Project Report

1. INTRODUCTION

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.

2. Purpose

The project aims to develop a system that converts the sign language into a human hearing voice in the desired language to convey a message to normal people, as well as convert speech into understandable sign language for the deaf and dumb. We are making use of a convolution neural network to create a model that is trained on different hand gestures. An app is built which uses this model. This app enables deaf and dumb people to convey their information using signs which get converted to human-understandable language and speech is given as output.

2. LITERATURE SURVEY

1. Existing problem
2. References
3. Problem Statement Definition

Literature Survey

1. Real-Time Communication System

Many of us think that artificial intelligence represents an abstract and futuristic notion we only see in sci-fi films with humanoid robots and holograms. However it's more and more grounded in our reality reaching various fields and categories of people including people with disabilities.

Artificial intelligence truly revolutionizes accessibility and inclusion! Thanks to AI technology solutions, people with disabilities can drastically improve their everyday lives.

2. AI: Specially Abled

Artificial intelligence is not designed to replace humans but rather to enhance our lives by helping us do things we are unable to do on our own. Many companies are working on this type of research which means there will likely be many new developments soon.

These innovations could positively impact everyone's life – even those without disabilities – because they make everyday tasks easier and less time-consuming.

3. Facial recognition

Facial recognition technology is quickly becoming a part of everyday life. It's used to improve public security, the accuracy of photo tagging and even make grocery shopping easier. This means that people with disabilities can get a job or go out without needing a caregiver or companion to help them find their way around and do things independently.

4. Predictive Text

Predictive text is a type of software that predicts what you are typing before you finish your sentence. It was originally designed for people who struggle to write because they have conditions like arthritis, cerebral palsy, or Parkinson's disease.

5. Smart home Technology

Smart home technology can be a great benefit for those with limited mobility. Through simple voice commands allowing to communicate what they need and request the information they are seeking, they can control nearly every aspect of their home from switching on/off lights, adjusting the temperature to turning off the stove, and playing music.

AI-assisted smart home technology can be very helpful for people living with disabilities, assist them in moving around the home, and support more independent living.

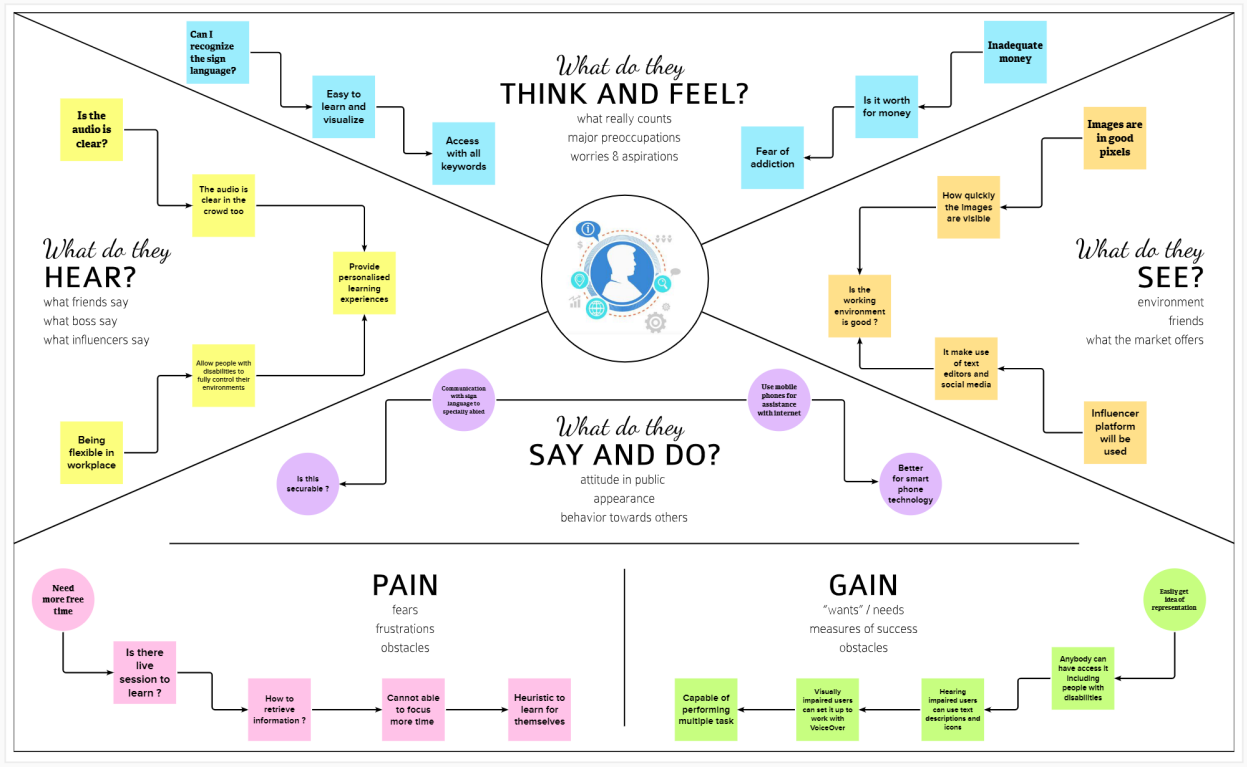
6. Increase Accessibility

AI technology can empower people living with limited physical mobility. Microsoft's AI for Accessibility program uses the potential of Artificial Intelligence to develop solutions to many physical and cognitive challenges disabled individuals face at work and in daily life to promote social inclusion for them.

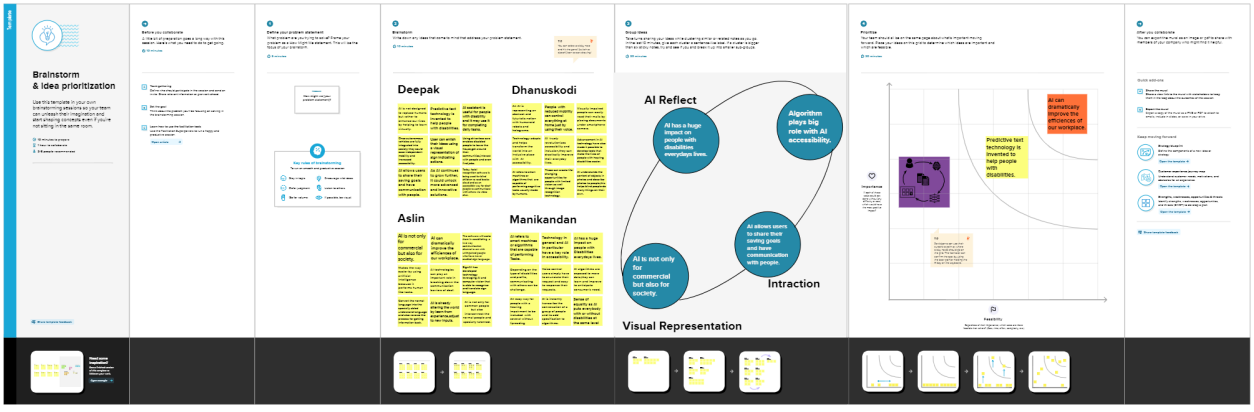
Microsoft's initiative aims to increase independence and productivity for disabled people in employment, daily life, and communication.

3. IDEATION & PROPOSED SOLUTION

1. Empathy Map Canvas



2. Ideation & Brainstorming



3. Proposed Solution

Project Design Phase-I
Proposed Solution Template

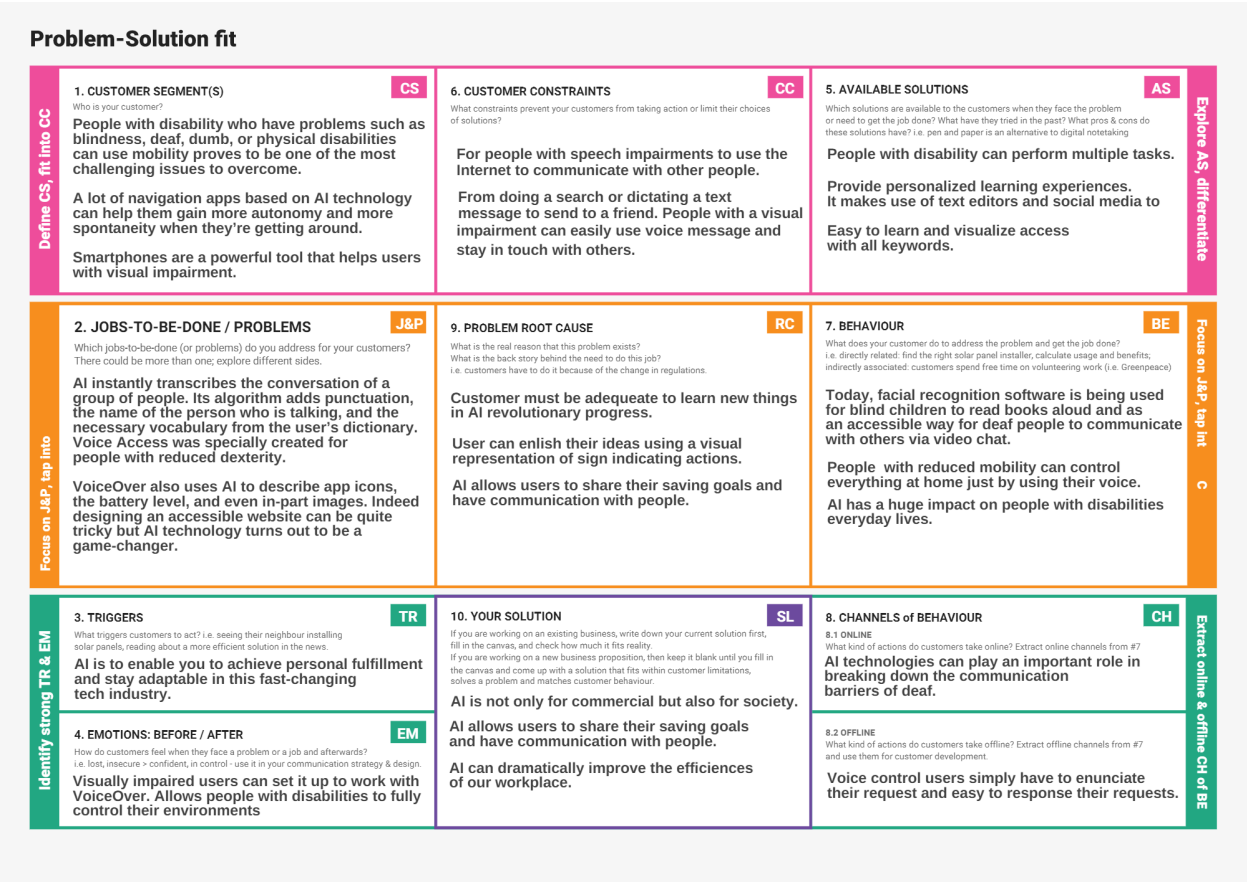
Date	24 September 2022
Team ID	PNT2022TMID44103
Project Name	Real-Time Communication System Powered by AI for Specially Abled
Maximum Marks	2 Marks

Proposed Solution Template:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	A large number of disabilities are preventable, including those arising from medical issues, the lack of accessibility in national sign languages, when a child has difficulty hearing, the absence of light makes it difficult for the hearing impaired to engage with others.
2.	Idea / Solution description	Recognize the sign language for specially abled person and also easy to learn then visualize things using facial recognization. It will provide experienced learning and allow the people with disability fully control their environment. This technology can be fulfilled by smart phone with an internet.
3.	Novelty / Uniqueness	AI can help individuals with disabilities by making a major difference in their ability with the big potential to automate tasks that typically require human intelligence, such as speech and voice recognition, visual perception, predictive text functionality, decision-making and performance of a variety of other tasks.
4.	Social Impact / Customer Satisfaction	Negative attitudes held by the families of the disabled, and often the disabled themselves, hinder disabled persons from taking an active part in the family, community or workforce. Differently-abled people face discrimination in everyday life, Communication with sign languages help the people with disability to communicate easily.
5.	Business Model (Revenue Model)	Inclusive design considers the needs of all users as a product or service is being developed, from start to finish. With inclusive or human-centered design, a person with a disability is simply another individual with specific lived experiences. So people with disability can able to access this product with subscription method.

6.	Scalability of the Solution	The ability to detect patterns in large amounts of data to better identify and define absolute image and text by experiencing the process and imaging the method will be very helpful for the people with disability.

4. Problem Solution fit



4. REQUIREMENT ANALYSIS

1. Functional requirement
2. Non-Functional requirements

Project Design Phase-II
Solution Requirements (Functional & Non-functional)

Date	08October 2022
Team ID	PNT2022TMID44103
Project Name	Real-Time Communication System Powered by AI for Specially-Abled
Maximum Marks	4 Marks

Functional Requirements:

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	• Registration through Web UI/ E-Mail ID. • Authentication via OTP.
FR-2	User Confirmation	• Confirmation via mail.
FR-3	System	• Desktop/ Mobile with good resolution camera. • Provides system access to capture images/ video and other relevant data.
FR-4	Text conversion	Converts the Sign language into a text using Convolutional Neural Network (CNN) Model.
FR-5	Sentence Translation	To create sentence(s) by recognizing the signs and pauses in the input video stream.

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 ease. 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.
NFR-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 waiting for the system's output.
NFR-5	Availability	The system should be universally accessible. Since sign language is almost same everywhere, the system can be used across the globe.
NFR-6	Scalability	The system should be scalable to accommodate new features and functionalities and to cater wider range of people in future.

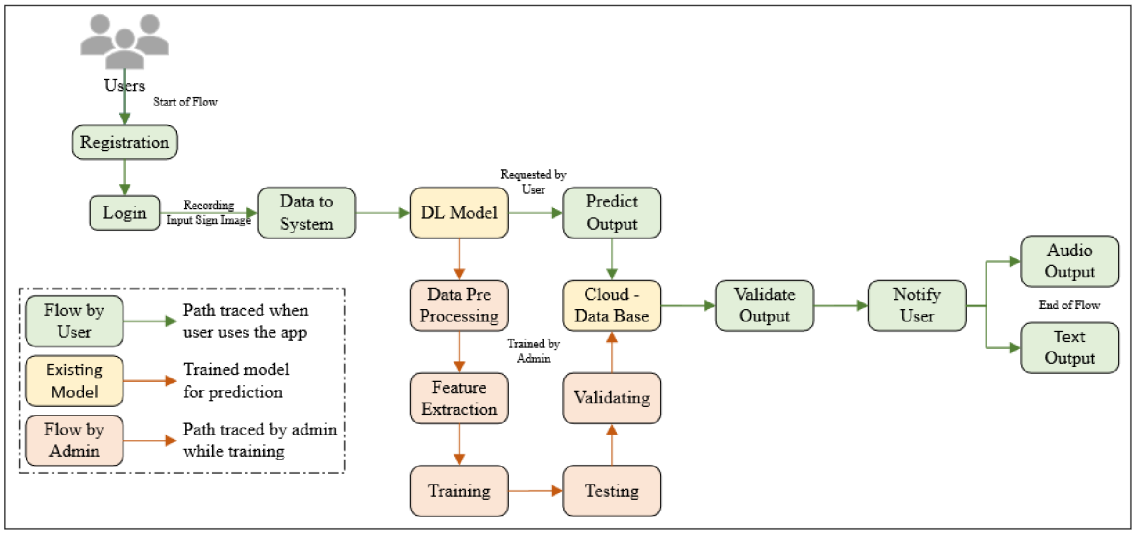
5. PROJECT DESIGN

1. Data Flow Diagrams & User Stories

Project Design Phase-II
Data Flow Diagram & User Stories

Date	10October 2022
Team ID	PNT2022TMID44103
Project Name	Real-Time Communication System Powered by AI for Specially-Abled
Maximum Marks	4 Marks

Data Flow Diagram:



2. Solution & Technical Architecture

Real-Time Communication System Powered By AI for Specially Abled

INTRODUCTION

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.

GOALS OF THE ARCHITECTURE

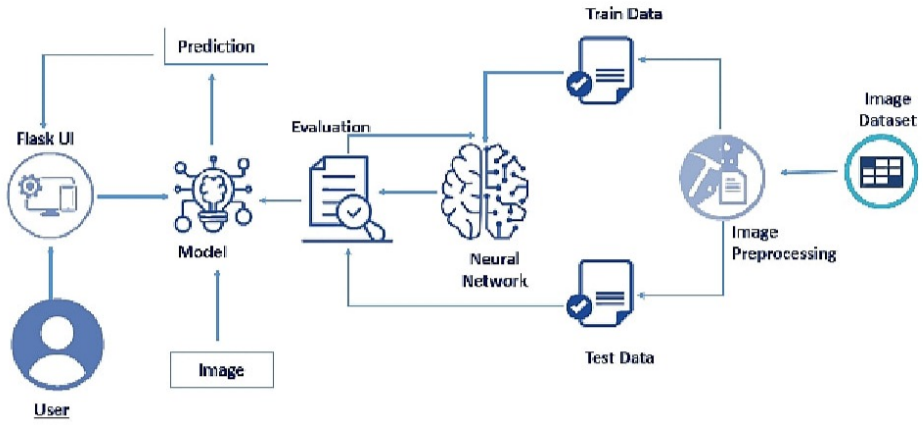
The project aims to develop a system that converts the sign language into a human hearing voice in the desired language to convey a message to normal people, as well as convert speech into understandable sign language for the deaf and dumb. We are making use of a convolution neural network to create 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.

QUALITY OF SERVICE REQUIREMENTS

Artificial intelligence (AI) refers to smart machines or algorithms that are capable of performing cognitive tasks usually made by humans. This includes different

technology solutions that mimic humans and use logic from playing chess to solving equations. Machine learning is one of the technologies that is part of AI: when algorithms are exposed to more data, they can learn and improve from it in order to anticipate consumers' needs. For example, Google uses machine learning: its algorithms collect what Internet users searched and what they liked on social networks in order to provide more personalized search results and recommendations.

TECHNICAL ARCHITECTURE



Conclusion

This model is implemented using agile methodology. This is Minimum Viable Product architecture.

6. PROJECT PLANNING & SCHEDULING

1. Sprint Planning & Estimation
2. Sprint Delivery Schedule

Project Planning Phase

Project Planning Template (Product Backlog, Sprint Planning, Stories, Story points)

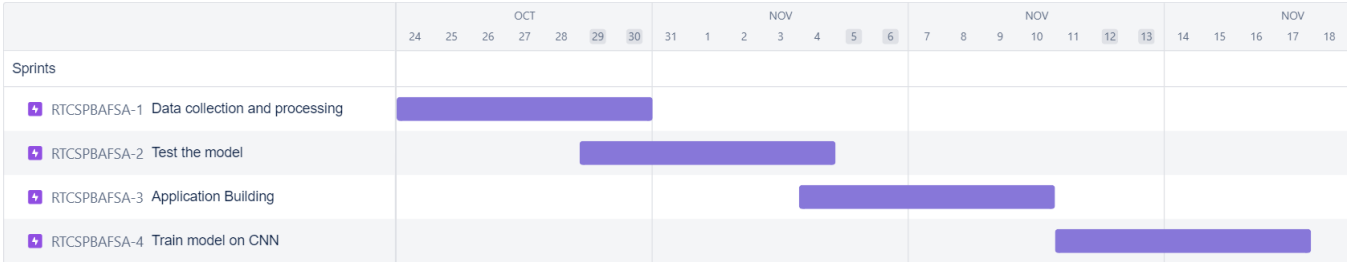
Date	08November2022
Team ID	PNT2022TMID44103
Project Name	Real Time Communication System Powered by AI for Specially Abled
Maximum Marks	8 Marks

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 theDataset .	20	High	Deepak Dhanuskodi Aslin Manikandan
Sprint-1		USN-2	Image preprocessing	20	Medium	Deepak Dhanuskodi Aslin Manikandan
Sprint-2	Model Building	USN-3	Import the required libraries, add the necessary layers and compile the model	20	High	Deepak Dhanuskodi Aslin Manikandan
Sprint-2		USN-4	Training the image classification modelusing CNN	20	Medium	Deepak Dhanuskodi
Sprint-3	Training and Testing	USN-5	Training the model and testing the model's performance	20	High	Aslin Manikandan
Sprint-4	Implementation of the application	USN-6	Converting the input sign language images into English alphabets	20	Medium	Deepak Dhanuskodi Aslin Manikandan

3. Reports from JIRA



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

1. Feature 1

```
import cv2
import numpy as np
from keras.models import load_model
from keras.utils import load_img, img_to_array
class Video(object):
  def __init__(self):
    self.video = cv2.VideoCapture(0)
    self.roi_start = (50, 150)
    self.roi_end = (250, 350)
     self.model = load_model('C:\Users\deepak\3D Objects\IBM\IBM-Project-32451-1660209977\aslpng1.h5')
        # Execute Local Trained Model
        self.model = load_model('IBM_Communication_Model.h5') # Execute IBM Trained Model
    self.index=['A','B','C','D','E','F','G','H','I']
    self.y = None
  def __del__(self):
    self.video.release()
  def get_frame(self):
    ret,frame = self.video.read()
    frame = cv2.resize(frame, (640, 480))
    copy = frame.copy()
```

```
    copy = copy[150:150+200,50:50+200]
                # Prediction Start
    cv2.imwrite('image.jpg',copy)
    copy_img = load_img('image.jpg', target_size=(64,64))
    x = img_to_array(copy_img)
    x = np.expand_dims(x, axis=0)
    pred = np.argmax(self.model.predict(x), axis=1)
    self.y = pred[0]
cv2.putText(frame,'ThePredictedAlphabetis:'+str(self.index[self.y]),(100,50),
cv2.FONT_HERSHEY_SIMPLEX,1,(0,0,0),3)
    ret,jpg = cv2.imencode('.jpg', frame)
    return jpg.tobytes()
```

In this project we have used Artificial Intelligence which deliberates the progress with high dimensional.

- **Computer Vision**

The world is composed of three-dimensional objects, but the inputs to the human eye and computers' TV cameras are two dimensional. Some useful programs can work solely in two dimensions, but full computer vision requires partial three-dimensional information that is not just a set of two-dimensional views.

2. Feature

```
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()
```

- **Speech Processing**

As well as trying to understand human systems, there are also numerous real world applications: speech recognition for dictation systems and voice activated control; speech production for automated announcements and computer interfaces.

- **Common Techniques**

Even apparently radically different AI systems (such as rule based expert systems and neural networks) have many common techniques.

- **Pattern Recognition**

When a program makes observations of some kind, it is often programmed to compare what it sees with a pattern.

- **Natural Language Processing**

As well as trying to understand human systems, there are also numerous real world applications: speech recognition for dictation systems and voice activated control; speech production for automated announcements and computer interfaces.

8. **TESTING**

1. Test Cases

Test case ID	Feature Type	Component	Test Scenario	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Comments	BUG ID	Executed By
LoginPage_TC_OO1	Functional	Home Page	Verify user is able to see the Login/Signup popup when user clicked on My account button	1. Go to website 2.Enter Valid username and password	Username: Deepak password: 123456	Login/Signup popup should display	Working as expected	Pass	-		Deepak
Loginpage_TC_002	Functional	Home Page	Verify that the error message is displayed when the user enters the wrong credentials	১. Go to website ২. Enter Invalid username and password	Username: XXXX Password: 12345	Error message should displayed	Working as expected	Pass	-		Dhanushkodi
LoginPage_TC_OO2	UI	Home Page	Verify the UI elements in Login/Signup popup	1.Go to website 2.Enter valid credentials3.Click Login	Username: Deepak password: 123456	Application should show below UI elements: a.email text box b.password text box c.Login button with orange colour d.New customer? Create account link e.Last password? Recovery password link	Working as expected	Pass	-		Manikandan
LoginPage_TC_OO3	Functional	Home page	Verify user is able to log into application with Valid credentials	১. Go to website ২. Enter details and click login	Username: Deepak password: 123456	User should navigate to user account homepage	Working as expected	Pass	-		Aslin
LoginPage_TC_OO4	Functional	Login page	Verify user is able to log into application with InValid credentials	১. Go to website ২. Enter details and click login	Username:XXXX password: 123456	Application should show 'Incorrect email or password ' validation message.	Working as expected	Pass	-		Dhanuskodi
LoginPage_TC_OO4	Functional	Login page	Verify user is able to log into application with InValid credentials	১. Go to website ২. Enter details and click login	Username:XXXX password: 123456	Application should show 'Incorrect email or password ' validation message.	Working as expected	Pass	-		Deepak
LoginPage_TC_OO5	Functional	Login page	Verify user is able to log into application with InValid credentials	১. Go to website ২. Enter details and click login	Username:XXXX password: 123456	Application should show 'Incorrect email or password ' validation message.	Working as expected	Pass	-		Manikandan
Progress_TC _OO6	Functional	Progress	Verify whether user is able to show symbol using hand	1. Show the essential symbol in hand 2. AI will identify the symbol extract from image	Identify the image using shown symbol by the user	AI will identify the image of real world entity	Working as expected	Pass	-		Aslin

2. User Acceptance Testing

Acceptance Testing
UAT Execution & Report Submission

Date	18 November 2022
Team ID	PNT2022TMID44103
Project Name	Real-Time Communication System Powered by AI for Specially Abled
Maximum Marks	4 Marks

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the [ProductName] project at the time of the release to User Acceptance Testing (UAT).

2. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	4	2	3	20
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	24	14	13	26	77

3. Test Case Analysis

This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	0	0	7
Client Application	51	0	0	51
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

9. **RESULTS**

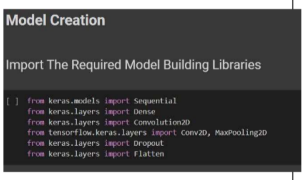
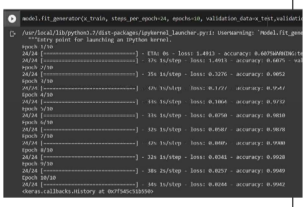
1. Performance Metrics

Project Development Phase
Model Performance Test

Date	18 November 2022
Team ID	PNT2022TMID44103
Project Name	Real-Time Communication System Powered by AI for Specially Abled
Maximum Marks	10 Marks

Model Performance Testing:

Project team shall fill the following information in model performance testing template.

S.No.	Parameter	Values	Screenshot
1.	Model Summary	-	
2.	Accuracy	Training Accuracy - Validation Accuracy -	
3.	Confidence Score (Only Yolo Projects)	Class Detected - Confidence Score -	

10. ADVANTAGES & DISADVANTAGES

One of the biggest advantages of Artificial Intelligence is that it can significantly reduce errors and increase accuracy and precision. The decisions taken by AI in every step is decided by information previously gathered and a certain set of algorithms. When programmed properly, these errors can be reduced to null.

The ability to create a machine that can simulate human intelligence is no small feat. It requires plenty of time and resources and can cost a huge deal of money. AI also needs to operate on the latest hardware and software to stay updated and meet the latest requirements, thus making it quite costly.

11. CONCLUSION

The most important role for humans will be to ensure that the rise of the AI doesn't get out of hand. Although there are both debatable pros and cons of artificial intelligence , its impact on the global industry is undeniable. It continues to grow every single day driving sustainability for businesses.

12. FUTURE SCOPE

In practically every field, AI is the driving force behind numerous innovations that will aid humans in resolving the majority of challenging issues.

Some of the most technologically advanced companies engage with users using digital assistants, which eliminates the need for human personnel. Many websites utilize

digital assistants to deliver user-requested content. We can discuss our search with them in conversation. Some chatbots are built in a way that makes it difficult to tell whether we are conversing with a human or a chatbot.

13. APPENDIX

This appendix consist of the Human beings are driven by emotions, whether we like it or not. AI on the other hand, is devoid of emotions and highly practical and rational in its approach. A huge advantage of Artificial Intelligence is that it doesn't have any biased views, which ensures more accurate decision-making and by delivering the natural language for the people with disabilities can be to easily interact with AI for the actions with real world objects or signs. 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.

Source Code

GitHub & Project Demo Link

GitHub Link : github.com/IBM-EPBL/IBM-Project-32451-1660209977

Project Demo Link : bit.ly/3tIp4zT