REAL-TIME COMMUNICATION SYSTEM POWERED BY AI
FOR SPECIALLY ABLED

Bachelor of Engineering

in

Computer Science and Engineering

Submitted by

TEAM ID:PNT2022TMID23704

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ELAYAMPALAYAM,TIRUCHENGODE

Project Report Index

1.INTRODUCTION:
1.1 Project Overview:

      Communication plays a significant role in making the world a better place.Communication creates bonding and relations among the people,where persona, social,or to diasability.They cannot hear or speak,which makes Earth a problematic place to live for them,Even simple basic tasks become difficult for them.Disability is an emotive human condition.It limits the individual to a certain level of Performance.Being deaf and dumb pushes the subject to oblivion,highly introverted.In a world of inequality,this Society needs empowerment. Hamessing technology to improve thier welfare is necessary.In a tech era,no one should be limited due to his or her inability.The application of technology should create a platform or a world equality despite the natural state of humans.On the other hand,technology is the most innovative thing on Earth for every time the clock ticks,researches,software engineers, programmers, and

information technology specifalists are always coming up with bright ideas to provide convenience to everyone.This paper shows how artificial intelligence is being used to help people who unable to do what most peopledo in their everyday lives.Aligned with communication,D-talk is a system that allows people who are unable to talk and hear be fully understood and for them to learn their language easier and also for the people that would interact and communicate with them.This system provides detailed hand research allows the readers to learn the system and what it can do to people who are struggling with what they are nit capable of and will provide the technical terms on how the system works

1.2 Purpose :

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 the people.Communications between deaf - mute and 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 people and an impaired person in any language.The project aims to develop a system that converts the sign people,as well as convert speech into understandable sign language for 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 build 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 :

2.1 Existing Problem:

One of the most precious gifts of nature to the human race is the ability to express itself by responding to the events that occur in its environment.Every normal person sees,hears,and then reacts to the situvations by expressing himself.But there are some less lucky ones who are deprived of this precious gift.Such people ,especially seaf and mute,rely on some sort of gesture language to communicate thier feelings to others.The deaf,dumb and the blind follow similar problems when it comes to the use of computers.In the era of advanced technologies,where computers,laptop and other processor-based devices are an integral part of everyday life,efforts must be made to make the disabilities in the life more independent.Our goal is to design a human computer interface system that can accurately identify the language of the deaf , dumb and the blind follow similiar problems when it comes to the use of computers.In the era of advanced technologies ,where computers,laptops and other processor-based devices are an integral part of everyday life,effort must be made to make the disabilities in life more independent.Our goal is to design a human computer interface system that can accurately identify the language of deaf and dumb.with the use of image processing and artificial intelligence, many techniques and algorithms have been developed in this area.Each character speech recognition system is trained to recognize the characters and convert them into required pattern . The proposed system aims to give speech speechless ,a real-time characts language is captured as a series of images,and it is processed and then coverted into speech and text

2.2 References

1)A singer Independent sign Language Recognintion with Coarticulation Elimination from Live Videos: an Indian scenario P.K Athira,C.J

Sruthi,A.Lijiya(2019)
Advantage:Economical can be implemented with a mobile camera which makes it very user-friendly
Disadvantage:Not efficient under cluttered backgrounds and different illumination conditions

  2)A Deep Learning based Indian sign Language Recognition System Sruthi C.J and Lijiya A (2019)
    Advantage:Training accuracy of 99.93% and with testing and validation accuracyof 98.64%
    Disadvantage:Facial expression and context analysis are the other part not included

3)Hand Gesture Recognition for sign Language Using 3DCNN Muneer Al Hammadi, Ghulam Muhammad, Wadood Abdul,Mansour Alsulaiman,Mohamed A. Bencherif,And Mohamed Amine Mekhtiche (2020)
Advantage: The proposed approaches were compared with six other state - of-the art method from the literature. They outperformed four of these methods and showed comparable performance to the other two.
Disadvantage:Does not work for a live video feed.

2.3 Problem statement Definition

Communicate is the only medium by which we can share our thoughts or convey the message but communicate between deafmute 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 languge.In emergency times conveying thier message is very difficult.

Problem:

The boy has difficulty in hearing.He uses sign language to communicate with others.But he can't able to communicate with normal people who don't understand sign language.

Solution:

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 converrt speech into understandaable sign language for the deaf,the system enhances the user friendly experience.

Problem:

karupan is a dumb by birth .He uses sign language to communicate with others. but he can't able to communicate with normal people who don't understand sign language.

Solution:

To create a app for understanding sign language and convert into Speech signal as output for normal people
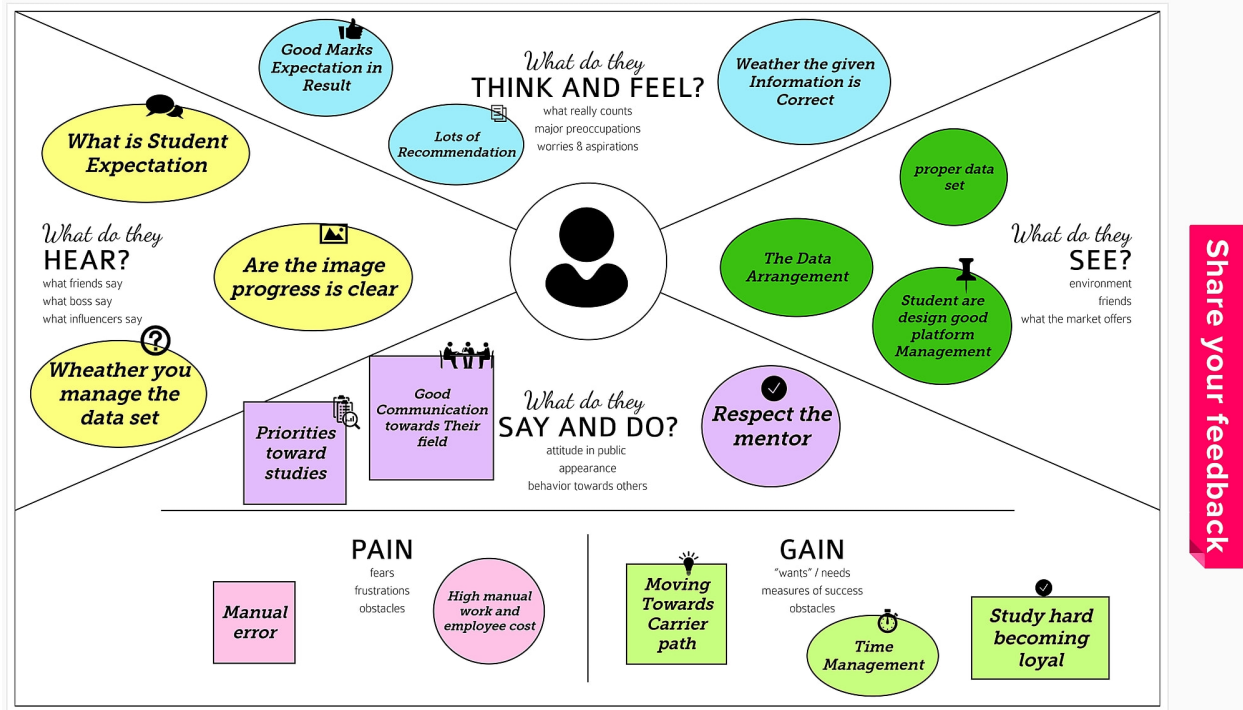
3.IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas:

3.2 Ideation & Brainstroming:

3.3 Proposed Solution

Project team shall fill the following information in proposed solution

template.

S.NO	Parameter	Description
1.	Problem Statement (Problem to be solved)	- Everyone is not convenient with language used in the application - Some people cannot understand English we can convert into their convenient language - They are facing difficulties in understanding the language used in the system

2.	Idea/Solution description	- Even sign language can also be translated to text message in our application using CNN - Text to sign language convertor uses Stanford Parser text processing and JA signing for the signing avatar - Can change the language using google language translator tool so that people can use the application based on their specialized language - Producing a model which can recognize Finger-spelling based handgestures in

		order to form a completeword by combining each gesture
		● By using this application both specially abled and normal people can translate their message to others easily
3.	Novelty/Uniqueness	● Conventional language can be changedusing the google language translator or tool ● Normal text can also be translated into sign language

4.	Social Impact/Customer Satisfaction	• the Main aim of the project is to build an application that helps the espesially abled people to communicate with others easily
		• The deaf and dumb people can easily translate their sign language into a human hearing voice • The normal people can also easily translate their voice into a sign language using this application
	Business Model	• We can generate

5.	(REvenue Model)	revenue by offereing subscription-based application to the people
		• Userrs who have got subscription can change the language accordingly
6.	Sclability of the Solution	• Even if the number of users increase the system will perform well • Need to pay attention to the application and to be responsible to the changes as fast as possible

3.4 Problem Solution fit:

Project Design Phase-I

Project Title: Real time communication systems powered by AI for specially abled . **Problem Solution Fit Template**   **Team ID:** PNT2022TMID23704

<table>
<tr>
<td rowspan="2">Define CS, fit into CC</td>
<td>

1. CUSTOMER SEGMENT(S) CS

Who is your customer?

The normal people who are trying to communicate with Specially abled persons such as deaf and dumb people are the customer

</td>
<td>

6. CUSTOMER CONSTRAINTS CC

What constraints prevent your customers from taking action or limit their choices of solutions?

The sign language is not understandable to all. The difficulty in understanding the sign language by normal people

</td>
<td>

5. AVAILABLE SOLUTIONS AS

Which solutions are available to the customers when they face the problem

or need to get the job done? What have they tried in the past? What pros& cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking

   Provide personalized learning experiences. It makes use of text editors and social media to Easy to learn and visualize access with all keywords.

   Using text type writers and AI Based devices ie.Voicerecongnition

</td>
<td rowspan="2">Explore AS, differentiate</td>
</tr>
<tr>
<td>

2. JOBS-TO-BE-DONE / PROBLEMS J&P

Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides

Create a communication link between deaf - dumb and normal people Understanding inputs from the user may take a lot of efforts..

AI instantly transcribes the conversation of a group of people. Its algorithm adds punctuation, the name of the person who is talking, and the necessary vocabulary from the user's dictionary. Voice Access was specially created for people with reduced dexterity.

</td>
<td>

9. PROBLEM ROOT CAUSE RC

What is the real reason that this problem exists? What is the back story behind the need to do this job?
i.e. customers have to do it because of the change in regulations.

The communication barrier is the root cause .

During emergency the specially abled people cannot contact or express their feelings to others (normal people) .

The feeling cannot be shared with other they feel stressed.

</td>
<td>

7. BEHAVIOUR BE

What does your customer do to address the problem and get the job done?

i.e. directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace)

   AI has a huge impact on people with disabilities everyday lives.

   Today, facial recognition software is being used for blind children to read books aloud and as an accessible way for deaf people to communicate with others via video chat.

</td>
</tr>
</table>

Focus on J&P, tap into BE, understand RC

3. TRIGGERS

What triggers custOmers tO act? i.e. seeing their neighbOur installing sOlar panels, reading abOut a mOre efficient sOlution in the news.

An ability of the customers to communicate efficiently at serious and necessary situations.

AI is to enable you to achieve personal fulfillment and stay adaptable in this fast-changing tech industry.

4. EMOTIONS: BEFORE / AFTER

How do customers feel when they face a problem or a job and afterwards? i.e. lOst, insecure > cOnfident, in cOntrOl - use it in yOur cOmmunication strategy & design.

Visually impaired users can set it up to work with VoiceOver.Allows people with disabilities to fully control their environments

10. YOUR SOLUTION

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 behaviour.

This device helps in emergency situations to contact . The customer can share their feelings and also helps in expressing emotions and their motives.

8. CHANNELS of BEHAVIOUR

8.1 ONLINE

What kind of actions do customers take online? Extract online channels from #7

AI technologies can play an important role in breaking down the communication through online translation.

8.2 OFFLINE

What kind Of actions dO custOmers take offline? Extract Offline channels frOm #7 and use them fOr custOmer devel0pment.

They buy devices that helps in translating signedlanguage to text and vice versa .

4.REQUIREMENT ANALYSIS:

4.1 Functional Requirements:

FR.No.	Functional Requirement(Epic)	Sub Requirement(Story/Sub-Task)

FR-1	User Registration	• Registration through Web UI/E-mail ID
		• Authentical via OTP
FR-2	User Confirmation	• Confirmation via mail
FR-3	System	• Desktop/Mobile with good resolution camera. • Provides System acces to capture images/video and other relevant data
		Converts the Sign

FR-4	Text Conversation	language into a text using Convolutional Neural Network(CNN)Model.
FR-5	Sentences Translation	To create sentences(s) by recognizing the signs and pauses in the input video stream.

4.2 Non-Functional Requirements:

NFR-No.	Non-functional Requirement(Epic)	Sub Requirement (Story/Sub-Task)
NFR-1	Usability	DEaf-mute people should be able to use the system with eaase.The same applies for normal people who get the system's output.the system should have

		good UI.
NFR-2	Security	Even though the use-case of the system doesn't need any security feature,it must be ensured that the privacy of user data be maintained and handled appropriately.
NRF-3	Reliability	The translation of sign languages should be reliable.The accuracy of the system should be tested extensively to make sure that it is up to the mark.
NFR-4	Performance	The processing should be done in considerable time so that the conversation

		can go on without wating for the system's output
NFR-6	Scalability	The System should be scalable to accomodate new features and functionalities and to cater wider range of people in future.

Project Design:
5.1 Data Flow Diagram
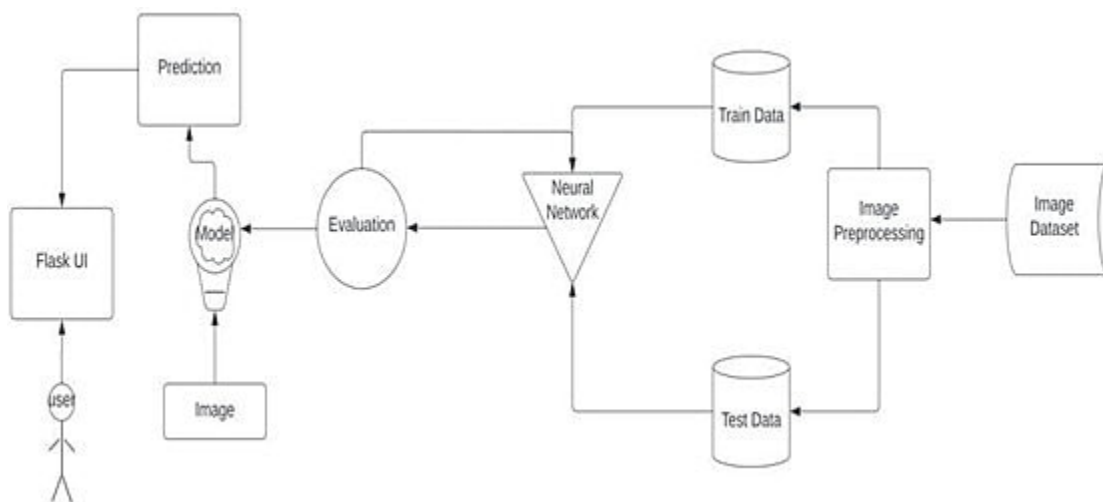
5.2 Solution & Technical Architechture:

<table>
<tr><td colspan="2" align="center">**Project Design Phase-I**
Solution Architecture</td></tr>
<tr><td>Date</td><td>13 October 2022</td></tr>
<tr><td>Team ID</td><td>PNT2022TMID23704</td></tr>
<tr><td>Project Name</td><td>Real-Time Communication System Powered by AI for Specially Abled</td></tr>
<tr><td>Maximum Marks</td><td>4 Marks</td></tr>
</table>
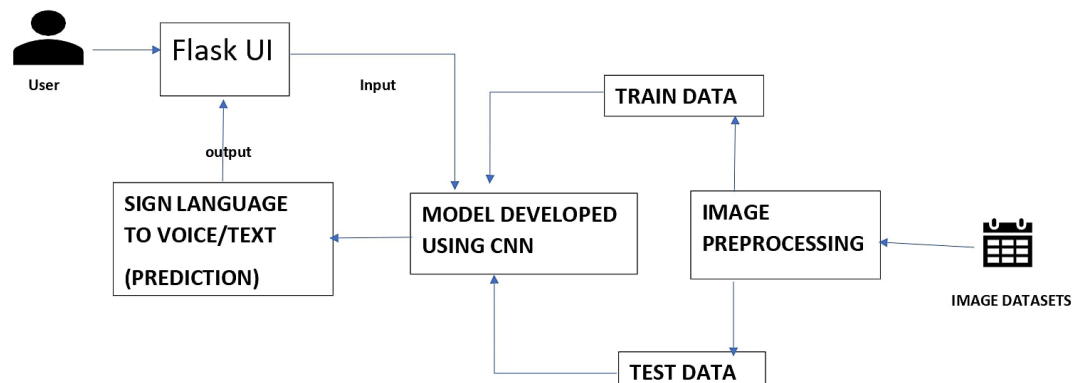
Technical Architecture:

The Deliverable shall include the architectural diagrams as below and the information as per the table 1 & table2

Example: Real time communicate system powered by AI for specially abled

USER

Image

Flask UI

Model

Evaluation

Neural Network

Train Data

Image Preprocessing

Image Dataset

Prediction

Test Data

5.3 User Stories:

```
  ┌─────────┐
  │  USER   │
  └─────────┘
       │
       ▼
  ┌─────────┐                                      ┌──────────┐
  │  Login  │                                      │ Database │
  └─────────┘                                      └──────────┘
       │                                                ▲
       ▼          Data Pre-processing    ┌──────────────┴──┐        Feature
  ┌─────────┐ ──────────────────────────▶│    Feature      │──────────────────┐
  │  Raw    │                            │   Extraction    │                  │
  │  Image  │                            └─────────────────┘                  │
  └─────────┘                                     ▲                           │
                                                  │ If Validation error       │
                                                  │                           ▼
  ┌─────────────┐                         ┌──────────────┐  Validating ┌──────────┐
  │ Raw Images  │ ───────────────────────▶│   Testing    │◀────────────│ Training │
  │(test Dataset)│                        └──────────────┘             └──────────┘
  └─────────────┘                                │                      Store Features
                                                 │ If Test Valid
                                                 ▼
                                         ┌──────────────┐              ┌──────────┐
                                         │  TestingCNN  │─────────────▶│          │
                                         │    Model     │              └──────────┘
                                         └──────────────┘
```
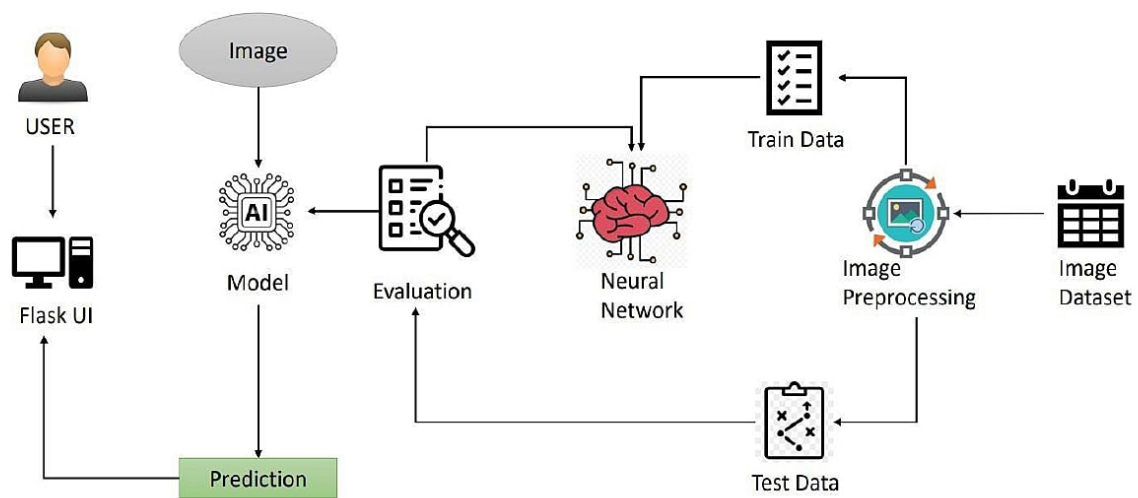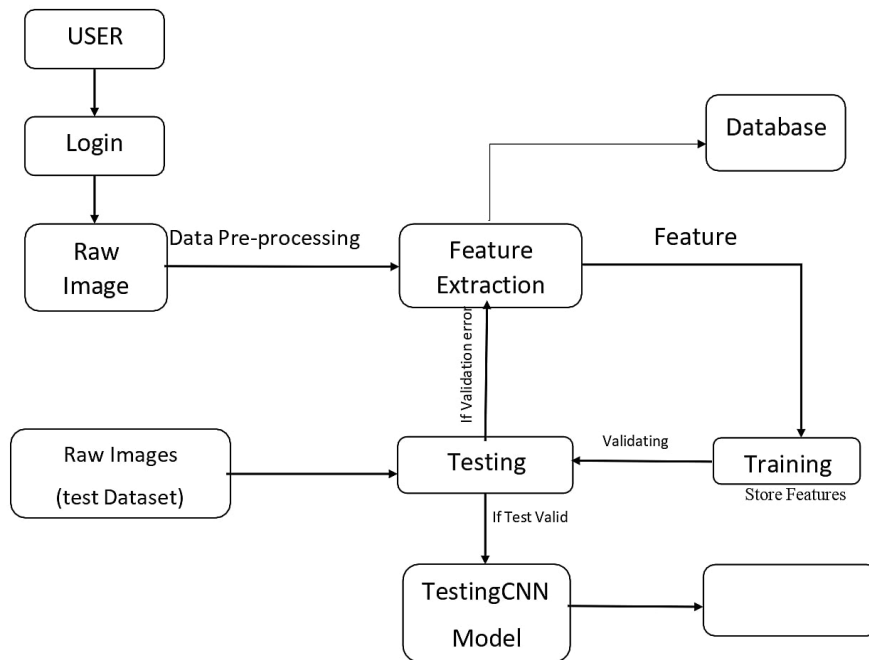
6.PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning &Scheduling:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data Collection	USN-1	Collect Dataset	10	High	Harini.S, Harshavarthini.P
Sprint-1		USN-2	Image Pre Processing	8	Medium	Devaki.A, Gobika.A
Sprint-2	Model Building	USN-3	Import the required libraries, add the necessary layers and compile the model	9	Medium	Harini.S, Harshavarthini.P
Sprint-2		USN-4	Training the image classification model using CNN	9	High	Devaki.A, Gobika.A
Sprint-3	Training and Testing	USN-5	Training the model and testing the model performance	7	High	Gobika.A, Devaki.A
Sprint-4	Implementation of the Application	USN-6	Converting the input sign language images into English alphabets	8	High	Harini.S, Harshavarthini.P,Devaki.A

10.ADVANTAGES & DISADVANTAGES

Advantages:

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

2.As sifferent sign language standards exists, their dataset can be abled,and the userr canchoose which sign language to read.

Disadvantage:

1.The current model only works from alphabets A toI.

2.In absence of gesture recognition, alphabets from J cannot be identified as they requiresome 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 languages is a useful tool for facilitating communication between deaf and hearing people.Because it allows for two-way communication gap between deaf people.Because it allows for two-way communication,the system aims to bridge the communication gap between deaf people and rest of society.The proposed methodology translates language into English alphabets that are understandable to humans.This system sends hand gesture s to the model,who recognizes them and displays the equip agent Alphbet on the screen.Deaf-mute people can use their hands to perform signlanguage ,which will then be converted into alphabets.

12.FUTURE SCOPE:

Having a technology that can translate hand sign language to its corresponding alphabets is agame changer in the field of communication and AI for the specially abled people such as deaf dumb.With introduction of gesture recognition,the wep 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.

13.APPENDIX

13.1 Source Code:

7.CODING & SOLUTIONING:

```python
In [1]: #import imagedatagenerator
        from keras.preprocessing.image import ImageDataGenerator
```

```python
In [2]: #training datagen
        train_datagen=ImageDataGenerator(rescale=1./255,shear_range=0.2,zoom_range=0.2,horizontal_flip=True)
```

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

```python
In [4]: import tensorflow as tf
        import os
```

```python
In [5]: #create model
        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
        from tensorflow.keras.preprocessing.image import ImageDataGenerator
```

```python
In [6]: import numpy as np
        import matplotlib.pyplot as plt #to view graph in colab itself
        import IPython.display as display
        from PIL import Image
        import pathlib
```

8.Testing and Training Dataset

```python
In [1]:   #import imagedatagenerator
          from keras.preprocessing.image import ImageDataGenerator
```

```python
In [2]:   #training datagen
          train_datagen=ImageDataGenerator(rescale=1./255,shear_range=0.2,zoom_range=0.2,horizontal_flip=True)
```

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

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In [4]:   import tensorflow as tf
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```python
In [6]:   import numpy as np
          import matplotlib.pyplot as plt #to view graph in colab itself
          import IPython.display as display
          from PIL import Image
          import pathlib
```

```python
In [8]:   !unzip '/content/conversation engine for deaf and dumb (1).zip'

          unzip:  cannot find or open /content/conversation engine for deaf and dumb .zip, /content/conversation engine for deaf and dumb .zip.zip or /content/co
```

```python
from tensorflow.keras.preprocessing.image import ImageDataGenerator
# Testing Datagen
test_datagen = ImageDataGenerator(rescale=1/255)
# Training Datagen
train_datagen = ImageDataGenerator(rescale=1/255,zoom_range=0.2,horizontal_flip=True,vertical_flip=False)
# Training Dataset
x_train=train_datagen.flow_from_directory(r'/content/drive/MyDrive/Dataset/training_set',target_size=(64,64), class_mode='categorical',batch_size=900)
# Testing Dataset
x_test=test_datagen.flow_from_directory(r'/content/drive/MyDrive/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
traindf=pd.read_csv('/content/drive/images_and_labels.txt',dtype=str,sep='\s')
traindf.columns = ['image','label','none1','none2','none3']
traindf.drop(['none1', 'none2','none3'], axis=1)
datagen=ImageDataGenerator(rescale=1./255.,validation_split=0.25)
train_generator=datagen.flow_from_dataframe
(
    dataframe=traindf,
    directory="/content/drive/",
    x_col="image",
    y_col="label",
    subset="training",
    batch_size=32,
    seed=42,
    shuffle=True,
    class_mode="categorical",
    target_size=(150,150)
)
validation_generator=datagen.flow_from_dataframe
(
    dataframe=traindf,
    directory="/content/drive/",
    x_col="image",
    y_col="label",
    subset="validation",
    batch_size=32,
    seed=42,
    shuffle=True,
```

Open.CV

```python
import cv2
import numpy as np
import matplotlib.pyplot as plt
```

```python
# Create a image

img1 = np.zeros((400,600,3),np.uint8)
plt.imshow(img1)
```
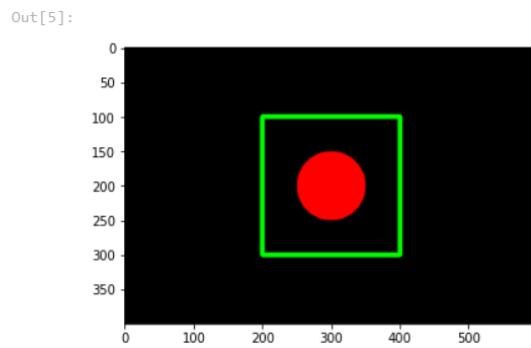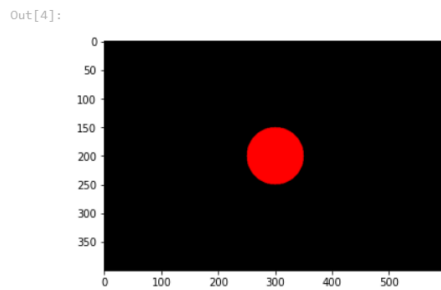
Out[2]:
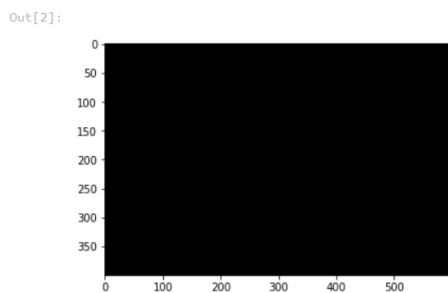

```python
# Drawing Functions
```

```python
# Draw a circle

circle = cv2.circle(img1, (300,200), 50, (255,0,0), -1)   # (0,0,0)--->(R,G,B)
plt.imshow(img1)
```
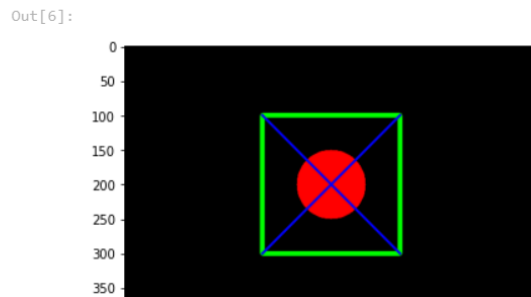
```python
# Draw a circle

circle = cv2.circle(img1, (300,200), 50, (255,0,0), -1)   # (0,0,0)--->(R,G,B)
plt.imshow(img1)
```
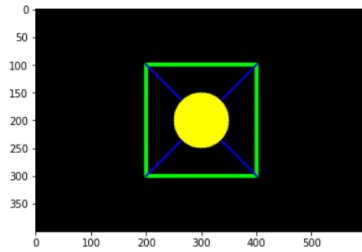
Out[4]:

Out[5]:

In [6]:

```python
# Drawing line

line1 = cv2.line(img1,(200,100),(400,300),(0,0,255),4)
line2 = cv2.line(img1,(200,300),(400,100),(0,0,255),4)
plt.imshow(img1)
```

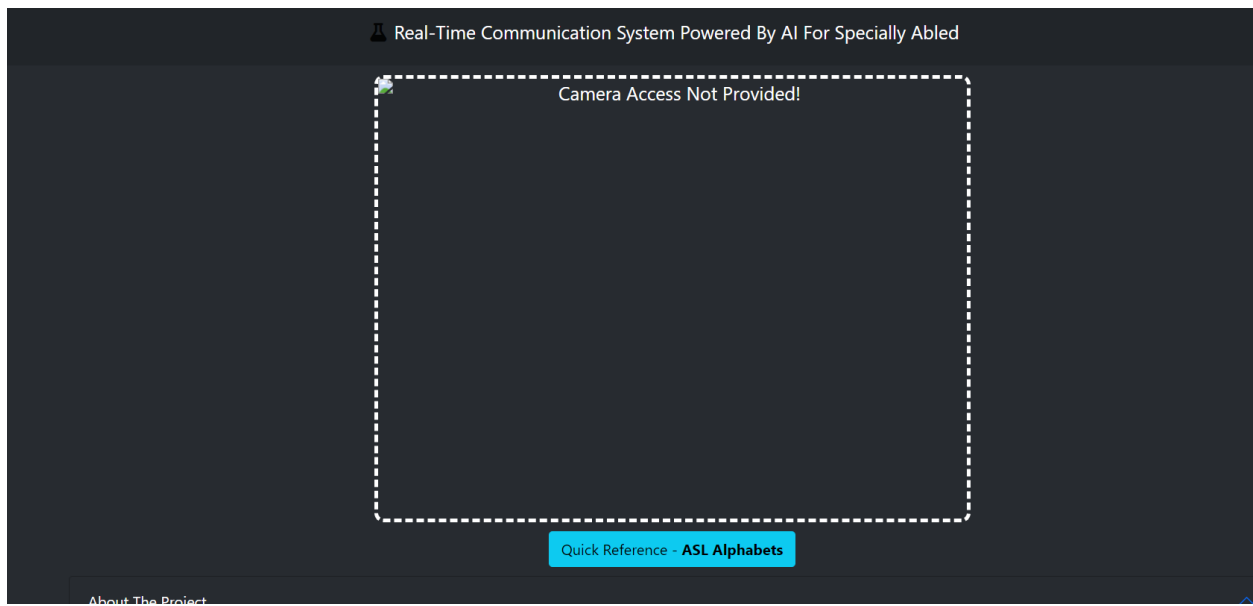Out[6]:

```
circle = cv2.circle(img1, (300,200), 50, (255,255,0), -1)   # (0,0,0)--->(R,G,B)
plt.imshow(img1)
```

9.Results:

Quick Reference - **ASL Alphabets**

About The Project

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.

Currently, Sign Recognition is available **only for alphabets A-I** 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.

Quick Reference - **ASL Alphabets**

About The Project

Developed By

Students at Vivekanandha College Of Engineering For Women during SmartBridge AI Externship Program.
1. **Harini**
2. **Harshavarthini**
3. **Devaki**
4. **Gobika**

Output

Duration: 0.5 Hrs

Skill Tags:

Step 2: Open the browser and navigate to localhost:5000 to check your application

13.2 Github &demo link:
Github link:

https://github.com/IBM-EPBL/IBM-Project-34645-1660241466

Demo link:

https://drive.google.com/file/d/1c8ZjaXR_nYp_eriD0NxlbHbYJiOEyB3N/view?usp=share_link