

Real - Time Communication System Powered by AI for Specially Abled

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CHAPTER 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 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.

1.2 PURPOSE

Dumb people are usually face some problems on normal communication with other people in society. It has been observed that they sometimes find it difficult to interact with normal people with their gestures. Because people with hearing problems or deaf people cannot speak like normal people, they have to depend on a kind of visual communication in most cases. To overcome these problems, we have proposed a system that uses cameras to capture and convert videos of hand gestures from dumb people who turn into speech for understanding normal people. The primary application for addressing the sign language is the improvement of the sign language. Computer recognition of the sign language is an important research problem for communication with the hearing impaired. The system does not require that the hand is perfectly aligned to the camera. The project uses the image processing system to identify, especially the English alphabetical character language used by the deaf to communicate. The system proposed to develop and build an intelligent system that uses image processing, machine learning and artificial intelligence concepts to make visual inputs of hand gestures of sign language and to create an easily recognizable form of outputs.

CHAPTER 2

LITERATURE SURVEY

2.1 EXISTING PROBLEM

One of the most precious gifts to a human being is an ability to see, listen, speak and respond according to the situations. But there are some unfortunate ones who are deprived of this. Making a single compact device for people with Visual, Hearing and Vocal impairment is a tough job. Communication between deaf-dumb and normal person have been always a challenging task. This paper proposes an innovative communication system framework for deaf, dumb and blind people in a single compact device. We provide a technique for a blind person to read a text and it can be achieved by capturing an image through a camera which converts a text to speech (TTS). It provides a way for the deaf people to read a text by speech to text (STT) conversion technology. Also, it provides a technique for dumb people using text to voice conversion. The system is provided with four switches and each switch has a different function. The blind people can be able to read the words using by Tesseract OCR (Online Character Recognition), the dumb people can communicate their message through text which will be read out by speak, the deaf people can be able to hear others speech from text. All these functions are implemented by the use of Raspberry Pi.

2.2 REFERENCE

Prof. P.G. Ahire, K.B. Tilekary, T.A. Jawake, P.B. Warale, "Two Way Communicator between Deaf and Dumb People and Normal People", 978-1-4799-6892-3/15 31.00 c 2015 IEEE. [2] Shreyashi Narayan Sawant, "Sign Language recognition System to aid Deaf- dumb People Using PCA", IJCSET ISSN : 2229-3345 Vol. 5 No. 05 May 2014. [3] Amitkumar Shined, Frames Kagalkar, "Sign Language to Text and Vice Versa Recognition using Computer Vision in Marathi", International Journal of Computer Applications (0975 – 8887) National Conference on Advances in Computing (NCAC 2015) [4] Setiawardhana, Risky Yuniar Hakkun, Achmad Baharuddin, "Sign Language Learning based on Android For Deaf and Speech Impaired People", 978-1-4673-9345- 4/15/31.00 c 2015 IEEE [5] M. Ebrahim Al-Ahdal & Nooritawati Md Tahir," Review in Sign Language Recognition Systems" Symposium on Computer & Informatics(ISCI),pp:52-57, IEEE ,2012 [6] Archana S. Ghotkar, Rucha Khatal, Sanjana Khupase, Surbhi Asati & Mithila Hadap," Hand Gesture Recognition for Indian Sign Language" International Conference on Computer Communication and Informatics (ICCCI), pp:1- 4.IEEE,Jan 2012. [7] Iwan Njoto Sandjaja, Nelson Marcos," Sign Language Number Recognition" Fifth International Joint Conference on INC, IMS and IDC, IEEE 2009

2.3 PROBLEM STATEMENT DEFINITION

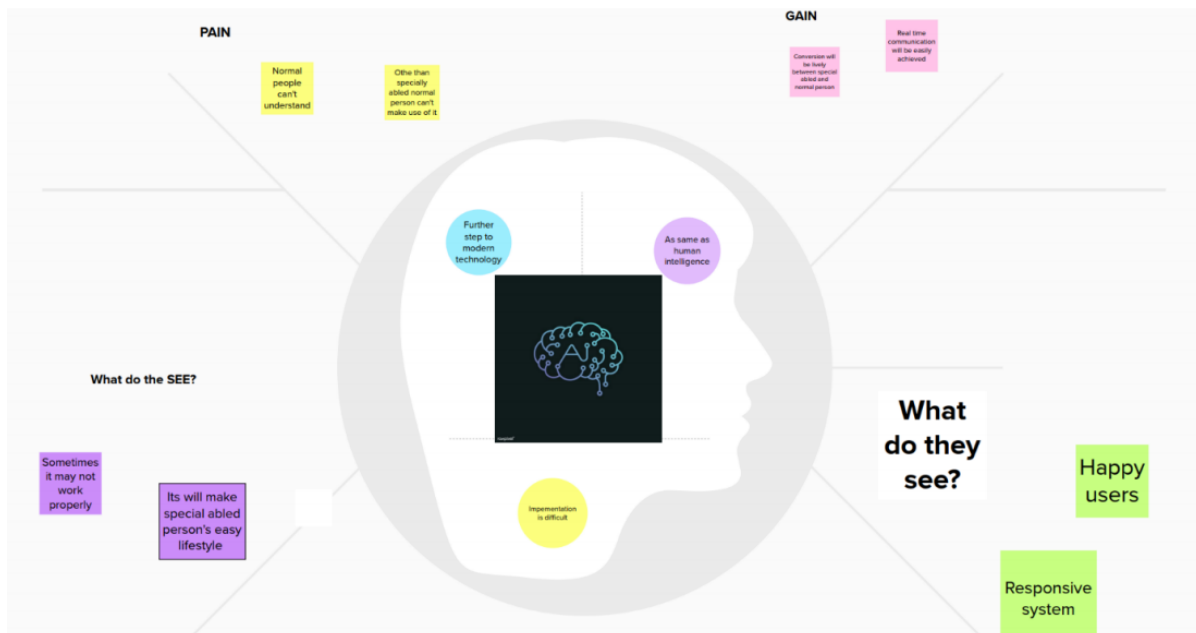
The project aims to develop a system that converts the sign language into a human hearing voice in the desired language as well as to convert speech into understandable sign language for the deaf and dumb. A convolution neural network is used to create a model that will be trained on different hand gestures. A web application to use the model will be built. This application will enable the deaf and dumb people to convey their information using signs which get converted to human-understandable language and speech is given as output.

CHAPTER 3

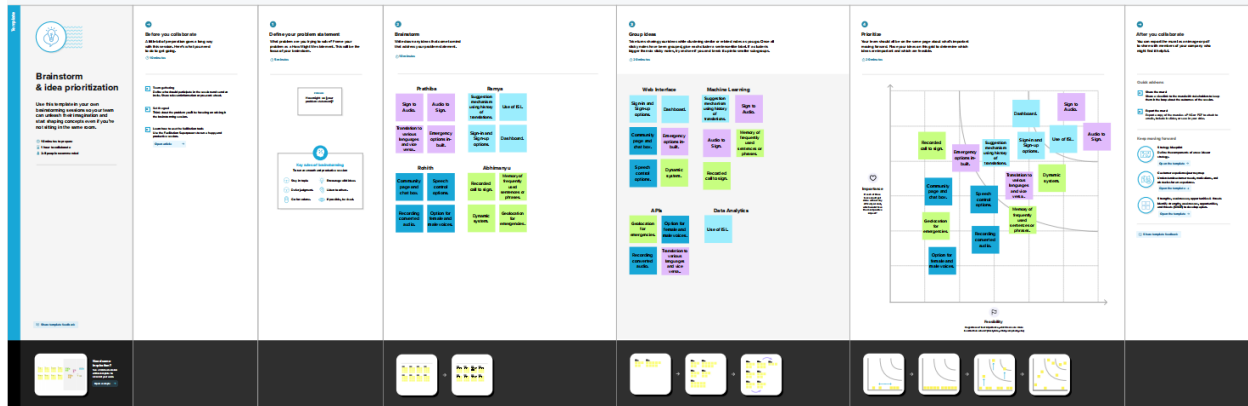
IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

An Empathy Map Is A Simple,Easy-To-Digest Visual That Captures Knowledge About a User'S Behaviors And Attitudes.



3.2 Ideation & Brainstorming



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)	<p>The project aims to develop a system that converts the sign language into a human hearing voice in the desired language as well as to convert speech into understandable sign language for the deaf and dumb.</p> <p>A convolution neural network is used to create a model that will be trained on different hand gestures.</p> <p>A web application to use the model will be built.</p>

2	Idea / Solution description	<p>The idea is 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.</p>
3	Novelty/ Uniqueness	<ul style="list-style-type: none"> ➤ Two-way communication. ➤ An application with embedded features: <ul style="list-style-type: none"> ○ Translation into various languages. ○ Suggestion mechanism based on the history of translations. ○ In-built emergency options.

4	Social Impact / Customer Satisfaction	<ul style="list-style-type: none"> ➤ Understanding specially-abled people in a better way. ➤ Equal opportunities ➤ Break the social barrier
5	Business Model (Revenue Model)	Not many models of this kind are available in the society, so educating people about the uses and technology of this model will surely create a huge market for this product. This can be done by means of mass communication and advertisements. Instead of promoting it in business point of view, promoting it in a service point of view will expand its reach.
6	Scalability of the Solution	If a basic model of this solution is created, then expanding it, needs some minimal man power with sufficient knowledge regarding this. So, with the increase in its demand, we can scale its production comfortably

3.4 Problem Solution fit

Problem-Solution fit canvas 2.0

Purpose / Vision

Define CS, fit into	1. CUSTOMER SEGMENT(S) CS Who is your customer? People who lost their speech or hearing ability by birth or due to some other factors.	6. CUSTOMER CC What constraints prevent your customers from taking action or limit their choices of solutions? (i.e. spending power, budget, no cash, network connection, available devices). Difficult accessibility, not user friendly, need more technical knowledge to handle, cost, ... etc. There are so many choice of solutions available but due to these some constraints, choice of solutions were limited.	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) The first ever approach to sign language it has only 6 sign gestures detection. Using colored hands for hand position recognition. But our model is trained to detect different sign languages without any colour gloves, using bare hands only.	Explore AS.
	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. Deaf and dumb people couldn't able to convey their messages to the normal people easily. Deaf people cannot hear the words as others speaks and dumb people cannot express their feelings by words.	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). In Previously developed solution, they have to use coloured hand gloves for hand position recognition. Also, the old method uses traditional translators which take too much of time to process.	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)) In our device, there's an option called problem detection display in which our customer can able to see the type of problem occurs & solution will be displayed.	
Identify strong TR & EM	3. TRIGGERS TR What triggers customers to act? (i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news). By comparing normal people, Specially Abled people should depend on others and want to live their life independently like other people	10. YOUR SOLUTION SL If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits really. 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. Using SSD ML algorithm recognizing the signs as words instead of old traditional translators, that are very slow and take too much since every alphabet as to be recognized to form the whole statement in old methods.	8. CHANNELS of BEHAVIOUR CH 8.1 ONLINE What kind of actions do customers take online? Extract online channels from #7 Advertise on online with influencers to test the product and promote it also on blog channels 8.2 OFFLINE What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development. On offline, we have our product experience stores where our customer can experience the product in real	Extract online & offline CH of BE
	4. EMOTIONS: BEFORE / AFTER EM How do customers feel when they face a problem or a job and afterwards? (i.e. feel insecure, reluctant in meeting, used in social communication, etc.) BEFORE: It is very difficult to convey the message to normal people. AFTER: They overcome their reluctance to have communication with normal people.			



Problem-Solution fit canvas is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 license Created by Daria Nepriakhina / Amaltama.com



CHAPTER 4

REQUIREMENT ANALYSIS

4.1 Functional requirements

1. **Blob Detection:** This algorithm helps to draw rectangles around the defective part. The methods aim to detect areas in a digital image that differ in properties, such as brightness or color, compared to surrounding regions. Independent detection of corresponding regions in scaled versions of the same image. A blob is a region of an image in which some properties are constant or approximately constant, all points in a blob can be viewed in a certain sense to be similar to one another.
2. **Skin color recognition:** Skin detection is the process of finding skin colored pixels and regions in an image or video. This process is typically used as a preprocessing step to find areas that may have human faces and limbs in images.
3. **Template Matching:** Template matching is a technique in digital image processing to find small portions of an image that match a template image. It can be used in as part of quality control, one way to navigate a mobile robot, or as a way to detect edges in images.

4.2 Non-Functional requirements

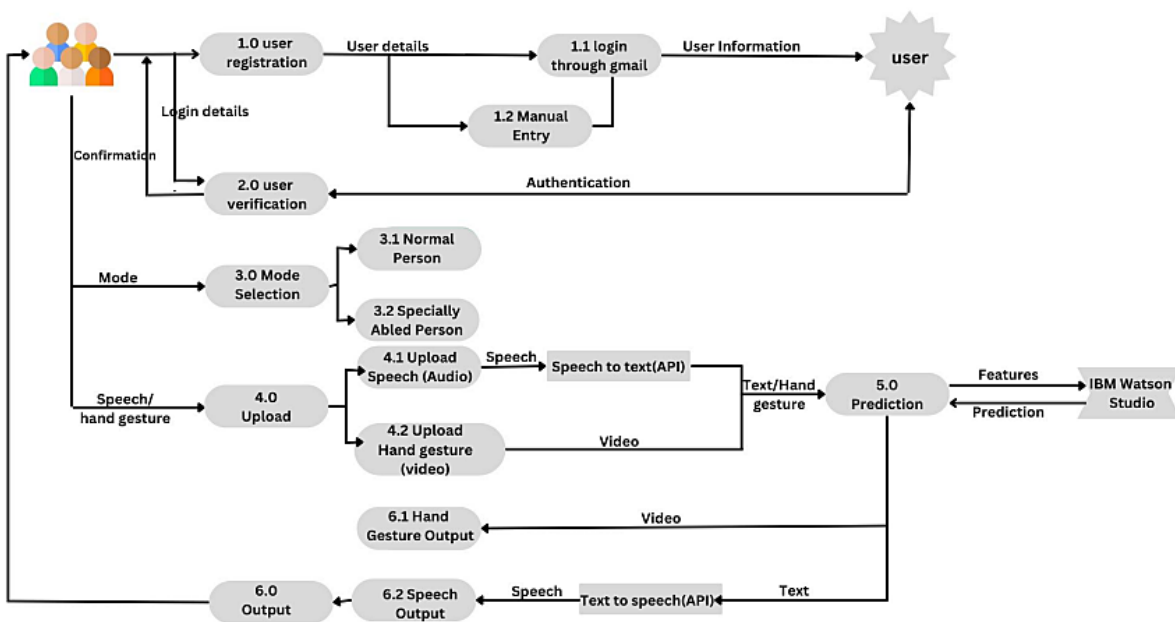
PRODUCT PERSPECTIVE: · To implement a system for recognizing sign language hand configurations as described which will additionally provide the facility to each individual to define and upload his own sign language into the system since every country or even regional group uses its own set of signs. · To develop a tool which will help deaf people in communication. To develop a Sign language, can be translated into text or sound based on images, videos. Signs can be converted to Speech so that there is a two - way communication.

PRODUCT FUNCTION: It's a Desktop application. · User will start video from camera. · User will be able to register different signs for further recognition using camera. · When user will start recognition activity and give various hand gestures in front of camera, sign will be

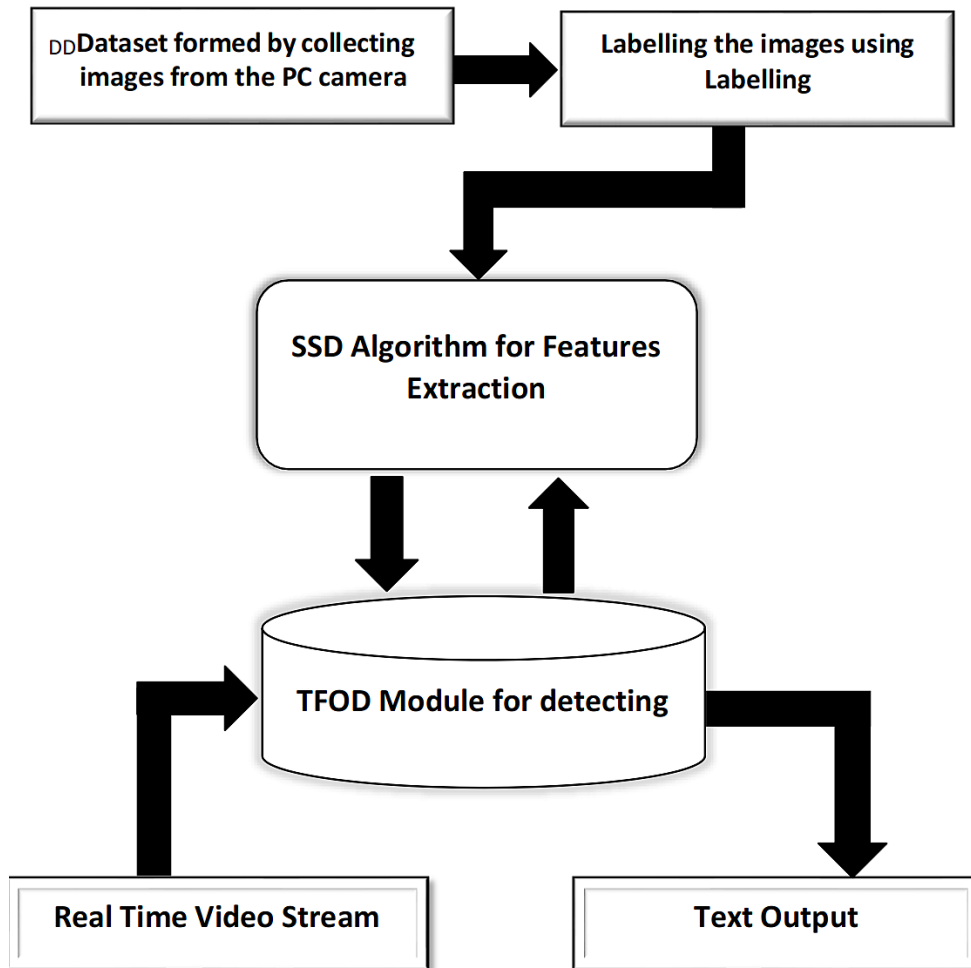
CHAPTER 5

5. PROJECT DESIGN

5.1 Data Flow Diagrams



5.2 Solution & Technical Architecture



SYSTEM ARCHITECTURE

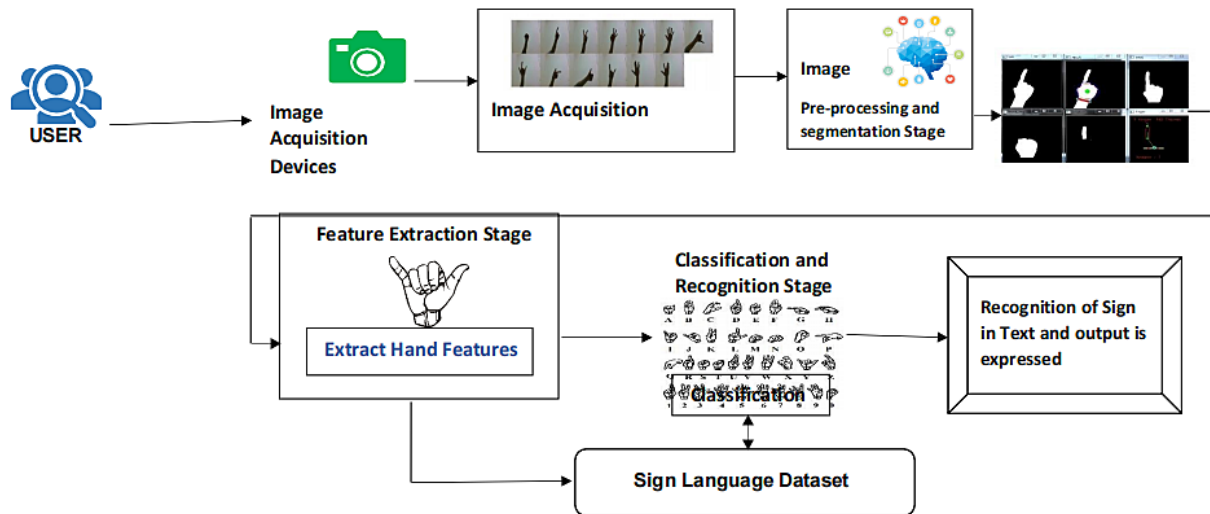


Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	Customer have to login through their respective website or phone number. Then interaction will happen with the User interface.	javascript, CSS,HTML
2.	Application Logic-1	It requires various types libraries, frameworks to develop the project	Java / Python
3.	Application Logic-2	Helps to converting the human gestures/actions into written words.	Machine learning
4.	Application Logic-3	Provides helpful,feasible answers after recognising the human gestures.	ANN,CNN
5.	Database	Data could be numbers or words.	MySQL, Rational database
6.	Cloud Database	Providing customer to use host database without buying additional hardware..	Deep learning and neural networks
7.	File Storage	File storage could be fast, reliable and flexible..	Local file system
8.	External API-1	Used to access the information in the cloud	Weather API
9.	External API-2	Used to access the information for data driven decision making...	Aadhar API
10.	Machine Learning Model	Machine learning interact with various algorithms that are required for implementation.	Image acquisition
11.	Infrastructure (Server / Cloud)	Application deployment on local system /local cloud server configuration. Install the windows version and execute the installer..	Local, Cloud Foundry, Kubernetes, etc.

5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Specially Abled Person)	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 and select the mode of usage	High	Sprint-1
		USN-2	As a user, I can register for the application through Gmail		High	Sprint-1
	Confirmation	USN-3	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	Medium	Sprint-2
	Login	USN-4	As a user, I can log into the application by entering email & password	Credentials has to be matched	Medium	Sprint-2
	Mode Selection	USN-5	As a user, I will be prompted to select the mode of communication and I will select the specially abled mode (Gesture to Speech)	Either of the modes has to be chosen for further processing	High	Sprint-3
	Video Capturing	USN-6	As a user of this mode I will capture my hand gesture as video	Minimum video quality criteria has to be met	High	Sprint-1
	Gesture interpretation	USN-7	As a user of this mode, I will be able to receive and interpret the translated gestures from the other end.	Must be a valid gesture	Low	Sprint-1

Customer (Normal Person)	Registration	USN-8	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account and select the mode of usage	High	Sprint-1
		USN-9	As a user, I can register for the application through Gmail		High	Sprint-1
	Confirmation	USN-10	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	Medium	Sprint-2
	Login	USN-11	As a user, I can log into the application by entering email & password	Credentials has to be matched	Medium	Sprint-2
	Mode Selection	USN-12	As a user, I will be prompted to select the mode of communication and I will select the specially abled mode (Gesture to Speech)	Either of the modes has to be chosen for further processing	High	Sprint-3
	Speech Recording	USN-13	As a user of this mode I will record the speech in order to convert it into gesture	Minimum audio quality criteria have to be met	High	Sprint-1
	Speech recognition	USN-14	As a user of this mode, I will be able to receive and interpret the translated speech from the other end.	The words must be a recognizable	Low	Sprint-1
Administrator	Application monitoring and controlling	USN-15	As an admin, I will be responsible for controlling the user activities and further upgradations of the application	Admin level privilege	Medium	Sprint-3

CHAPTER 6

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

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 Data set	9	High	LHAVANYA DEVI R N, SARANYA K
Sprint-1		USN-2	Image pre processing	8	Medium	LHAVANYA DEVI R N, SARANYA K
Sprint-2	Model Building	USN-3	Import the required libraries, add the necessary layers and compile the model	10	High	BAVNA GRACE B, ADLIN JIBISHA A
Sprint-2		USN-4	Training the image classification model using CNN	7	Medium	BAVNA GRACE B, ADLIN JIBISHA A
Sprint-3	Training and Testing	USN-5	Training the model and testing the model's performance	9	High	SARANYA K, BAVNA GRACE B
Sprint-4	Implementation of the application	USN-6	Converting the input sign language images into English alphabets	8	Medium	LHAVANYA DEVI R N, ADLIN JIBISHA A

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

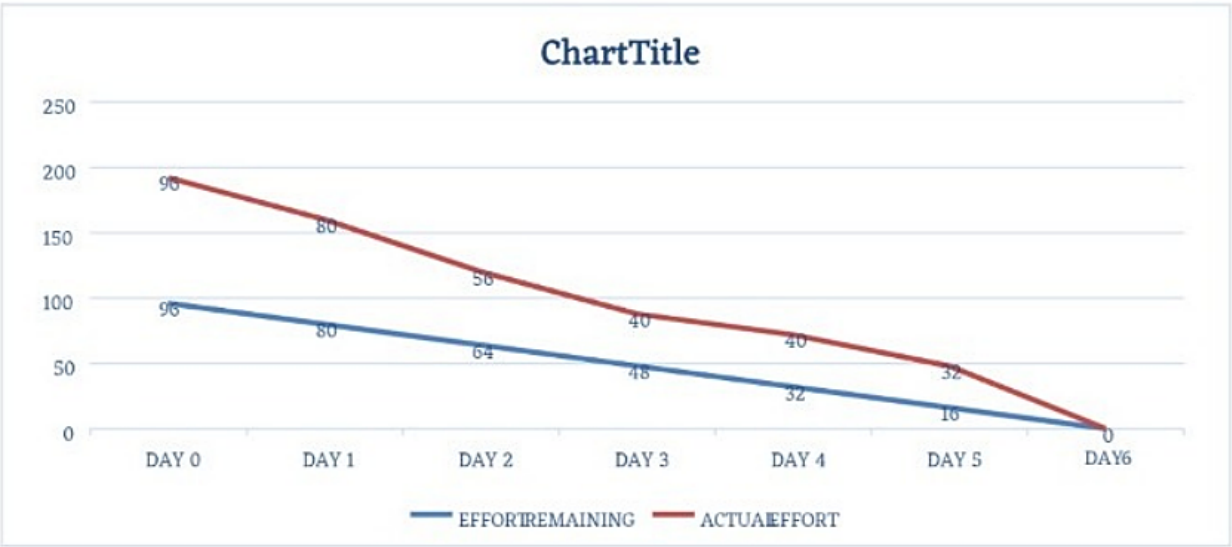
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	10	6 Days	24 Oct 2022	29 Oct 2022	8	29 Oct 2022
Sprint-2	10	6 Days	31 Oct 2022	04 Nov 2022	5	04 Nov 2022
Sprint-3	10	6 Days	07 Nov 2022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

Velocity:

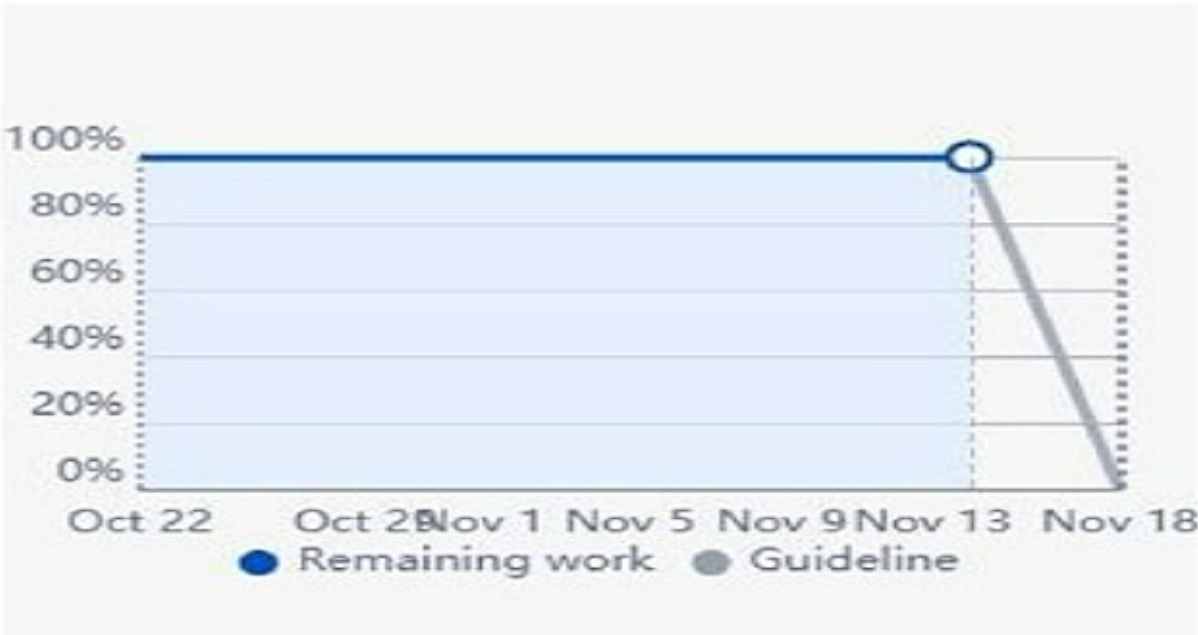
$$AV = \frac{\text{sprint duration}}{\text{velocity}}$$

$$AV = 6/10 = 0.6$$

BURNDOWN CHART



SPRINT BURNDOWN CHART



6.2 Sprint Delivery Schedule

Sprint delivery Plan :

Sprint	Total Story Point	Duration	Sprint Start Date	Sprint EndDate (Planned)	Story Point Completed (as on planned end date)	Sprint Release Date (Actual)
Sprint - 1	20	4 Days	24 Oct 2022	27 Oct 2022	20	27 Oct 2022
Sprint - 2	20	6 Days	29 Oct 2022	03 Nov 2022	20	03 Nov 2022
Sprint – 3	20	6 Days	04 Nov 2022	09 Nov 2022	20	09 Nov 2022
Sprint - 4	20	8 Days	10 Nov 2022	18 Nov 2022	20	18 Nov 2022

Velocity:

Imagine we have a 10 day sprint duration and the velocity of the team is 20.

$$AV = \frac{\text{Sprint}}{\text{Duration}} = 20 = 2\text{Velocity}$$

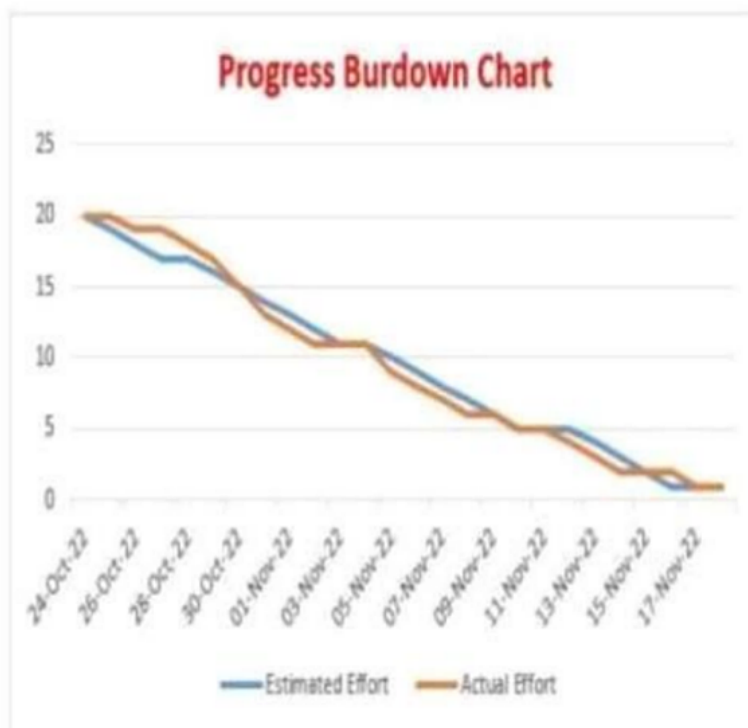
Burndown Chart:

A Burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum.

However, burn down charts can be applied to any project containing measurable progress over time.

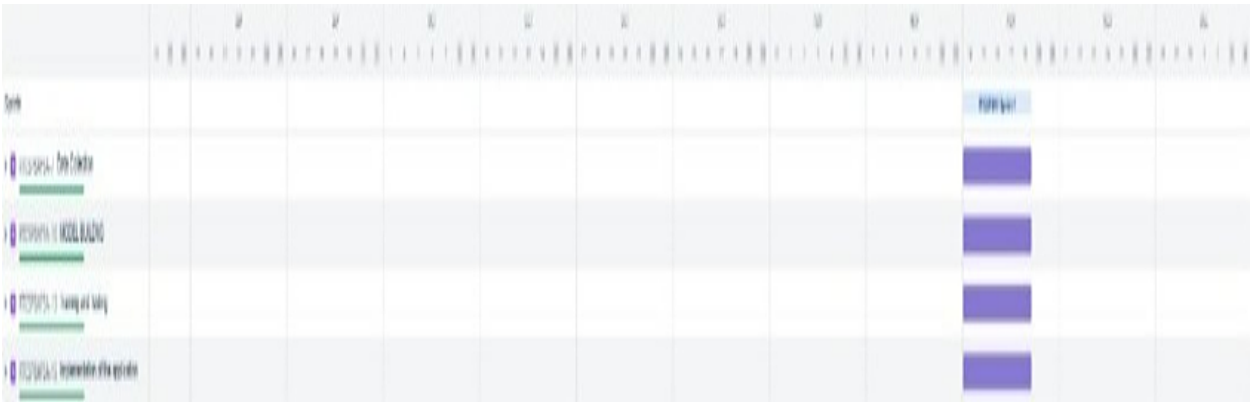
BURNDOWN CHART			
Sprint	Date	Estimated Effort	Actual Effort
Sprint - 1	24 – Oct - 2022	20	20
	25 – Oct - 2022	19	20
	26 – Oct - 2022	18	19
	27 – Oct - 2022	17	19
	28 – Oct - 2022	17	18
Sprint - 2	29 – Oct - 2022	16	17
	30 – Oct - 2022	15	15
	31 – Oct - 2022	14	13
	01 – Nov - 2022	13	12
	02 – Nov - 2022	12	11
	03 – Nov - 2022	11	11
Sprint - 3	04 – Nov - 2022	11	11
	05 – Nov - 2022	10	9
	06 – Nov - 2022	9	8
	07 – Nov - 2022	8	7

Sprint - 4	08 – Nov - 2022	7	6
	09 – Nov - 2022	6	6
	10 – Nov - 2022	5	5
	11 – Nov - 2022	5	5
	12 – Nov - 2022	5	4
	13 – Nov - 2022	4	3
	14 – Nov - 2022	3	2
	15 – Nov - 2022	2	2
	16 – Nov - 2022	1	2
	17 – Nov - 2022	1	1
	18 – Nov - 2022	1	1



BURN DOWN CHART

6.3 Report From JIRA



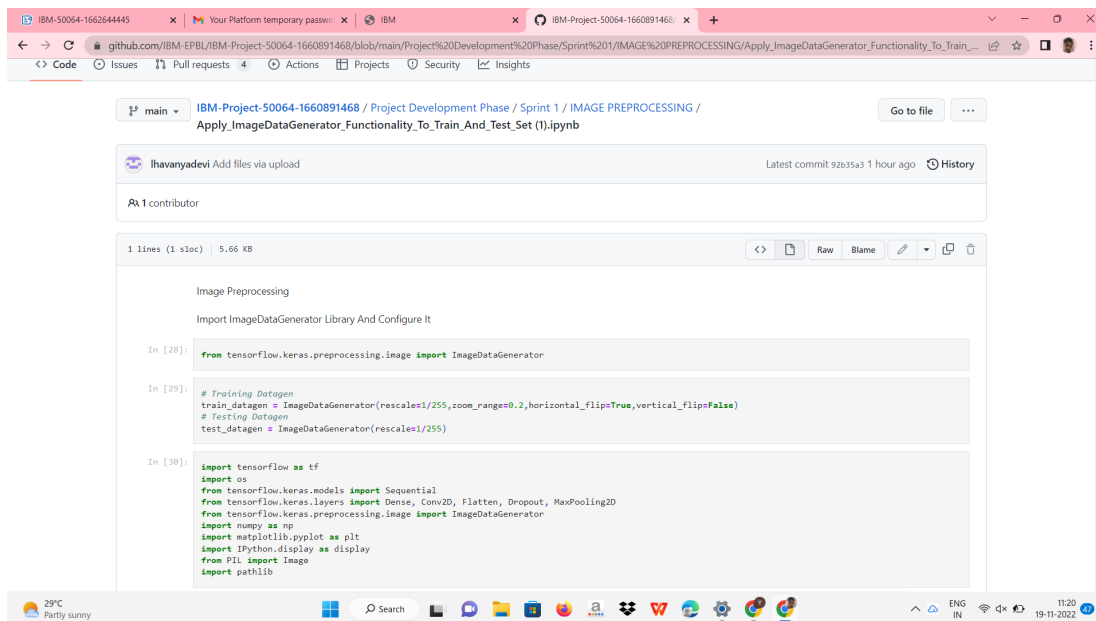
CHAPTER 7

7. CODING & SOLUTIONING

(Explain the features added in the project along with code)

7.1 IMAGE PREPROCESSING

- Image pre-processing includes zooming, shearing, flipping to increase the robustness of the model after it is built. Keras package is used for pre-processing images.
- Importing ImageDataGenerator Library to create an instance for which include shearing, rescale, zooming, etc to make the model robust with different types of images.



The screenshot shows a GitHub repository page for a project named 'IBM-Project-50064-1660891468'. The file being viewed is 'Apply_ImageDataGenerator_Functionality_To_Train_And_Test_Set (1).ipynb'. The code is written in Python and demonstrates how to use the ImageDataGenerator library for image preprocessing. It includes imports for tensorflow.keras.preprocessing.image, tensorflow.keras.models, tensorflow.keras.layers, numpy, matplotlib.pyplot, IPython.display, PIL, and pathlib. The code defines training and testing datagen objects using ImageDataGenerator with parameters for rescale, zoom_range, horizontal_flip, and vertical_flip. It also shows the import of tensorflow, os, Sequential, Dense, Conv2D, Flatten, Dropout, MaxPooling2D, and ImageDataGenerator.

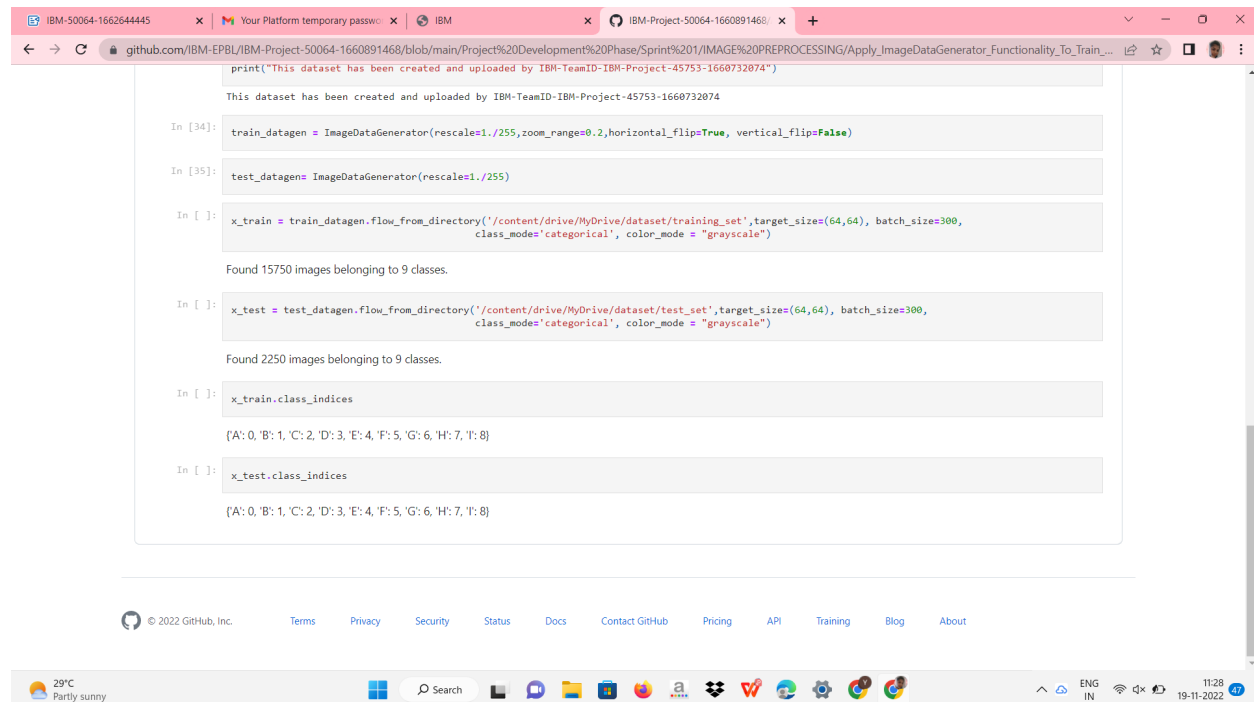
```
Image Preprocessing
Import ImageDataGenerator Library And Configure It

In [28]: from tensorflow.keras.preprocessing.image import ImageDataGenerator

In [29]: # 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)

In [30]: import tensorflow as tf
import os
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Conv2D, Flatten, Dropout, MaxPooling2D
from tensorflow.keras.preprocessing.image import ImageDataGenerator
import numpy as np
import matplotlib.pyplot as plt
import IPython.display as display
from PIL import Image
import pathlib
```

- Applying ImageDataGenerator Functionality To Train And Test Set



The screenshot shows a Jupyter Notebook interface with a pink header bar containing browser tabs for IBM and GitHub. The notebook content includes a print statement, two ImageDataGenerator objects, and two flow_from_directory calls. The output shows the number of images found for training and testing, and the class indices for both sets.

```
print("This dataset has been created and uploaded by IBM-TeamID-IBM-Project-45753-1660732074")
This dataset has been created and uploaded by IBM-TeamID-IBM-Project-45753-1660732074

In [34]: train_datagen = ImageDataGenerator(rescale=1./255, zoom_range=0.2, horizontal_flip=True, vertical_flip=False)

In [35]: test_datagen = ImageDataGenerator(rescale=1./255)

In [ ]: x_train = train_datagen.flow_from_directory('/content/drive/MyDrive/dataset/training_set', target_size=(64,64), batch_size=300,
class_mode='categorical', color_mode = "grayscale")

Found 15750 images belonging to 9 classes.

In [ ]: x_test = test_datagen.flow_from_directory('/content/drive/MyDrive/dataset/test_set', target_size=(64,64), batch_size=300,
class_mode='categorical', color_mode = "grayscale")

Found 2250 images belonging to 9 classes.

In [ ]: x_train.class_indices

{'A': 0, 'B': 1, 'C': 2, 'D': 3, 'E': 4, 'F': 5, 'G': 6, 'H': 7, 'I': 8}

In [ ]: x_test.class_indices

{'A': 0, 'B': 1, 'C': 2, 'D': 3, 'E': 4, 'F': 5, 'G': 6, 'H': 7, 'I': 8}
```

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29°C Partly sunny Search 11:28 19-11-2022

7.2.MODEL BUILDING

```
In [3]: 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
```

- Initializing The Model

```
In [4]: model = Sequential()

WARNING:tensorflow:From c:\users\adars\appdata\local\programs\python\python37\lib\site-packages\keras\backend\tensorflow_backend.py:74: The name tf.get_default_graph is deprecated. Please use tf.compat.v1.get_default_graph instead.
```

- Adding The Convolution Layer


```
In [5]: model.add(Convolution2D(32,(3,3),input_shape=(64,64,1),activation='relu'))
```

WARNING:tensorflow:From c:\users\adars\appdata\local\programs\python\python37\lib\site-packages\keras\backend\tensorflow_backend.py:517: The name tf.placeholder is deprecated. Please use tf.compat.v1.placeholder instead.

WARNING:tensorflow:From c:\users\adars\appdata\local\programs\python\python37\lib\site-packages\keras\backend\tensorflow_backend.py:4138: The name tf.random_uniform is deprecated. Please use tf.random.uniform instead.

- Adding The Pooling Layer

```
In [6]: model.add(MaxPooling2D(pool_size=(2,2)))
```

WARNING:tensorflow:From c:\users\adars\appdata\local\programs\python\python37\lib\site-packages\keras\backend\tensorflow_backend.py:3976: The name tf.nn.max_pool is deprecated. Please use tf.nn.max_pool2d instead.

- Adding The Flatten Layer

```
In [7]: model.add(Flatten())
```

- Compiling The Model

```
In [9]: model.compile(loss='categorical_crossentropy',optimizer='adam',metrics=['accuracy'])
```

WARNING:tensorflow:From c:\users\adars\appdata\local\programs\python\python37\lib\site-packages\keras\optimizers.py:790: The name tf.train.Optimizer is deprecated. Please use tf.compat.v1.train.Optimizer instead.

WARNING:tensorflow:From c:\users\adars\appdata\local\programs\python\python37\lib\site-packages\keras\backend\tensorflow_backend.py:3295: The name tf.log is deprecated. Please use tf.math.log instead.

- Fit And Saving the Model

```
In [10]: model.fit_generator(x_train,steps_per_epoch=24,epochs=10,validation_data=x_test,validation_steps=40)

model.save('signlanguage.h5')
```

WARNING:tensorflow:From c:\users\adars\appdata\local\programs\python\python37\lib\site-packages\tensorflow\python\ops\math_grad.py:1250: add_dispatch_support.<locals>.wrapper (from tensorflow.python.ops.array_ops) is deprecated and will be removed in a future version.

Instructions for updating:

Use tf.where in 2.0, which has the same broadcast rule as np.where

WARNING:tensorflow:From c:\users\adars\appdata\local\programs\python\python37\lib\site-packages\keras\backend\tensorflow_backend.py:986: The name tf.assign_add is deprecated. Please use tf.compat.v1.assign_add instead.

```
Epoch 1/10
24/24 [=====] - 17s 720ms/step - loss: 1.3771 - acc: 0.6265 - val_loss: 0.5072 - val_acc: 0.8809
Epoch 2/10
24/24 [=====] - 15s 635ms/step - loss: 0.3532 - acc: 0.9039 - val_loss: 0.2881 - val_acc: 0.9302
Epoch 3/10
24/24 [=====] - 15s 633ms/step - loss: 0.1826 - acc: 0.9522 - val_loss: 0.1999 - val_acc: 0.9471
Epoch 4/10
24/24 [=====] - 15s 645ms/step - loss: 0.1130 - acc: 0.9707 - val_loss: 0.1902 - val_acc: 0.9676
Epoch 5/10
24/24 [=====] - 15s 630ms/step - loss: 0.0773 - acc: 0.9802 - val_loss: 0.1742 - val_acc: 0.9653
Epoch 6/10
24/24 [=====] - 15s 641ms/step - loss: 0.0534 - acc: 0.9872 - val_loss: 0.1953 - val_acc: 0.9733
Epoch 7/10
24/24 [=====] - 15s 633ms/step - loss: 0.0366 - acc: 0.9917 - val_loss: 0.1920 - val_acc: 0.9698
Epoch 8/10
24/24 [=====] - 15s 637ms/step - loss: 0.0314 - acc: 0.9936 - val_loss: 0.2024 - val_acc: 0.9716
Epoch 9/10
24/24 [=====] - 15s 630ms/step - loss: 0.0271 - acc: 0.9939 - val_loss: 0.2371 - val_acc: 0.9738
Epoch 10/10
24/24 [=====] - 15s 634ms/step - loss: 0.0192 - acc: 0.9965 - val_loss: 0.1944 - val_acc: 0.9747
```

TESTING THE MODEL

- Importing The Packages and Loading the Saved Model

```
In [1]: from keras.models import load_model
        from keras.models import Sequential
        import numpy as np
        import cv2

        # Create a simple test image (a 28x28 pixel image with a single pixel set to 1)
        img = np.zeros((28, 28))
        img[10, 10] = 1
        img = img.astype('float32')

        # Load the saved model
        model = load_model('signlanguage.h5')

        # Predict the class for the test image
        prediction = model.predict(img)
        print(prediction)

        # Print the predicted class
        predictions = model.predict_classes(img)
        print(predictions)

In [2]: model = load_model('signlanguage.h5')

end.py:3976: The name tf.nn.max_pool is deprecated. Please use tf.nn.max_pool2d instead.
WARNING:tensorflow:From c:\users\adars\appdata\local\programs\python\python37\lib\site-packages\keras\backend\tensorflow_backend.py:174: The name tf.get_default_session is deprecated. Please use tf.compat.v1.get_default_session instead.
WARNING:tensorflow:From c:\users\adars\appdata\local\programs\python\python37\lib\site-packages\keras\backend\tensorflow_backend.py:181: The name tf.ConfigProto is deprecated. Please use tf.compat.v1.ConfigProto instead.
WARNING:tensorflow:From c:\users\adars\appdata\local\programs\python\python37\lib\site-packages\keras\backend\tensorflow_backend.py:186: The name tf.Session is deprecated. Please use tf.compat.v1.Session instead.
WARNING:tensorflow:From c:\users\adars\appdata\local\programs\python\python37\lib\site-packages\keras\optimizers.py:790: The name tf.train.Optimizer is deprecated. Please use tf.compat.v1.train.Optimizer instead.
WARNING:tensorflow:From c:\users\adars\appdata\local\programs\python\python37\lib\site-packages\tensorflow\python\ops\math_grad.py:1250: add_dispatch_support.<locals>.wrapper (from tensorflow.python.ops.array_ops) is deprecated and will be removed in a future version.
Instructions for updating:
Use tf.where in 2.0, which has the same broadcast rule as np.where
```

- Loading the Test Image, Pre-Processing it And Prediction

```
In [19]: from skimage.transform import resize

        def detect(frame):
            img = resize(frame, (64, 64))
            img = np.expand_dims(img, axis=0)
            if np.max(img) > 1:
                img = img / 255.0
            prediction = model.predict(img)
            print(prediction)
            predictions = model.predict_classes(img)
            print(predictions)

In [21]: frame = cv2.imread(r"dataset/test_set/G/1.png")
        data = detect(frame)

[[1.1529493e-09 1.6801257e-12 3.0758306e-07 3.6168924e-08 2.1814937e-11
  6.9361130e-09 9.9995184e-01 4.7746969e-05 3.6307211e-09]]
[6]
```

➤ The output [6] in the above image represents the index value in the array['A','B','C','D','E','F','G','H','I'].

➤ Thus, the predicted alphabetic is

HTML CODING

```
<!DOCTYPE html>

<html>

<head>

<meta name="viewport" content="width=device-width, initial-scale=1">

<style>

body {font-family: Arial, Helvetica, sans-serif;}


/* Full-width input fields */

input[type=text], input[type=password] {

width: 100%;

padding: 12px 20px;

margin: 8px 0;

display: inline-block;

border: 1px solid #ccc;

box-sizing: border-box;

}


/* Set a style for all buttons */

button {

background-color: #04AA6D;

color: white;

padding: 14px 20px;

margin: 8px 0;

border: none;

cursor: pointer;
```

Ln 1, Col 1

```
width: 100%;  
  
}  
  
button:hover {  
  opacity: 0.8;  
}  
  
/* Extra styles for the cancel button */  
.cancelbtn {  
  width: auto;  
  
  padding: 10px 18px;  
  
  background-color: #f44336;  
}  
  
/* Center the image and position the close button */  
.imgcontainer {  
  text-align: center;  
  
  margin: 24px 0 12px 0;  
  
  position: relative;  
}  
  
img.avatar {  
  width: 40%;  
  
  border-radius: 50%;  
}
```

CHAPTER 8

TESTING

8.1 Test Cases

After finishing the development of any computer based system the next complicated time consuming process is system testing. During the time of the testing only development company can know that, how far the user requirements have been met out, and so on.

Software testing is an important element of the software quality assurance and represents the ultimate review of specification, design and coding. The increasing feasibility of software as a system and the cost associated with the software failures are motivated forces for well planned through testing.

These are several rules that can save as testing objectives they are:

1. Testing is a process of executing program with the intent of finding an error.
2. A good test case is one that has a high probability of finding an undiscovered error.

TEST CASES

Sl. No	Test Case Name	Test Procedure	Pre-Condition	Expected Result	Passed/ failed
1	Data Input	Enter no details and click submit button	Enter no details input	Alert "Select Dataset, Enter Latitude, Longitude"	Passed

2	Data Input	Select dataset and click submit button	Select dataset and click submit button	Alert “Select Dataset, Enter Latitude, Longitude”	Passed
3	Data Input	Select dataset, enter latitude and click submit button	Select dataset, enter latitude and click submit button	Alert “Select Dataset, Enter Latitude, Longitude”	Passed

8.2 USER ACCEPTANCE TESTING:

User Acceptance Testing is the key factor for the success of any system. The system under consideration is tested for user acceptance by constantly keeping in touch with prospective system users at the time of developing and making changes whenever required.

CHAPTER 9

RESULTS

9.1 Performance Metrics

In the implementation phase, developers change several tasks that they were planned to do. They notice that they can build the system without preparing any training and testing images as they were plan. The code is depending on skin color and contour to find the right sign. Moreover, developers narrow the tasks to only one task which is browse websites only. Moreover, the result was precise and accurate aligned with the methodology and testing that was used. This signifies that developing modern technology assists disabled individuals specifically deaf-dumb on interacting among people.

The measurement variables along with the supporting evidence from the methodology concluded that the measures taken to evaluate this study were supported all throughout. Meanwhile, the efficiency and effectiveness of the system provide the utmost benefit of disabled individuals by offering convenience and being able to make their lives easier and better for there are no required training or specificities for them to use the system. Thus, as a result, D-talk allows everyone to determine the hand gestures that are being projected and be able to come up with interpretations on enabled individuals.

Hence, communications between deaf-dumb and enabled individuals are way easier and lacks misunderstandings are being prevented this time. This application can catch finger shapes by using the code for Extract skin color and draw lines around the hand. As a result, the system will recognize any element in the frame. The application main screen is shown in figure 9. Thus, users must be careful about what is inside the frame to avoid any other unwanted requests. This system will recognize any element in the box, and the brightness does not matter. D-talk is a dynamic system that includes three gestures in total to browse websites. All that users need to implement this system is WiFi connection and webcam to capture user gestures. The following figures 10 and 11 show the hand gestures that are used for orders that the system can recognize to browse websites. It could be used as a guide for users.

10.ADVANTAGES &DISADVANTAGES

11.CONCLUSION

The proposed communication system between Deaf and Dumb people and ordinary people are aiming for it when bridging the communication gap between two societies. Several work is done earlier in this area, but this paper adds in complete two - sided communication in an

efficient manner because the system is implemented as one Handy mobile application. So, it really serves its needs in all aspects. The above strategies prove to be efficient In terms of time and accuracy. Further improvements can be done in the implementation of the communicator with other sign language such as American Sign Language, Accent recognition for different accents throughout Globe, recognition of emotions in sign language and language Translation.

12.FUTURE SCOPE:

Proposed systems scope is related with education of dumb peoples. Dumb people faces many problems when normal person could not understand their language. They were facing communication gap with normal peoples. For communication between deaf person and a second person, a mediator is required to translate sign language of deaf person. But a mediator is required to know the sign language used by deaf person. But this is not always possible since there are multiple sign languages for multiple languages.