



**NAALAIYA THIRAN PROJECT - 2022
HX8001-PROFESSIONAL READINESS FOR
INNOVATION, EMPLOYABILITY AND
ENTREPRENEURSHIP**



**IT - ITes SSC
NASSCOM**



**REAL-TIME COMMUNICATION SYSTEM
POWERED BY AI FOR SPECIALLY ABLED**

A PROJECT REPORT

Submitted by

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NOVEMBER 2022

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BONAFIDE CERTIFICATE

Certified that this report “**REAL-TIME COMMUNICATION SYSTEM POWERED BY AI FOR SPECIALLY ABLED**” is the Bonafide work of **HARIHARAN.S (411519104024), B.M.KUMARAVEL (411519104038), S.LOGESHWARAN (411519104041) AND MEDEPALLI YADIDYA (411519104047)** who carried out **HX8001 - Professional Readiness for Innovation, Employability and Entrepreneurship project** offered by IBM and Anna University, Chennai.

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Project Report Format

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CHAPTER-1

INTRODUCTION

1.1 Project Overview

The goal of this project was to build a neural network able to classify which letter of the American Sign Language(ASL) alphabet is being signed, given an image of a signing hand. This project is a first step towards building a possible sign language translator, which can take communications in sign language and translate them into written and oral language. Such a translator would greatly lower the barrier for many deaf and mute individuals to be able to better communicate with others in day to day interactions.

This goal is further motivated by the isolation that is felt within the deaf community. Loneliness and depression exists in higher rates among the deaf population, especially when they are immersed in a hearing world . Large barriers that profoundly affect life quality stem from the communication disconnect between the deaf and the hearing. Some examples are information deprivation, limitation of social connections, and difficulty integrating in society.

Most research implementations for this task have used depth maps generated by depth camera and high resolution images. The objective of this project was to see if neural networks are able to classify signed ASL letters using simple images of hands taken with a personal device such as a laptop webcam. This is in alignment with the motivation as this would make a future implementation of a real time ASL-to-oral/written language translator practical in an everyday situation.

1.2 Purpose

In our world, comprising of a 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.

CHAPTER-2

LITERATURE SURVEY

Literature survey:

A literature survey or a literature review in a project report is that section which shows the various analyses and research made in the field of your interest and the results already published, taking into account the various parameters of the project and the extent of the project. It is the most important part of your report as it gives you a direction in the area of your research.

It helps you set a goal for your analysis - thus giving you your problem statement.

2.1 Existing Problem

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.

2.2 References

TITLE: Innovative study of an AI voice based smart device to assist deaf people

AUTHOR: Dhaya Sindhu Battina

YEAR: 2021

Assistive technology consists of a wide range of hardware and software tools that enable a person to receive information in the format that suits their needs best. These Various technology may be available to the deaf.many items, including cochlear implants, loop systems ,accessibility,FM technology and assistive listening devices,visual warning systems, videophones, and much more . Recognizing the worth and boundaries of different assistive

devices can be advantageous for both. Artificial intelligence (AI) enables computers to learn from existing experiences, adapt to new information, and perform tasks that are similar to those carried out by humans. The vast majority of artificial intelligence applications that users know of today – ranging from chess playing robots to self-driving vehicles – are primarily reliant on deep learning and computational linguistics. Computers may be taught to do particular jobs by processing huge quantities of data and detecting trends in the data. This is accomplished via the use of various technologies.

TITLE: Communication system for deaf and dumb people

AUTHOR: Shraddha R. Ghorpade, Prof. Surendra K. Waghmare2

YEAR: 2019

People with disabilities are having a difficult time keeping up with the rapidly evolving technology, which is one of the major issues that our society is dealing with. For those with disabilities, having access to communication tools has become crucial. Typically deaf and stupid people use sign language to communicate, but they struggle to do so with non-sign language users' language. Information is the main topic of communication between normal and deaf individuals using sign language, which is expressive and natural. So that we can converse with them and comprehend what they're saying, we need a translation. A language translation technology converts common sign language into voice, enabling regular people to communicate with one another. When it comes to communicating with other people, sign language (SL) is the primary method of communication for hearing-impaired individuals and other groups. It is conveyed via both manual (body and hand movements) and non-manual (face expressions) characteristics. All of these characteristics are combined to create utterances that communicate the meaning of words or statements.

TITLE: Educational Status of Differently Abled Persons and Developed Policies in India

AUTHOR: Chiranjit Majumder

YEAR: 2019 April

One of the socially created phenomenon is basically Disability. The fact is that many children and adults suffered from disabilities excluded from mainstream education benefits. Disabled persons are segregated from education system because of social negligence and absence of support system in the home and inadequacy of sufficient facilities in schools particularly.

However, education is the most important medium for social, economic and political transformation. Socialization of children with disabilities (CWD) through education receives an unremarkably important roles in societies such as India where social exclusion of Physically

Challenged Persons (PCPs) is significant. Indisputably, the literacy level of Physically Challenged Persons (PCPs) is very low in India. Very poor educational outcomes for children with disabilities remain in developing countries specially. Most of disabled persons do not get the full benefits of education. However, some policies in India has started to display some concern for Physically Challenged students. Education is utmost significant to lift up the socioeconomic status of PCPs. But education of disabled persons has not received adequate intentness and resources that it requires. Physically Challenged Persons (PCPs), few who are enrolled in schools are not given equal opportunity for middle secondary and higher education levels. Many Disabled persons are educated but they do not get any work for earning in our society.

2.3 Problem Statement Definition

Communication is the only medium by which we can share our thoughts or convey the message but 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.

Problem:

Roheem 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 convert speech into **understandable** sign language for the deaf ,the system enhances the user friendly experience.

Problem:

Shyam 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.

CHAPTER-3

3.1 Empathy Map Canvas

Definition:

An empathy map canvas is a more in-depth version of the original empathy map, which helps identify and describe the user's needs and pain points. And this is valuable information for improving the user experience.

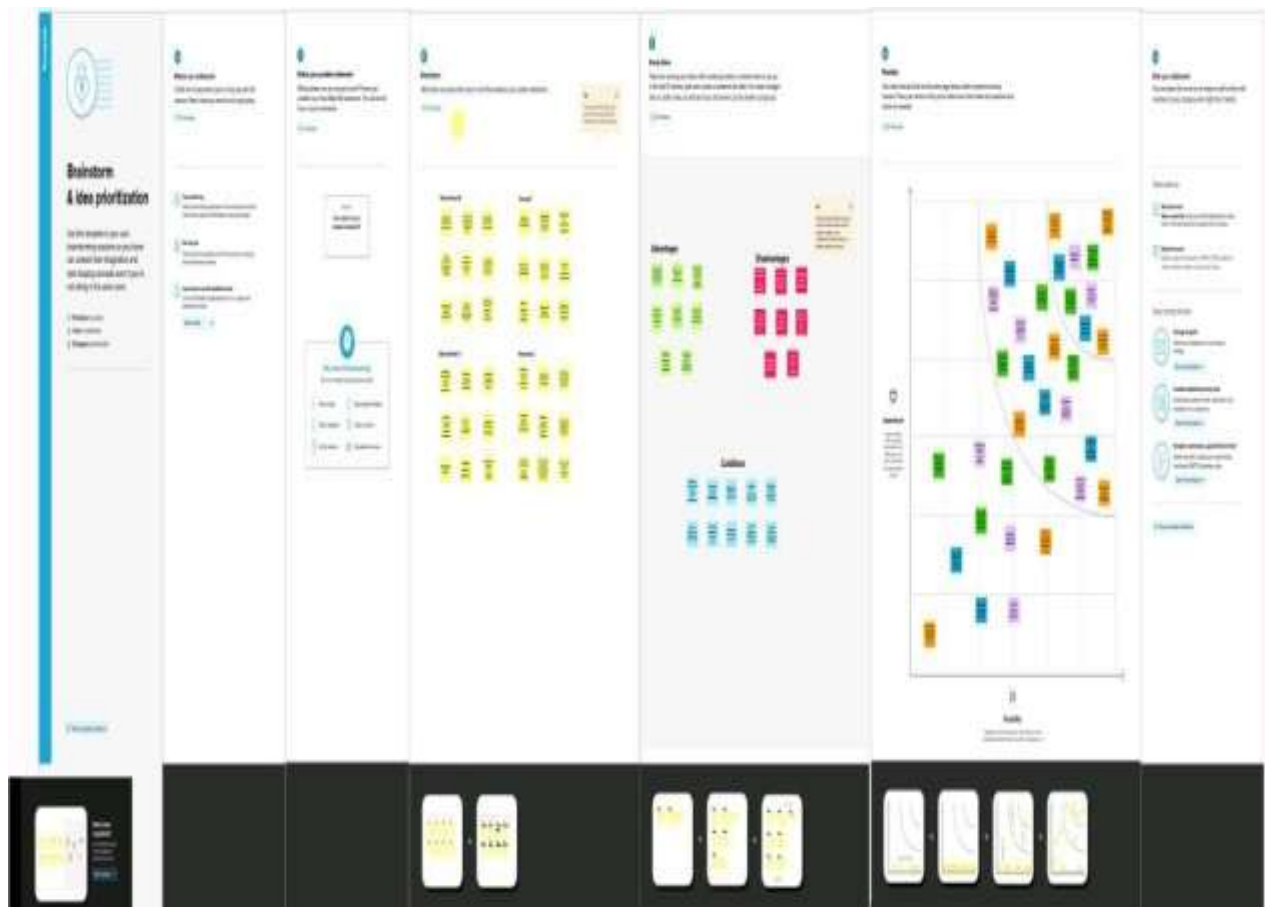
An empathy map canvas helps brands provide a better experience for users by helping teams understand the perspectives and mindset of their customers. Using a template to create an empathy map canvas reduces the preparation time and standardizes the process so you create empathy map canvases of similar quality.



3.2 Ideation & Brainstorming

Definition:

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich number of creative solutions.



3.3 pro posed Solution

S.No	Parameter	Description
1.	Problem Statement (Problem to be solved)	Deaf and dumb people couldn't able to communicate with the normal people easily.
2.	Idea/Solution description	A real time ML based system is built for the real time sign language detection with a Tensor Flow object detection
3.	Novelty/Uniqueness	This model 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.
4.	Social Impact/Customer satisfaction	It drastically reduce communication difference gap between normal people and specially abled people with the help of AI. So they can live their life independently.
5.	Business Model (Revenue Model)	We use freemium business revenue model for making revenue. In our device, we give most of the basic features for free of charge but they have to pay if they need more advanced features.
6.	Scalability of the Solution	The model which is TensorFlow model that has been used can be replaced with another model as well. The same system can be implemented for different sign languages by substituting the dataset.

3.4 Problem Solution Fit

Definition:

The Problem-Solution Fit simply means that you have found a problem with your customer and that the solution you have realized for it actually solves the customer's problem.

Problem-Solution fit canvas 2.0 Purpose / Vision

<p>1. CUSTOMER SEGMENT(S) Who is your customer?</p> <p>People who lost their speech or hearing ability by birth or due to some other factors.</p>	<p>6. CUSTOMER What constraints prevent your customers from doing what is critical to their success or solution? (i.e. spending power, budget, on call, network connection, mobile devices).</p> <p>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.</p>	<p>5. AVAILABLE SOLUTIONS What solutions are available to the customer, when they find the problem, when to get the job done? What is going to be in the past? What goes & controls most customers' hand? Is past and future is an alternative to digital monitoring?</p> <p>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.</p>
<p>2. JOBS-TO-BE-DONE / PROBLEMS What jobs/hurdles do problem do you address for your customer? These could be more than one solution different jobs.</p> <p>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.</p>	<p>9. PROBLEM ROOT CAUSE What is the root reason that this problem exist? What is the back story behind the need to do this job? Is technology failed to do the job due to the change in requirements?</p> <p>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.</p>	<p>7. BEHAVIOUR What does your customer do to address the problem and get the job done? Is already existing? And thought to be solved easily, calculate usage and benefits, identify associated customers based on experience with it & consequences.</p> <p>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.</p>
<p>3. TRIGGERS What triggers customers to act? Is seeing their neighbours handling water jerrycan, reading about a more efficient solution in the news.</p> <p>By comparing normal people, Specially Abled people should depend on others and want to live their life independently like other people.</p> <p>4. EMOTIONS: BEFORE / AFTER How do customers feel before they face a problem or a job and afterwards? Is it that someone is helping them to overcome it or it is a very difficult situation to handle.</p> <p>BEFORE: It is very difficult to convey the message to normal people. AFTER: They overcome their reluctance to have communication with normal people.</p>	<p>10. YOUR SOLUTION If you are working on an existing business, write down your existing solution that is in the market, and check how much it is really. If you are working on a new business proposition, then keep it close until you find the service and come up with a solution that can solve customer's problems, solves a problem and makes customer's business.</p> <p>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.</p>	<p>8. CHANNELS of BEHAVIOUR 8.1 ONLINE What kind of online do customers use online? Extract online channels from it.</p> <p>Advertise on online with influencers to test the product and promote it also on blog channels.</p> <p>8.2 OFFLINE What kind of offline do customers use offline? Extract offline channels from it and use them for customer's experience.</p> <p>On offline, we have our product experience stores where our customer can experience the product in real.</p>


 Problem-Solution Fit canvas 2.0 licensed under a Creative Commons Attribution-NonCommercial-NoDerivs 4.0 International License. By Data Visualization / Amaltama.com

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CHAPTER- 4

REQUIREMENT ANALYSIS

4.1 Functional Requirements

FR No.	Functional Requirement	Sub Requirements
FR-1	User Registration	Registration through Form Registration through Gmail.
FR-2	User confirmation	Confirmation via Email Confirmation via OTP
FR-3	System	Desktop with high resolution camera
FR-4	Authorization Levels	There are two levelsof authorization namelystandard access level and advanced accesslevel.
FR-5	External interface	Ethernet, Wi-Fi,USB to provideinternet facility to access the resources with real time communication.
FR-6	Reporting	If any issues found in the application, automatically it will be notified to the developer.

4.2 Non-Functional Requirements

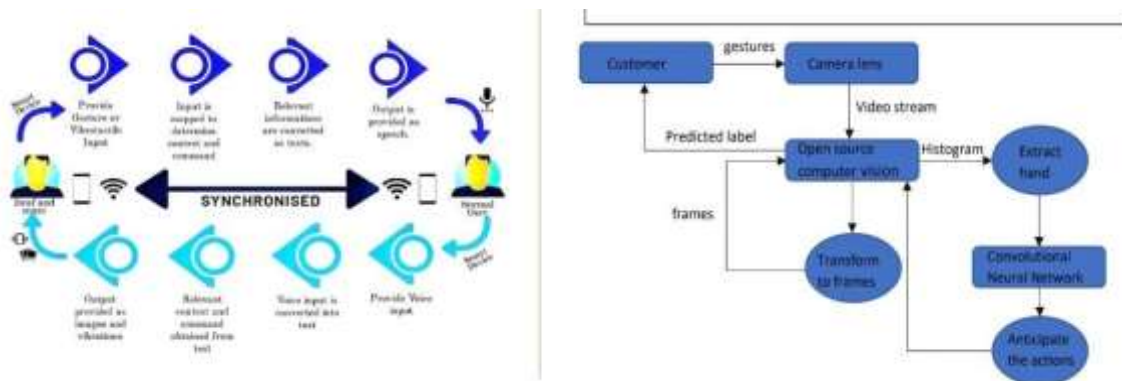
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	To convey a message to normal people, as well as convert speech into understandable sign language for the deaf and dumb people.
NFR-2	Security	Converted information using signs into speech is accessed only by the user.
NFR-3	Reliability	Provides insight into potential issues for desktop applications on managed devices.
NFR-4	Performance	The time for converting signs into speech should be faster for the real time communication.
NFR-5	Availability	Provides automatic recovery as much's possible.
NFR-6	Scalability	This app enables deaf and dumb people to convey their information using signs which get converted to human-understandable language and speech's given as output.

CHAPTER-5

PROJECT DESIGN

5.1 Data Flow Diagram

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.



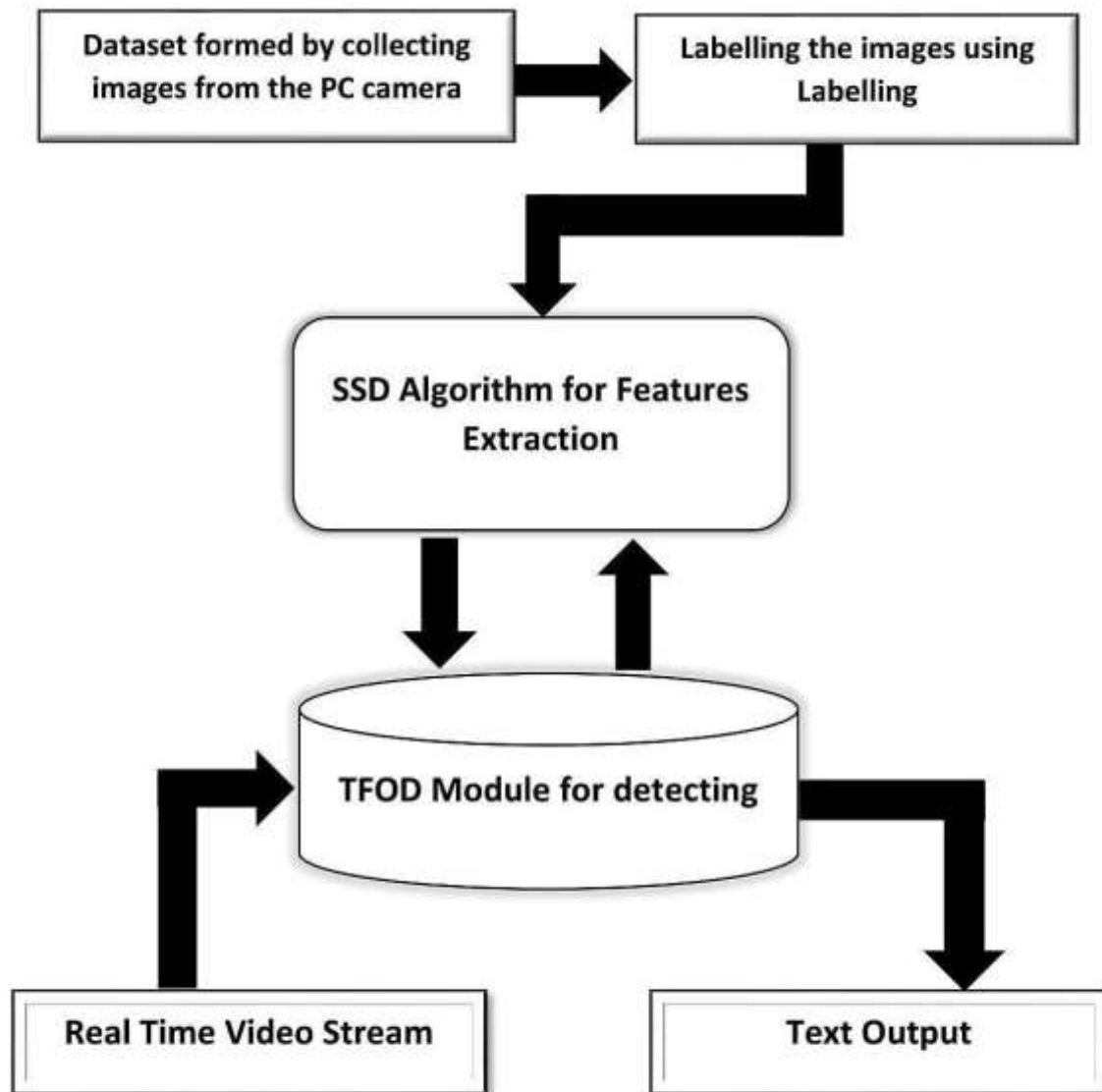
5.2 Solution & Technical Architecture

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

1. Find the best tech solution to solve existing business problems.
2. Describe the structure, characteristics, behaviour, and other aspects of the software to project stakeholders.
3. Define features, development phases, and solution requirements.

4. Provide specifications according to which the solution is defined, managed, and delivered.

Solution Architecture Diagram :



SYSTEM ARCHITECTURE

Technology Stack (Architecture & Stack):

Technical Architecture:

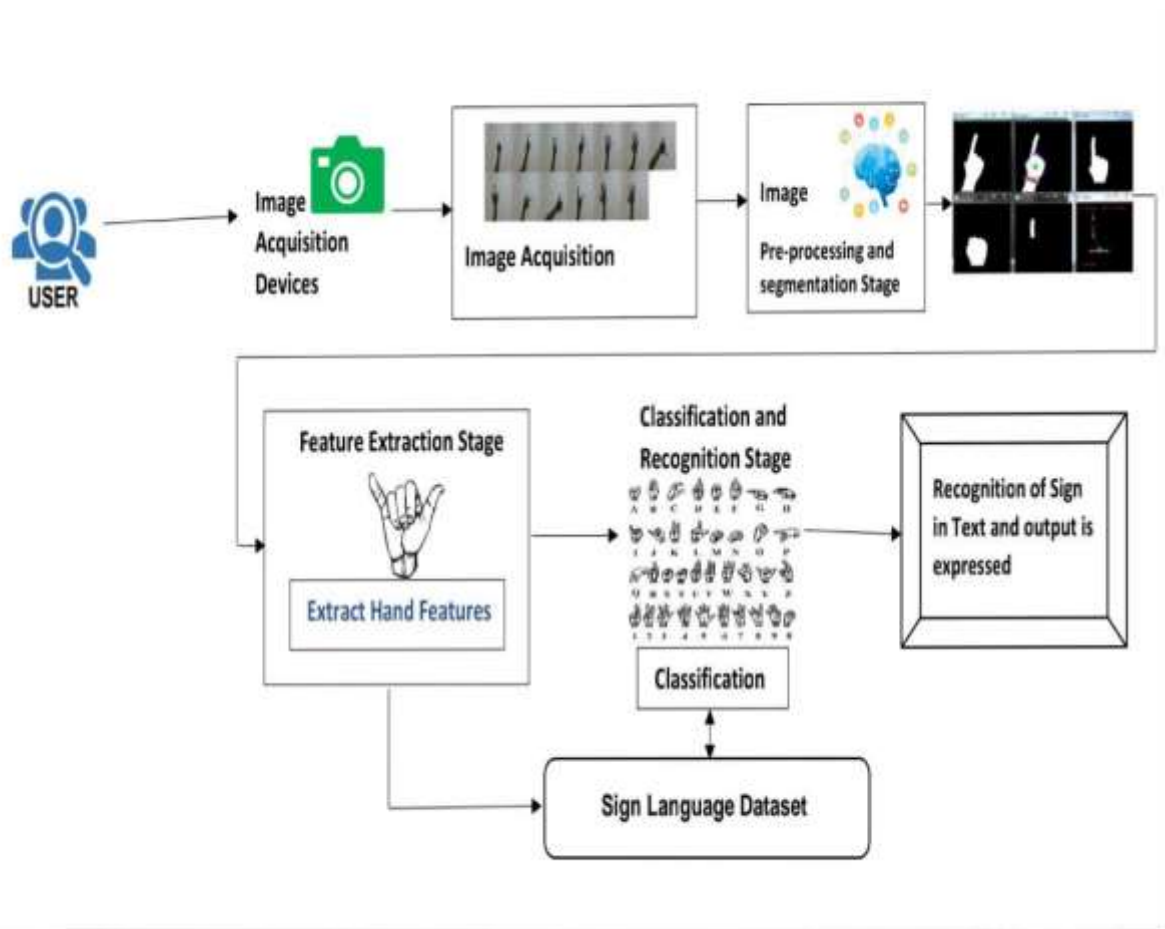


Table-1 Components and Technologies:

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.

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	The framework which are used.	Tensor flow, Theano, RNN, PyTorch
2.	Security Implementations	Security controls which can implemented by using firewall..	Firewall and some security related softwares..
3.	Scalable Architecture	The architecture will be scalable (Micro services).	Data, models, speed and consistency..
4.	Availability	The availability of application (use of load balancers, distributed servers etc)	Image recognition, sign/gestures recognition, text recognition & real time captioning..
5.	Performance	Design aspects for the performance of application (number of requests per second, use of cacheetc.,	Using Convolutional neural network, maching learning for conversation and improve the sensivity of the performance..

5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As customer, I could able to register for the app by entering my E-mail and proper password.	I could able to access my registered account.	High	Sprint 1
		USN-2	As a user, I'll get the acknowledgement verification email once after my registration has been done for the app.	I can get verification email and clickok to confirm it..	High	Sprint 1
		USN-3	As a customer, I could able to register for application via their official websites and social media.	I could able to register and access my account by using their website & socialmedia.	Medim	Sprint 2
		USN-4	As a customer, I could able to register for application through Gmail	via some thirdparties link	Low	Sprint 2
	Login	USN-5	As a customer, I could able to login into application by entering already registered email and password	I can type manually and also can used saved login credentials	High	Sprint 1

	Dashboard	USN6	As a customer,I can get all services and help in dashboard	I can access my dashboard and change profile	Medium	Sprint 2
Customer (Webuser)	Registration	USN7	As a customer, I could able to login through registered phone number by using otp instead of Gmail	I could able to register & login via phone number to access my account	High	Sprint 2
Customer Care Executive	Service	USN8	Can avail the service by calling customer care or reaching through E-mail.	Can avail the service by calling customer care or reaching through E-mail.	Medium	Sprint 1
Administrator		USN9	Respective person in the company should take care all of this.	All the requirements are there.	High	Sprint 2
	Sign up	USN-10	Customer have to sign-up to use these things and all	Have to enter valid credentials.	High	Sprint 2

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
	Wish list	USN-11	Customer's desired choices to avail these services.	As a customer can review and choose their services as he want/preferred.	Medium	Sprint 1
	Enrollment	USN-12	Now, customer can avail all services once he/she enrolled.	As a customer, it's quite enchanting	Medium	Sprint 2

CHAPTER-6

PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Product Backlog, Sprint Schedule, and Estimation:

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	LOGESHWARAN S, KUMARAVEL BM
Sprint-1		USN-2	Image preprocessing	8	Medium	LOGESHWARAN S, KUMARAVEL BM, HARIHARAN S
Sprint-2	Model Building	USN-3	Import the required libraries, add the necessary layers and compile the model	10	High	MEDEPALLI YADIDYA, HARIHARAN S
Sprint-2		USN-4	Training the image classification model using CNN	7	Medium	MEDEPALLI YADIDYA, HARIHARAN S
Sprint-3	Training and Testing	USN-5	Training the model and testing the model's performance	9	High	LOGESHWARAN S, KUMARAVEL BM
Sprint-4	Implementation of the application	USN-6	Converting the input sign language images into English alphabets	8	Medium	MEDEPALLI YADIDYA, HARIHARAN S.

6.2 Sprint Delivery Schedule

Project Tracker, Velocity & Burndown Chart:

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

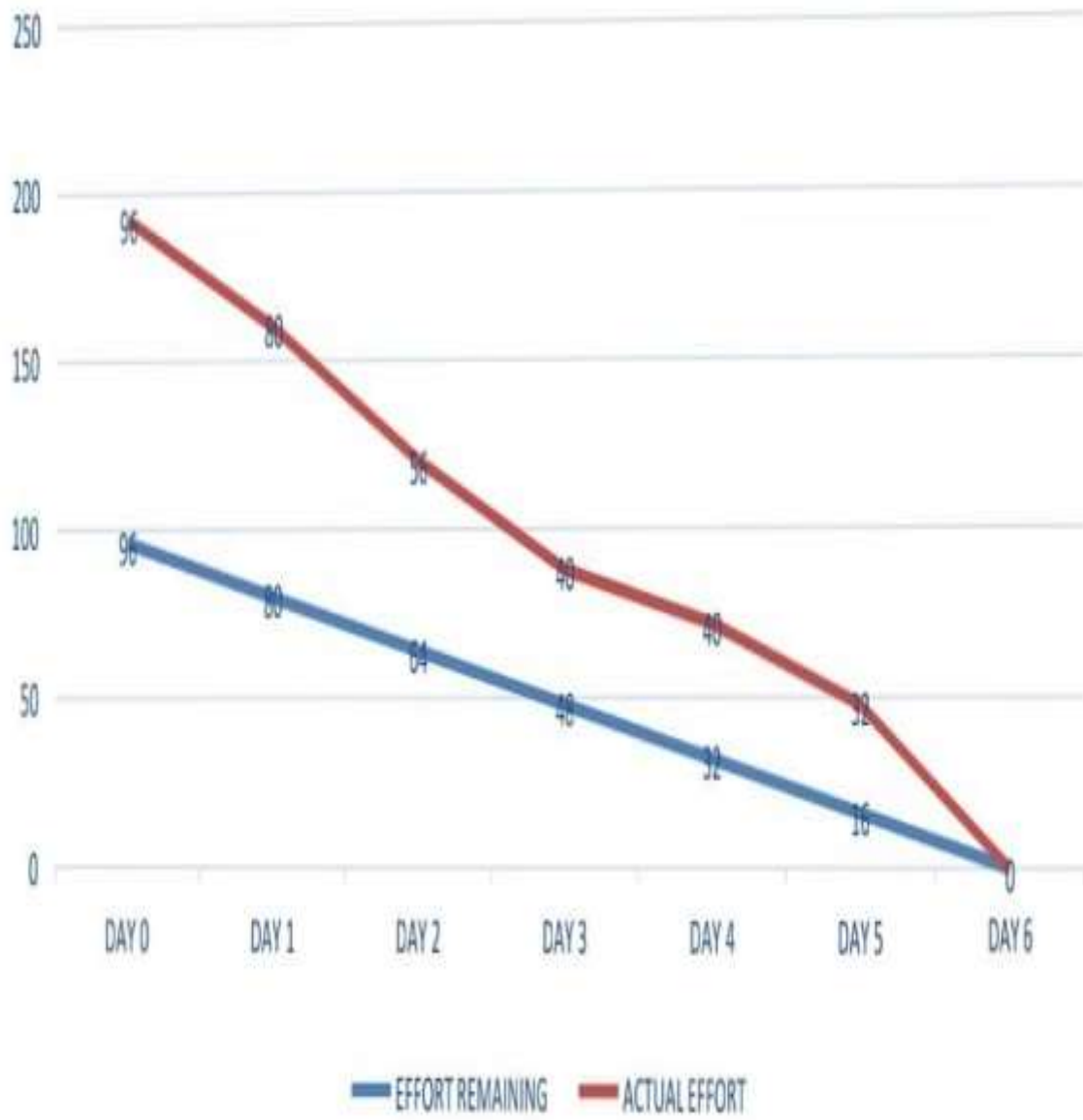
Velocity:

$$AV = 6/10 = 0.6$$

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.

Chart Title



6.3 Reports from JIRA

Reports from JIRA:

Jira helps teams plan, assign, track, report, and manage work and brings teams together for everything from agile software development and customer support to start-ups and enterprises. Software teams build better with Jira Software, the #1 tool for agile teams. As a Jira administrator, you can create project categories so your team can view work across related projects in one place. Your team can use categories in advanced search, filters, reports, and more.



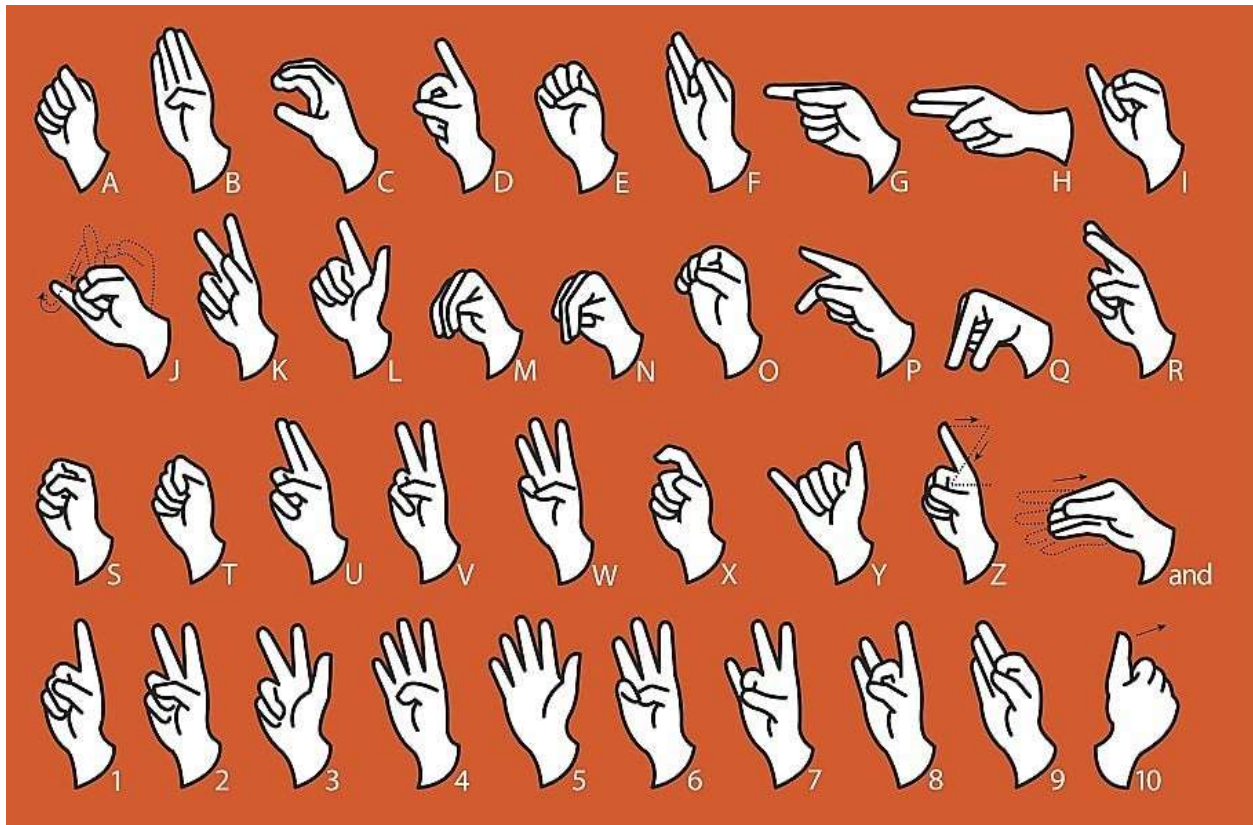
CHAPTER-7

CODING & SOLUTIONING

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

7.1 Feature 1

The user can choose which sign language to read based on the different sign language standards that exist.



MODEL BUILDING

```
from keras.models import Sequential from keras.layers
import Dense from keras.layers import Convolution2D from
tensorflow.keras.layers import Conv2D, MaxPooling2D from
keras.layers import Dropout from keras.layers import Flatten
```

In [101]:

```
#Creating the model
model=Sequential()
#Adding the layers
model.add(Convolution2D(32,(3,3), input_shape=(64,64,1), activation = 'relu'))
model.add(MaxPooling2D(pool_size=(2,2))) model.add(Flatten())

#adding hidden layers
model.add(Dense(400, activation='relu'))
model.add(Dense(200, activation='relu'))
model.add(Dense(100, activation='relu'))

#Adding the output layer
model.add(Dense(9, activation='softmax'))
```

In [102]:

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

In [157]:

```
model.fit_generator(x_train, steps_per_epoch=30, epochs=10,
validation_data=x_test,validation_steps=50)
Epoch 1/10
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1: UserWarning:
`Model.fit_generator` is deprecated and will be removed in a future version. Please use
`Model.fit`, which supports generators.
    """Entry point for launching an IPython kernel.
30/30 [=====] - ETA: 0s - loss: 0.0083 - accuracy: 0.9957
WARNING:tensorflow:Your input ran out of data; interrupting training. Make sure that your
dataset or generator can generate at least `steps_per_epoch * epochs` batches (in this case, 50
batches). You may need to use the repeat() function when building your dataset.
30/30 [=====] - 18s 587ms/step - loss: 0.0083 - accuracy:
0.9957 - val_loss: 0.2910 - val_accuracy: 0.9693
```

Epoch 2/10
30/30 [=====] - 12s 402ms/step - loss: 0.0081 - accuracy:
0.9980
Epoch 3/10
30/30 [=====] - 12s 400ms/step - loss: 0.0102 - accuracy:
0.9963
Epoch 4/10
30/30 [=====] - 12s 402ms/step - loss: 0.0049 - accuracy:
0.9993
Epoch 5/10
30/30 [=====] - 12s 402ms/step - loss: 0.0030 - accuracy:
0.9997
Epoch 6/10
30/30 [=====] - 12s 394ms/step - loss: 0.0019 - accuracy:
0.9997
Epoch 7/10
30/30 [=====] - 12s 401ms/step - loss: 0.0081 - accuracy:
0.9973
Epoch 8/10
30/30 [=====] - 12s 402ms/step - loss: 0.0124 - accuracy:
0.9960
Epoch 9/10
30/30 [=====] - 12s 401ms/step - loss: 0.0070 - accuracy:
0.9987
Epoch 10/10
30/30 [=====] - 12s 399ms/step - loss: 0.0089 - accuracy:
0.9973

model.save('Real_time.h5')

TEST THE MODEL

```
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import
image import numpy as np import cv2
model = load_model('/content/Real_time.h5')
```

```
img = image.load_img('/content/Dataset/test_set/H/107.png',target_size = (100,100))img
```



```
from skimage.transform import resize
def detect(frame):
    img=image.img_to_array(frame)
    img = resize(img,(64,64,1))
    img = np.expand_dims(img,axis=0)
    pred=np.argmax(model.predict(img))
    op=['A','B','C','D','E','F','G','H','I']
    print("THE PREDICTED LETTER IS ",op[pred])
```

In [150]:

```
img=image.load_img("/content/Dataset/test_set/H/107.png") detect(img)
1/1 [=====] - 0s 28ms/step
THE PREDICTED LETTER IS H
```

In [155]:

```
img = image.load_img('/content/Dataset/test_set/A/110.png') pred=detect(img)
1/1 [=====] - 0s 26ms/step
THE PREDICTED LETTER IS A
```

In [158]:

```
img=image.load_img('/content/Dataset/test_set/E/111.png') detect(img)
1/1 [=====] - 0s 30ms/step THE
PREDICTED LETTER IS E
```

7.2 Feature 2

The communication gap between deaf and dumb people and the general public can be bridged with a mobile application.

Mobile App:

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

```
app = Flask(__name__) @app.route('/') def
index(): return
render_template('index.html')
```

```
def gen(camera):
    while True:
        frame = camera.get_frame() yield(b'--frame\r\n'
        b'Content-Type: image/jpeg\r\n\r\n' + frame +
        b'\r\n\r\n')
```

```
@app.route('/video_feed
') def video_feed(): video
= Video()
    return Response(gen(video), mimetype='multipart/x-mixed-replace; boundary = frame')
```

```
if __name__ == '__main__': app.run()
```

CHAPTER-8

TESTING

8.1 Test cases

- Our code was tested on various angle to check whether it gives the correct output.
- To satisfy the customer's expectations we tested it fully

8.2 User Acceptance Testing

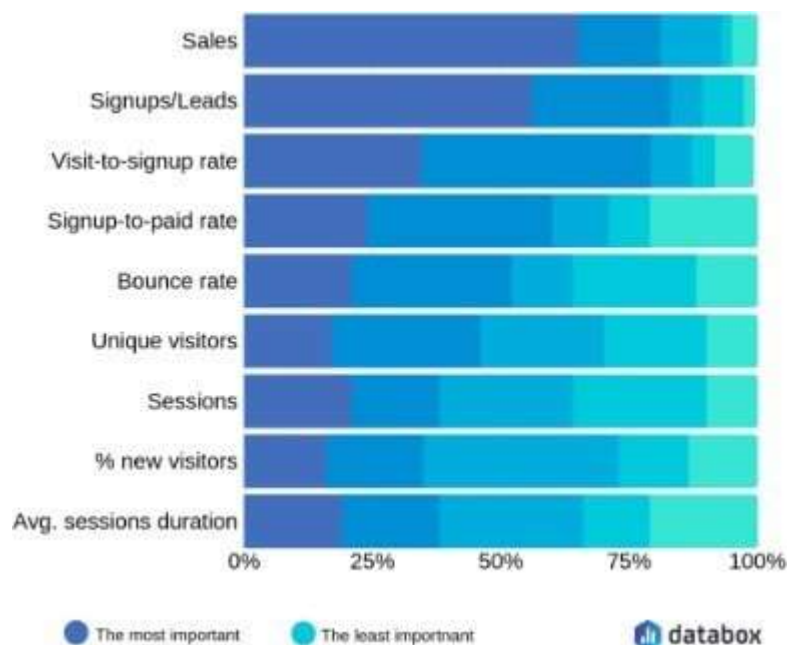
Our project was tested by an end user to verify that it has working correctly.

CHAPTER-9

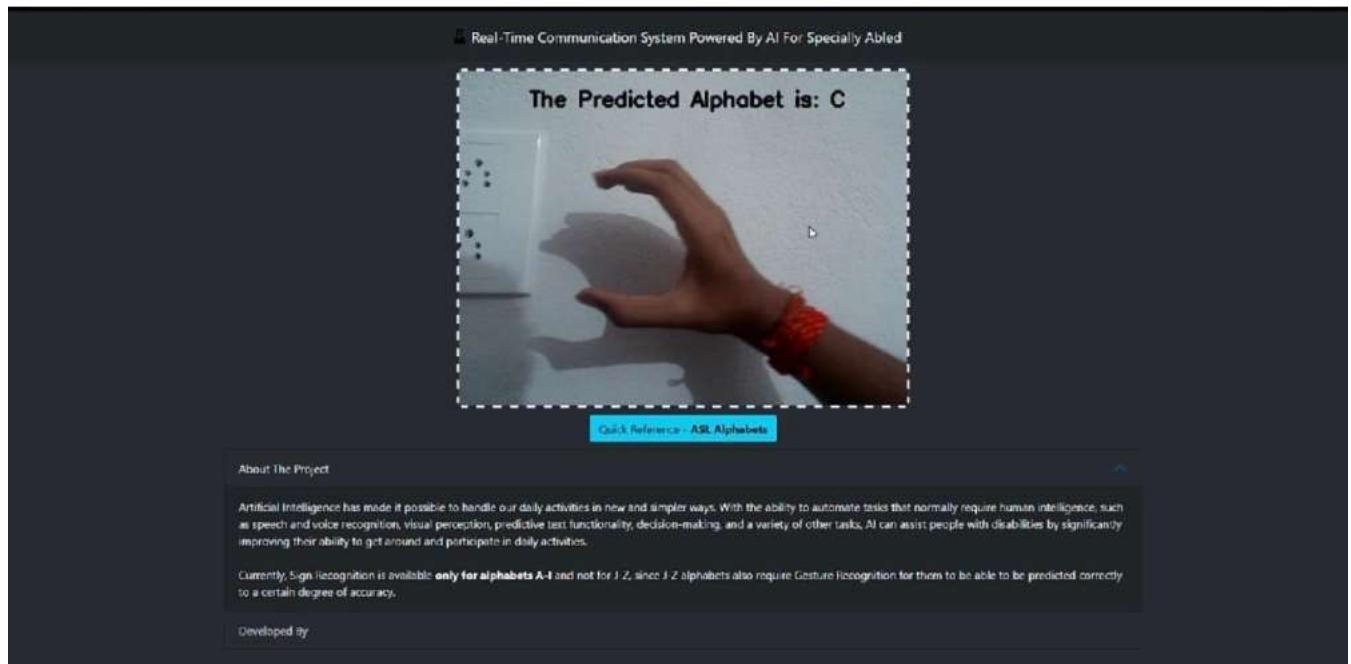
RESULTS

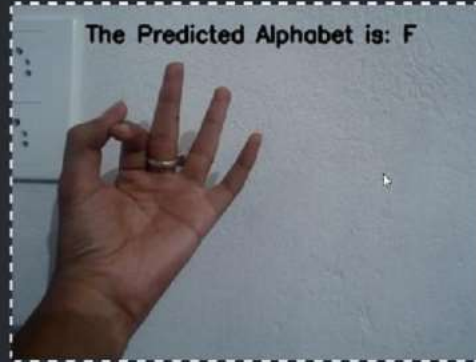
9.1 Performance Metrics

- The proposed procedure was implemented and tested on a set of images.
- The training database consists of 15750 images of Alphabets from "A" to "I", while the testing database consists of 2250 images of Alphabets from "A" to "I".
- Once the gesture is recognized the equivalent alphabet is shown on the screen.



output:





[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.

Developed By



[Quick Reference - ASL Alphabets](#)

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Developed By

CHAPTER-10

ADVANTAGES & DISADVANTAGES

Advantages:

- The speech is converted to sign language very quick to provide greater and faster understanding to specially-abled people.
- The user interface is convenient and simple for both people.

Disadvantages:

- The number of images and pixels for the model to train in the dataset is not high so accuracy is moderate level.
- It will be improved by changing the dataset.
- Currently, we have deployed a dataset in the model for the alphabets A to I only.

CHAPTER-11

CONCLUSION

CONCLUSION:

It aims to bridge the communication gap between deaf people and the rest of society. The proposed methodology translates sign language into English alphabets that are understandable to humans. This system sends hand gestures to the model, who recognizes them and displays the equivalent.

CHAPTER-12

FUTURE SCOPE

FUTURE OF SCOPE:

With the introduction of gesture recognition, the web app can easily be expanded to recognize letters beyond 'I', digits, and other symbols plus gesture recognition can also allow controlling of software/hardware interfaces. 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 specially-abled people such as thosedead or dumb.

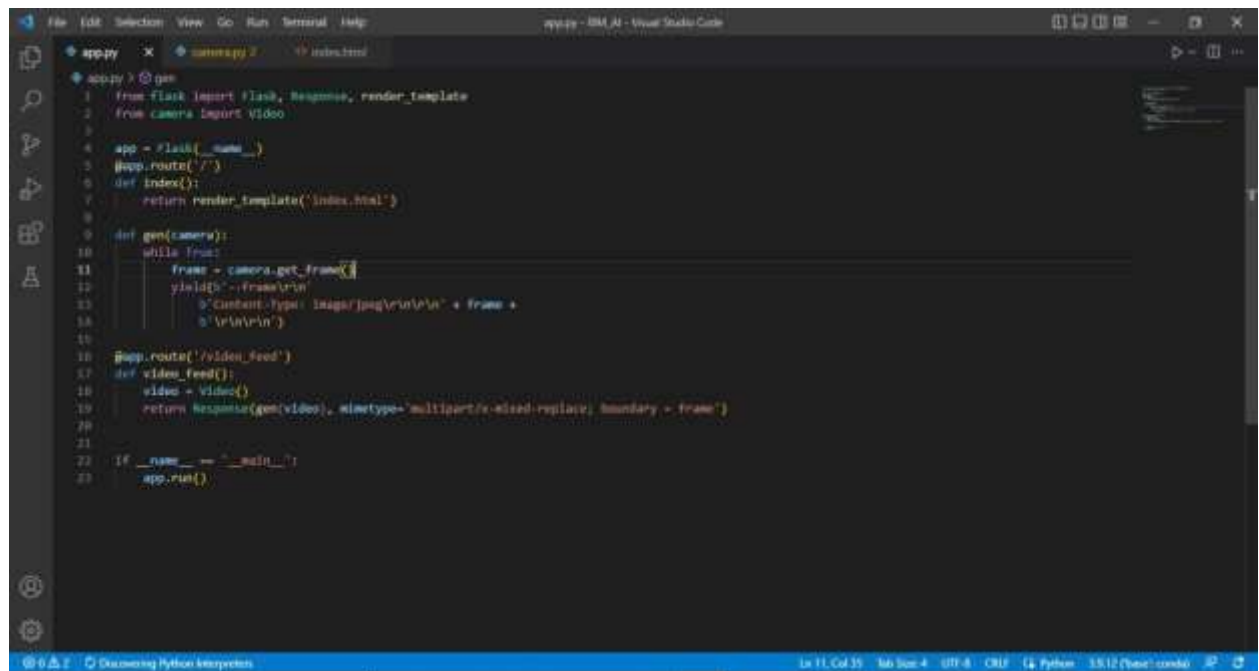
CHAPTER-13

APPENDIX

APPENDIX:

Source code:

Flask:



```
File Edit Selection View Go Run Terminal Help
app.py - RM/Al - Visual Studio Code

app.py x camera.py index.html
app.py > gen
1 from flask import Flask, Response, render_template
2 from camera import Video
3
4 app = Flask(__name__)
5 @app.route('/')
6 def index():
7     return render_template('index.html')
8
9 def gen(camera):
10     while True:
11         frame = camera.get_frame()
12         yield(b'<frame>\n'
13              + b'Content-type: image/jpeg\n' + frame +
14              b'\n\n')
15
16 @app.route('/video_feed')
17 def video_feed():
18     video = Video()
19     return Response(gen(video), mimetype='multipart/x-mixed-replace; boundary=frame')
20
21
22 if __name__ == '__main__':
23     app.run()
```

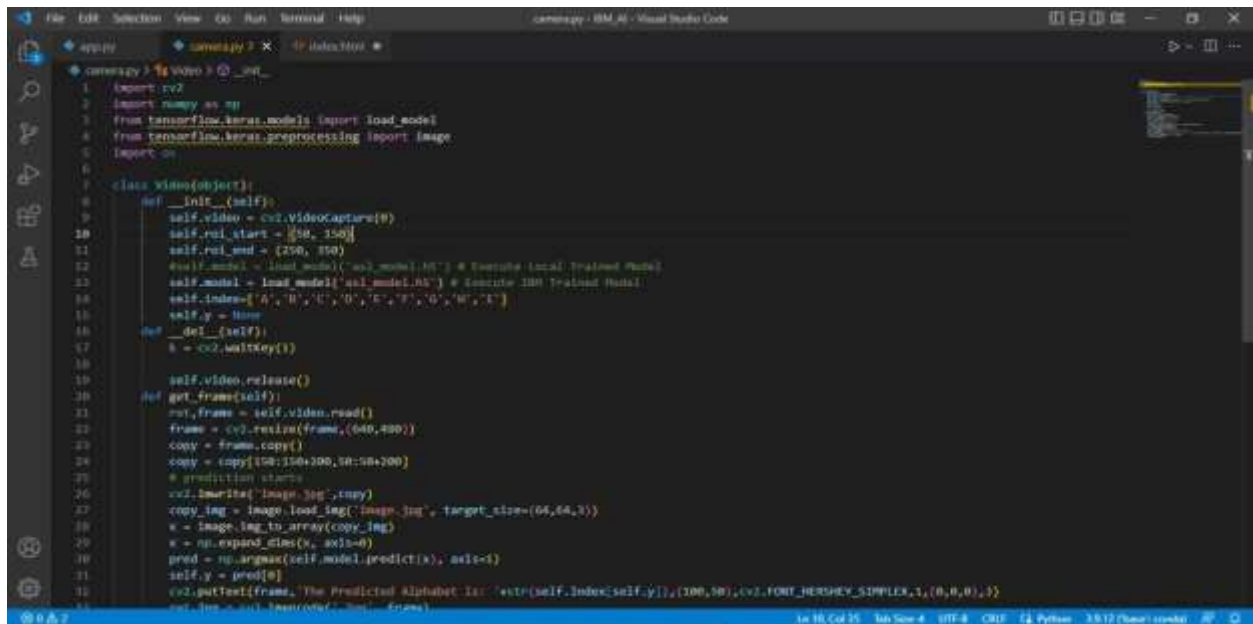
Ln 11, Col 35 · Tab Size: 4 · UTF-8 · ORF · Python 3.8.12 (base: conda)

HTML:

```

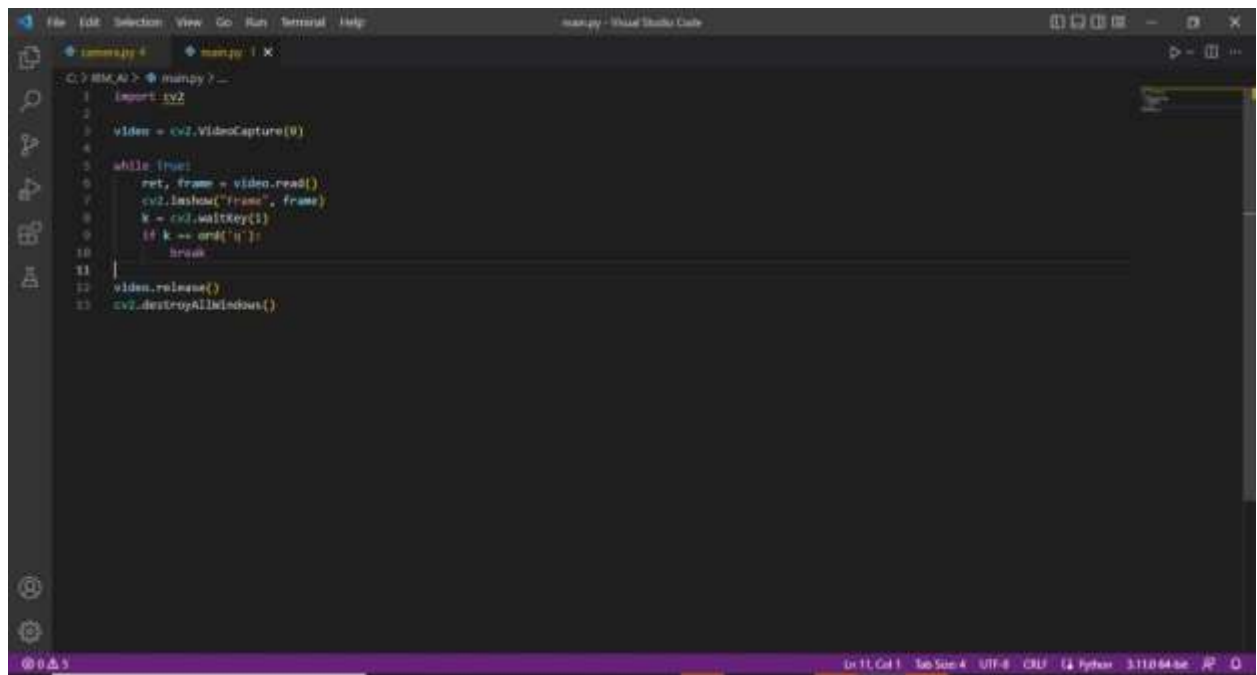
1 <!DOCTYPE html>
2 <html lang="en">
3
4 <head>
5   <meta charset="utf-8">
6   <meta name="viewport" content="width=device-width, initial-scale=1.0, shrink-to-fit=no">
7   <title>REAL TIME COMMUNICATION </title>
8   <link rel="stylesheet" href="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/css/bootstrap.min.css">
9   <link rel="stylesheet" href="https://www.fontawesome.com/releases/v6.2.0/css/all.css">
10  <link rel="stylesheet" href="Navbar/NavbarBrand.css">
11 </head>
12
13 <body style="background-color: #F5F5F5;">
14   <div class="navbar navbar-light navbar-expand-md py-2" style="background-color: #E2E2E2;">
15     <div class="container">
16       <div class="navbar-brand d-flex align-items-center" href="#">
17         <span class="h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11 h12 h13 h14 h15 h16 h17 h18 h19 h20 h21 h22 h23 h24 h25 h26 h27 h28 h29 h30 h31 h32 h33 h34 h35 h36 h37 h38 h39 h40 h41 h42 h43 h44 h45 h46 h47 h48 h49 h50 h51 h52 h53 h54 h55 h56 h57 h58 h59 h60 h61 h62 h63 h64 h65 h66 h67 h68 h69 h70 h71 h72 h73 h74 h75 h76 h77 h78 h79 h80 h81 h82 h83 h84 h85 h86 h87 h88 h89 h90 h91 h92 h93 h94 h95 h96 h97 h98 h99 h100 h101 h102 h103 h104 h105 h106 h107 h108 h109 h110 h111 h112 h113 h114 h115 h116 h117 h118 h119 h120 h121 h122 h123 h124 h125 h126 h127 h128 h129 h130 h131 h132 h133 h134 h135 h136 h137 h138 h139 h140 h141 h142 h143 h144 h145 h146 h147 h148 h149 h150 h151 h152 h153 h154 h155 h156 h157 h158 h159 h160 h161 h162 h163 h164 h165 h166 h167 h168 h169 h170 h171 h172 h173 h174 h175 h176 h177 h178 h179 h180 h181 h182 h183 h184 h185 h186 h187 h188 h189 h190 h191 h192 h193 h194 h195 h196 h197 h198 h199 h200 h201 h202 h203 h204 h205 h206 h207 h208 h209 h210 h211 h212 h213 h214 h215 h216 h217 h218 h219 h220 h221 h222 h223 h224 h225 h226 h227 h228 h229 h230 h231 h232 h233 h234 h235 h236 h237 h238 h239 h240 h241 h242 h243 h244 h245 h246 h247 h248 h249 h250 h251 h252 h253 h254 h255 h256 h257 h258 h259 h260 h261 h262 h263 h264 h265 h266 h267 h268 h269 h270 h271 h272 h273 h274 h275 h276 h277 h278 h279 h280 h281 h282 h283 h284 h285 h286 h287 h288 h289 h290 h291 h292 h293 h294 h295 h296 h297 h298 h299 h300 h301 h302 h303 h304 h305 h306 h307 h308 h309 h310 h311 h312 h313 h314 h315 h316 h317 h318 h319 h320 h321 h322 h323 h324 h325 h326 h327 h328 h329 h330 h331 h332 h333 h334 h335 h336 h337 h338 h339 h340 h341 h342 h343 h344 h345 h346 h347 h348 h349 h350 h351 h352 h353 h354 h355 h356 h357 h358 h359 h360 h361 h362 h363 h364 h365 h366 h367 h368 h369 h370 h371 h372 h373 h374 h375 h376 h377 h378 h379 h380 h381 h382 h383 h384 h385 h386 h387 h388 h389 h390 h391 h392 h393 h394 h395 h396 h397 h398 h399 h400 h401 h402 h403 h404 h405 h406 h407 h408 h409 h410 h411 h412 h413 h414 h415 h416 h417 h418 h419 h420 h421 h422 h423 h424 h425 h426 h427 h428 h429 h430 h431 h432 h433 h434 h435 h436 h437 h438 h439 h440 h441 h442 h443 h444 h445 h446 h447 h448 h449 h450 h451 h452 h453 h454 h455 h456 h457 h458 h459 h460 h461 h462 h463 h464 h465 h466 h467 h468 h469 h470 h471 h472 h473 h474 h475 h476 h477 h478 h479 h480 h481 h482 h483 h484 h485 h486 h487 h488 h489 h490 h491 h492 h493 h494 h495 h496 h497 h498 h499 h500 h501 h502 h503 h504 h505 h506 h507 h508 h509 h510 h511 h512 h513 h514 h515 h516 h517 h518 h519 h520 h521 h522 h523 h524 h525 h526 h527 h528 h529 h530 h531 h532 h533 h534 h535 h536 h537 h538 h539 h540 h541 h542 h543 h544 h545 h546 h547 h548 h549 h550 h551 h552 h553 h554 h555 h556 h557 h558 h559 h560 h561 h562 h563 h564 h565 h566 h567 h568 h569 h570 h571 h572 h573 h574 h575 h576 h577 h578 h579 h580 h581 h582 h583 h584 h585 h586 h587 h588 h589 h590 h591 h592 h593 h594 h595 h596 h597 h598 h599 h600 h601 h602 h603 h604 h605 h606 h607 h608 h609 h610 h611 h612 h613 h614 h615 h616 h617 h618 h619 h620 h621 h622 h623 h624 h625 h626 h627 h628 h629 h630 h631 h632 h633 h634 h635 h636 h637 h638 h639 h640 h641 h642 h643 h644 h645 h646 h647 h648 h649 h650 h651 h652 h653 h654 h655 h656 h657 h658 h659 h660 h661 h662 h663 h664 h665 h666 h667 h668 h669 h670 h671 h672 h673 h674 h675 h676 h677 h678 h679 h680 h681 h682 h683 h684 h685 h686 h687 h688 h689 h690 h691 h692 h693 h694 h695 h696 h697 h698 h699 h700 h701 h702 h703 h704 h705 h706 h707 h708 h709 h710 h711 h712 h713 h714 h715 h716 h717 h718 h719 h720 h721 h722 h723 h724 h725 h726 h727 h728 h729 h730 h731 h732 h733 h734 h735 h736 h737 h738 h739 h740 h741 h742 h743 h744 h745 h746 h747 h748 h749 h750 h751 h752 h753 h754 h755 h756 h757 h758 h759 h760 h761 h762 h763 h764 h765 h766 h767 h768 h769 h770 h771 h772 h773 h774 h775 h776 h777 h778 h779 h780 h781 h782 h783 h784 h785 h786 h787 h788 h789 h790 h791 h792 h793 h794 h795 h796 h797 h798 h799 h800 h801 h802 h803 h804 h805 h806 h807 h808 h809 h810 h811 h812 h813 h814 h815 h816 h817 h818 h819 h820 h821 h822 h823 h824 h825 h826 h827 h828 h829 h830 h831 h832 h833 h834 h835 h836 h837 h838 h839 h840 h841 h842 h843 h844 h845 h846 h847 h848 h849 h850 h851 h852 h853 h854 h855 h856 h857 h858 h859 h860 h861 h862 h863 h864 h865 h866 h867 h868 h869 h870 h871 h872 h873 h874 h875 h876 h877 h878 h879 h880 h881 h882 h883 h884 h885 h886 h887 h888 h889 h890 h891 h892 h893 h894 h895 h896 h897 h898 h899 h900 h901 h902 h903 h904 h905 h906 h907 h908 h909 h910 h911 h912 h913 h914 h915 h916 h917 h918 h919 h920 h921 h922 h923 h924 h925 h926 h927 h928 h929 h930 h931 h932 h933 h934 h935 h936 h937 h938 h939 h940 h941 h942 h943 h944 h945 h946 h947 h948 h949 h950 h951 h9
```


Camera:



```
1 import cv2
2 import numpy as np
3 from tensorflow.keras.models import load_model
4 from tensorflow.keras.preprocessing import image
5 import os
6
7 class Video(object):
8     def __init__(self):
9         self.video = cv2.VideoCapture(0)
10        self.rcv_start = [50, 150]
11        self.rcv_end = [250, 350]
12        self.model = load_model('cvt_model.h5') # Overfit Local Trained Model
13        self_model = load_model('cvt_model.h5') # Overfit 100 Trained Model
14        self.index = ['A', 'B', 'C', 'D', 'E', 'F', 'G', 'H', 'I']
15        self.y = None
16
17     def __del__(self):
18         k = cv2.waitKey(1)
19
20        self.video.release()
21
22     def get_frame(self):
23        ret, frame = self.video.read()
24        frame = cv2.resize(frame, (640, 480))
25        copy = frame.copy()
26        copy = copy[100:350+100, 50:350+200]
27        # prediction starts
28        cv2.imshow('Image', copy)
29        copy_img = image.load_img('image.jpg', target_size=(64, 64))
30        x = image.img_to_array(copy_img)
31        x = np.expand_dims(x, axis=0)
32        pred = np.argmax(self.model.predict(x), axis=-1)
33        self.y = pred[0]
34        cv2.putText(frame, 'The Predicted Alphabet is: ' + str(self.index[self.y]), (100, 50), cv2.FONT_HERSHEY_SIMPLEX, 1, (0, 0, 0), 3)
35        ret, img = cv2.imencode('jpg', frame)
```

Main:



```
1 import cv2
2
3 video = cv2.VideoCapture(0)
4
5 while True:
6     ret, frame = video.read()
7     cv2.imshow('frame', frame)
8     k = cv2.waitKey(1)
9     if k == ord('q'):
10         break
11
12 video.release()
13 cv2.destroyAllWindows()
```

Trained Model:

The screenshot displays a Jupyter Notebook interface with the following content:

Model Training for Real Time Communication through AI for Specially Abled

Loading the Dataset & Image Data Generation

```

from tensorflow.keras.preprocessing.image import ImageDataGenerator

# Training Images
train_generator = ImageDataGenerator(rescale=1/255, zoom_range=0.2, horizontal_flip=True, vertical_flip=False)
train_generator.flow_from_directory('data/train', target_size=(224, 224), class_mode='categorical')

# Testing Images
test_generator = ImageDataGenerator(rescale=1/255)
test_generator.flow_from_directory('data/test', target_size=(224, 224), class_mode='categorical')

# Load Images
train_images = train_generator.flow_from_directory('data/train', target_size=(224, 224), class_mode='categorical')
test_images = test_generator.flow_from_directory('data/test', target_size=(224, 224), class_mode='categorical')

# Create Model
model = tf.keras.Sequential([
    tf.keras.layers.Dense(128, activation='relu'),
    tf.keras.layers.Dense(10, activation='softmax')
])

# Compile Model
model.compile(optimizer='adam', loss='categorical_crossentropy', metrics=['accuracy'])

# Train Model
model.fit(train_images, validation_data=test_images, epochs=10)

```

Model Creation

```

from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Activation, Flatten, Dropout

```

GitHub Repository: <https://github.com/IBM-EPBL/IBM-Project-7817-1658900197>