network is being used to build a model that is trained on various hand motions. Based on this model, an app is created. With the help of this app, persons who are deaf or dumb can communicate using signs that are translated into speech and human-understandable words.

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 'T', digits and other symbols and gesture recognition can allow controlling of software/hardware interfaces.

As future enhancements, we can add NLP in this project. We can provide voice as input Converts it into text using natural language processing and natural language toolkit then we can preprocess the text into numeric and process it using dense layer to predict the alphabet using the pre trained model.

13 APPENDIX

13.1 SOURCE CODE

Model_Training_Communication.ipynb

```
from tensorflow.keras.preprocessing.image import ImageDataGenerator
# Training Datagen
train_datagen =
ImageDataGenerator(rescale=1/255,zoom_range=0.2,horizontal_flip=True,vertical_flip=False)
# Testing Datagen
test_datagen = ImageDataGenerator(rescale=1/255)
# Training Dataset
x_train=train_datagen.flow_from_directory(r'E:\IBM\Real-Time-Communication-Specially-Abled-
main\ProjectFiles\Dataset\training_set',target_size=(64,64), class_mode='categorical',batch_size=900)
# Testing Dataset
x_test=test_datagen.flow_from_directory(r'E:\IBM\Real-Time-Communication-Specially-Abled-
main\ProjectFiles\Dataset\test_set',target_size=(64,64), class_mode='categorical',batch_size=900)
print("Len x-train : ", len(x_train))
print("Len x-test : ", len(x_test))
# The Class Indices in Training Dataset
x_train.class_indices
# Importing Libraries
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Convolution2D,MaxPooling2D,Flatten,Dense
# Creating Model
model=Sequential()
# Adding Layers
model.add(Convolution2D(32,(3,3),activation='relu',input_shape=(64,64,3)))
model.add(MaxPooling2D(pool_size=(2,2)))
model.add(Flatten())
# Adding Hidden Layers
model.add(Dense(300,activation='relu'))
model.add(Dense(150,activation='relu'))
# Adding Output Layer
model.add(Dense(9,activation='softmax'))
# Compiling the Model
model.compile(loss='categorical_crossentropy',optimizer='adam',metrics=['accuracy'])
import scipy
# Fitting the Model Generator
model.fit(x_train,steps_per_epoch=len(x_train),epochs=30,validation_data=x_test,validation_steps=len(x
_test))
model.save('asl_model.h5')
# Current accuracy is 0.8454
```

App.py

```
from camera import Video
from flask import Flask, Response, render_template
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()
```

Camera.py

```
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(r'E:\IBM\Real-Time-Communication-Specially-Abled-
main\ProjectFiles\Flask\asl_model.h5')
        # Execute Local Trained Model
        # self.model = load_model('IBM_Communication_Model.h5') # Execute IBM
Trained Model
        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)
        x = np.expand_dims(x, axis=0)
        pred = np.argmax(self.model.predict(x), axis=1)
        self.y = pred[0]
        cv2.putText(frame,'The          Predicted          Alphabet          is:
'+str(self.index[self.y]),(100,50),cv2.FONT_HERSHEY_SIMPLEX,1,(0,0,0),3)
        ret,jpg = cv2.imencode('.jpg', frame)
        return jpg.tobytes()

```

Main.py

```

import cv2
video = cv2.VideoCapture(0)
while True:
    ret, frame = video.read()

```

```

        cv2.imshow("Frame", frame)
        k = cv2.waitKey(1)
        if k == ord('q'):
            break
    video.release()
    cv2.destroyAllWindows()

```

Index.html

```

<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="utf-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0, shrink-to-fit=no">
    <title>SmartBridge_WebApp_VideoTemplate</title>
    <link rel="stylesheet"
href="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/css/bootstrap.min.css">
    <link rel="stylesheet" href="https://use.fontawesome.com/releases/v5.12.0/css/all.css">
    <link rel="stylesheet" href="assets/css/Banner-Heading-Image.css">
    <link rel="stylesheet" href="assets/css/Navbar-Centered-Brand.css">
    <link rel="stylesheet" href="assets/css/styles.css">
</head>
<body style="background: rgb(29, 1, 37);">
    <nav class="navbar navbar-light navbar-expand-md py-3" style="background: rgb(54, 2, 68);">
        <div class="container">
            <div></div><a class="navbar-brand d-flex align-items-center" href="#"><span
                class="bs-icon-sm bs-icon-rounded bs-icon-primary d-flex justify-content-center align-items-center me-2 bs-icon"><i
                    class="fas fa-flask"></i></span><span style="color: rgb(255, 255, 255); font-size: 28px; font-weight: bolder ;font-family: 'Times New Roman', Times, serif;">Real-Time
Communication

```

System Powered By AI For Specially Abled

<div></div>

</div>

</nav>

<section>

<div class="d-flex flex-column justify-content-center align-items-center">

<div class="d-flex flex-column justify-content-center align-items-center" id="div-video-feed"

style="width: 640px;height: 480px;margin: 10px;min-height: 480px;min-width: 640px;border-radius: 10px;border: 4px dashed rgb(7, 245, 253) ;">

</div>

</div>

<div class="d-flex flex-column justify-content-center align-items-center" style="margin-bottom: 10px;"><button

class="btn btn-info" type="button" data-bs-target="#modal-1" data-bs-toggle="modal">Quick Reference

- ASL Alphabets</button></div>

</section>

<section>

<div class="container">

<div class="accordion text-white" role="tablist" id="accordion-1">

<div class="accordion-item" style="background: rgb(33,37,41);">

<h2 class="accordion-header" role="tab"><button class="accordion-button" data-bs-toggle="collapse"

data-bs-target="#accordion-1 .item-1" aria-expanded="true"

aria-controls="accordion-1 .item-1"

style="background: rgba(77, 2, 43, 0.185);color: rgb(255,255,255);">About
The Project</button></h2>

```
<div class="accordion-collapse collapse show item-1" role="tabpanel" data-bs-parent="#accordion-1">
```

```
<div class="accordion-body">
```

```
<p class="mb-0">Artificial Intelligence has made it possible to handle our daily activities in new and simpler ways. With the ability to automate tasks that normally require human intelligence, such as speech and voice recognition, visual perception, predictive text functionality, decision-making, and a variety of other tasks, AI can assist people with disabilities by significantly improving their ability to get around and participate in daily activities.<br><br>Currently, Sign Recognition is available <strong>only for alphabets A-I</strong> and not for J-Z, since J-Z alphabets also require Gesture Recognition for them to be able to be predicted correctly to a certain degree of accuracy.</p>
```

```
</div>
```

```
</div>
```

```
</div>
```

```
<div class="accordion-item" style="background: rgb(33,37,41);">
```

```
<h2 class="accordion-header" role="tab"><button class="accordion-button collapsed" data-bs-toggle="collapse" data-bs-target="#accordion-1 .item-2" aria-expanded="false"
```

```
aria-controls="accordion-1 .item-2" style="background: rgb(48, 39, 46);color: rgb(231,241,255);">Developed By</button></h2>
```

```
<div class="accordion-collapse collapse item-2" role="tabpanel" data-bs-parent="#accordion-1">
```

```
<div class="accordion-body"><p class="mb-0">Students at Panimalar Engineering College during IBM project nalaiyathiran
```

```
Program.<br><br>1. <strong>MANIKANDAN S</strong> 2019PECIT286
```

```
<br>2.
```


13.2 GITHUB & PROJECT DEMO LINK

Github Project Files link

<https://github.com/IBM-EPBL/IBM-Project-5240-1658752241>

Project Demonstration Link

<https://drive.google.com/file/d/1k5JQYDa-ITCYLPY57srULPCXfc7xOjdB/view?usp=sharing>