Real Time Communication System Powered by AI for Specially Abled
Team Leader: SUBREENA BANO
Team Member1 : GULSHAN ARA
Team Member 2 : SUGUNA S.V
Team Member 3 : SUREGA.A

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:

Artificial Intelligence has been opening up new and simpler ways to manage our daily activities. 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, AI can help individuals with disabilities by making a major difference in their ability to get around and take part in the activities of daily living.

Artificial Intelligence can be a game-changer for disabled people by making it easier to create interactive tools that support physical accessibility and independence. Let's go

through some useful applications of Artificial Intelligence in this field and see how it can be used to improve the lives of those with disabilities in a number of ways

2.LITRETURE SURVEY:
2.1.Existing System &
2.2.References:
1. Based Real Time Communication for Physically and Speech Disabled People (Ong Chin Ann, Marlene Valeriu Lu – 2019)
Communication is a social process of exchanging information from one entity to another in verbal and non-verbal form. It defines our existence and it is an important instrument that connects people together. It comes naturally as a raw skill embedded in most people at birth and we acquired the ways of communication through cognitive learning. Communication is the basis, which drives the process of development in all the fields (Manohar, 2008) and it is the very core of our civilisation. The ability to communicate allows us to express emotion, feelings, convey our thoughts and ideas as well as to relate our experiences. It plays an important role in the dis semination of information and sharing of knowledge especially in the academic arena. Research has found that human started to learn how to communicate with each other since they are born not only through spoken and written languages but also body gesture, posture, facial expression and eye contacts (Busso, et al., 2004; Cohen, Grag & Huang, 2000).
2.Systemetic review of computer vision semantic analysis in medical (Antonio Victor Alencar Lundgren, Byron Leite Dantas Bezzerra – 2021)
Medical diagnosing techniques have fascinated us for a long time. It has been common for us to use them in our daily life and implement these technologies. Machine learning and especially computer vision contribute a lot in medical science, which make different difficult tasks easy for doctors and more tolerable for patients. They are widely useful in early detection of disease, and hence are a valuable tool to save human life. Cardio graphic techniques are a must for old age and infant safety.These include:• Retinoscopy - They although primitive in approach are a must once in a life time and retinoscopy have made yet successful to measure activities of rod and cone receptors in our eyes. Retina has three distinct areas for colors - erythrolabe, chlorolabe and cyanolabe…
3.A survey on Facial Emotion Recognition Techniques (Felipe Zago Canal, Tobias Rossi Muller, Gustavo Gino Scotton – 2022)
Facial expressions recognition is an ability to recognize people by their facial characteristic and differentiate it with one another. Human is born with the ability to recognize other people easily by identifying their facial features such as shape, appearance, skin texture and skin complexion. Other than that, humans also have the

ability to express, interpret and differentiate facial expressions. The regular recur-ring ones are happiness, anger, disgust, fear, surprise and sad (Ekman & Friesen,1978). The six facial emotions stated above are important and play a major role in expressing emotion as well as recognising facial expression (Busso, et al, 2004).

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4.Machine Learning based techniques in data analysis (Lavanya Vemulapalli, Dr.P.Chandra Sekhar – 2018)

A lot more applications available for us in play store, app store, amazon, etc., which are dependent machine learning. There are significant number of organizations and startups which turn towards optimum machine learning, and have proved that investing in machine learning is the best in today's world.It is an application from which we can virtually explore streets of cities. It uses a dense geosampling tool to shows the streets of cities. Streets are captured through a fleet of vehicles equipped with a specialized camera.

5. Survey on Machine Learning Algorithm's (Rekha Nagar, Dr. Yudhvir Singh – 2022)

The subfield of artificial intelligence, machine learning has gained muchpopularity in last few couple of years. Many tech giants use machine learning algorithms, like Netflix's algorithms to make movie prediction from your previous watched movies. In this section, we would like to present some of the famous algorithms which use frequently.They are:• Naïve-Bayes' algorithm - This is the algorithm mostly used in machines and hardware. It simply applies Bayes' theorem along with strong independence assumptions. Let's take an example, to mark an email as spam, used for face detection software, etc.• K-means clustering algorithm - This is a type of unsupervised learning which has various uses including business and management. This algorithm also lets us know profit at each stage of the product. It is also referred as Lloyd's algorithm. This algorithm is also used in grouping of features into different labels.Decision Trees - These are trees in which decisions are made by the computer at

each stage based upon recurrence relations.

2.3.Problem Statement Definition:

Problem
Statement (PS)   I am   I'm trying to   But   Because   Which makes me
feel
1. Deaf and
Dumb peoples   can't
communicate to normal people   Person with Hearing impairment   Convey my
message to a normal people   They were not able to understand our gestures
They were not aware of the hand gestures used by us   Very difficult to convey and
communicate with the normal people
2. Normal people not able
to
communicate with PwD   Person who lives along with a people of
PwD   Understand the messages conveyed by the
PwD(dumb
and Deaf).   I can't able to understand the
communication They were made to me   I don't know the meaning of the hand
gestures they use   Feels useless when I am not able to understand and not able to
help them.

3.IDEATION & PROPOSED SOLUTION:
3.1. Empathy Map Canvas:
https://github.com/IBM-EPBL/IBM-Project-49962-
1660885834/tree/main/Project%20Design%20and%20planning/Ideation/empathy%20
map

3.2.Ideation and Brainstroming :
https://github.com/IBM-EPBL/IBM-Project-49962-
1660885834/tree/main/Project%20Design%20and%20planning/Ideation/brain%20stor
m%20and%20ideation

3.3.Proposed Solution:

S.No.   Parameter   Description

1.   Problem Statement (Problem to be solved)   To Develop a model which is very useful to communicate to normal people by using hand signal and gestures.

2.   Idea / Solution description   ●   Using CNN model of image recognition to identify the accurate hand gestures
●   A quick result of voice and text after the gestures get identified

3.   Novelty / Uniqueness   Image to sound detection is the uniqueness of this project. After analysing the hand signals the gesture get identified and provides a sound

4.   Social Impact / Customer Satisfaction   ●   Disabled people experience a great deal of difficulty with day-to-day activities
●   Normal people who not able to communicate with disabled peoples can now easily get communicate with them. It will be the great impact and provide a satisfaction

3.4.Problem Solution:

1.CUSTOMER SEGMENTS(CS)

6.CUSTOMER CONSTRAINTS (CC)
5.AVAILABLE SOLUTIONS(AS)
There were two customers:
        Deaf and
Dumb People who can't convey the message properly.
    The normal People who are trying to communicate them were customers.   ●   Specially Abled Person use their hand signals to get communicate with other.
●   Normal people will face difficulty in understanding the sign language.   CNN to identify the hand gestures.
        AI to communicate with gesture and voice   Flask to develop application.

2. JOBS TO BE DONE

     9. PROBLEM ROOT CAUSE(RC)
7. BEHAVIOUR(BE)
●   Create an efficient app to convert hand gestures to voice and text.
●   Develop cnn model to recognize the voice and text.
●   Developing and Training the Dataset is major task   ●   The

Communication barrier is root cause.
- Problem of conveying message properly to the normal people.
- The proper expression of the feel was not expressed   Searching the medium to express the feelings.   Searching a device to get translate.

   3. TRIGGERS(TM)

   4. YOUR SOLUTION(SL)
8.CHANNELS OF BEHAVIOUR (CH)
   The ability of the customers to communicate efficiently at serious and necessary situations.   This application help in communication between the normal people and dumb and deaf people   The Application developed by us is the main channel of the behavior.
Online translation is also and Channel of Behaviour.

4.REQUIREMENTS & ANALYSIS
4.1.Functional Requirements:

   Functional Requirement (Epic)   Sub Requirement (Story / Sub-Task)
FR-1   User Registration
   LOW VISION:
   As a user who has trouble reading due to low vision, I want to be able to make the text larger on the screen so that I can read it.
   Registration through Gmail

FR-2   User Confirmation   IMPAIRED USER:
   As a user who is hearing -impaired, I want a turn on video captions so that I can understand what is being said in videos.
   Confirmation via Email

FR-3   User Registration
   COLOR BLINDNESS:
   As a user who is color blind, I want to links to be distinguishable on the page so that I can find the links and navigate the site.

Registration through Gmail

4.2.Non-Functional Requirements:

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

NFR No.   Non-Functional Requirement   Description

NFR-1   Usability   ●   Visual and Audio Help

●   Text size scaling

●   Reverse contrast

NFR-2   Security   Important information:

●   Walking in single file or in narrow space.

●   Steps, Stairs and Slope.

●   Kerbs and Roads.

NFR-3   Reliability   To determine reliability measures are:

●   Test-Retest Repeatability

●   Individual Repeatability

NFR-4   Performance   To determine predictors of success in reading with low vision aids, in terms of reading acuity, optimum acuity reserve, and maximum reading speed, for observers with low vision for various causes.

NFR-5   Availability   Lack of adequate low vision services and barriers to their provision and uptake impact negatively on efforts to prevent visual impairment and blindness.

NFR-6   Scalability   There is a large selection of device to help people with low vision. Some are "Optical", glass lenses such as magnifying glasses and telescopes.

5.PROJECT DESIGN:

5.1.Data Flow Diagrams:

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

          :

5.2.Solution & Technical Architecture:

5.3. User Stories:

User Type (Epic)	Functional Requirement	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Low vision)	Registration	USN-1	As a user, who has trouble reading due to low vision, I want to be able to make the text larger on the screen so that I can read it.	I can access my account / dashboard	High	Sprint-1
Customer (Color blindness)		USN-2	As a user, who is color blind ,I want to have access to information conveyed in color so that, I do not miss anything and I understand the content.	I can receive confirmation email & click confirm	High	Sprint-1
Customer (Impaired user)		USN-3	As a user, who is hearing-mpaired, Iwant a transcript of the spoken audio so that I can have access to all information provided in audio clips	I can register & access the dashboard with Facebook Login	Low	Sprint-2

6. PROJECT PLANNING & SCHEDULING:
6.1. Sprint Planning & Explanation:

TITLE	DESCRIPTION	DATE	ACHIEVEMENT
Literature Survey & Information Gathering	Literature survey on the selected project & gathering information by referring the, technical papers, research publications etc.	20 September 2022	Referring to the previous findings made to understand the drawbacks that are present in the app. Able to understand the technologies and methods used in building of the system.

Helped us to know what would be the output if a technology is used.

Prepare Empathy Map

Prepare Empathy Map
Canvas to capture the user Pains & Gains, Prepare list of problem statements

20 October
2022

Empathy map
enabled us to gather all the ideas at one single place.

Successfully
segregated the pros, cons, public opinion and time required for building of the app and other factors clearly.

Very helpful when we were at the scratch.

Ideation
List the by organizing the brainstorming session and prioritize the top 3 ideas
based on   the feasibility & importance.
20 October
2022
Brainstorming session enabled us to join together
and collectively give various ideas to solve existing problem.

Based on the priority, best ideas to implement and booming technologies suggested were plotted in the graph for clear cut understanding.

TITLE	DESCRIPTION	DATE	ACHIEVEMENT

Proposed Solution

Prepare the proposed solution document, which includes the novelty, feasibility of idea, business model, social impact, scalability of solution, etc.

21 October 2022

Once the ideation was finished, we as team now decided our own solution in order to solve the existing problem.

Document made on the Problem statement, customer satisfaction and uniqueness made to understand the core of the existing problem, much better.

Problem Solution Fit

Prepare problem - solution fit document.

21 October 2022

Similar to ideation, where we were actually thinking on the side of user and noted the pros, cons, issues faced in using the app.

 Pointed out the triggers and   problem root cause
and also the available solutions that reduce the effects of their inability.

See that, the proposed solution can be a bonanza besides the available solution to the disabled.

Solution Architecture

Prepare solution architecture document.

21 October 2022

In this phase , we as a team made an architecture diagram which would describe the

role performed by admin, end user and the the operations being performed.

The operations involved in the proposed solution are briefed in this diagram.

TITLE	DESCRIPTION	DATE	ACHIEVEMENT

Customer Journey

Prepare the customer journey maps to understand the user interactions & experiences with the application (entry to exit).

21 October 2022

● Listed different factors like Research, Comparison with others, working condition of the app, questioning and sign out.

● It made to understand the customer's point of view precisely before , at present and after using the app.

Functional Requirement

Prepare the functional requirement document.

21 October 2022

● Stated the software and hardware requirements required from user's side in order to use the app.

● Also mentioned the specifications and the functionalities required to use the app.

Data Flow Diagrams

Draw the data flow diagrams and submit for review.

21 October 2022

DFD is constructed in order to understand the start and end process of app usage.

Also, mentioned the user stories along with their sprints to determine the amount of time required in implementing the particular sprint.

Technology Architecture

Prepare the technolo gy architecture diagram.

21 October 2022

Given a detailed mindblowing architecture where all the technologies are used and also the sequential process from start to end.

Sample outputs provided enriched the quality and importance of using the app.

Prepare Milestone &
Activity List
          Prepare the milestones & activity list of the project.
          22 October 2022
            Made us to list the achievements obtained in each and every phase.

 Made us to feel good and confident to move forward towards development phase.

Project Development -
Delivery of Sprint-1, 2, 3 & 4   Develop & submit the developed   code   by testing it.
IN PROGRESS…   ●   Entire development phase is divided into four sprints.

●   Design and build each and every module .

6.2.Sprint Delivery Schedule:
https://github.com/IBM-EPBL/IBM-Project-49962-
1660885834/tree/main/Project%20Development%20Phase

7.CODING & SOLUTIONING:
7.1 Detection of Hand Signals Clearly :

```
    def detect(jpeg):
  img = resize(jpeg, (64, 64, 3))
  copy = img.copy()
  copy = copy[150:150 + 200, 50:50 + 200]
  cv2.imwrite('image.jpg', copy)

  copy_img = image.load_img('image.jpg')
  x = image.img_to_array(copy_img)
  x = np.expand_dims(x, axis=0)
  prediction = np.argmax(model.predict(x), axis=1)
  pred = vals[prediction[0]]    print("it indicates : ", pred)
```

```
    return pred
```

7.2.Getting the Results From HTML Page:

```html
<!DOCTYPE html>
<html>
<head>
  <title>html page</title>
</head>
<body>
  <h1>video streaming</h1>
  <img id="video" src="{{ url_for('video_feed') }}">
</body>
</html>
```

7.3.Reading Live Stream Frame Using Python code with Clear Pixels:

```python
import cv2
class VideoCamera():    def __init__(self):      # Open a camera
        self.cap = cv2.VideoCapture(0)
    def __del__(self):
        self.cap.release()
    def get_frame(self):
        ret, frame = self.cap.read()
        if ret:
            ret, jpeg = cv2.imencode('.jpg', frame)
            return jpeg.tobytes()
        else:
            return None
```

AND BELOW CODE IS TO DISPLAY

```python
 def gen():
```

```python
 global video_camera
global global_frame
if video_camera == None:
    video_camera = VideoCamera()
while True:
    frame = video_camera.get_frame()
    if frame != None:
        global_frame = frame
        yield (b'--frame\r\n'
            b'Content-Type: image/jpeg\r\n\r\n' + frame + b'\r\n\r\n')
    else:
        yield (b'--frame\r\n'
            b'Content-Type: image/jpeg\r\n\r\n' + global_frame + b'\r\n\r\n')
```

8.TESTING:

1.   Purpose of Document
The purpose of this document is to briefly explain the test coverage and open issuesof
the project at the time of the release to User Acceptance Testing (UAT

        2.Test Case Analysis
This report shows the numberof test cases that have passed, failed,and untested

Section	Total Cases	Not Tested	Fail	Pass
Camera detection	1	0	0	1
Train the model and saving	7	0	0	7
Frame capturing and output	2	0	2	0

9.PERFORMANCE TESTING:

S.No.	Parameter	Values	Screenshot
1.	Project structure	PYTHON FILE	

HTML FILE

FLASK APP

LOADED MODEL

| 2. | OUTPUT | Camera enable and le er display | |

10.ADVANTAGES & DISADVANTAGES:

ADVANTAGES:

● Main advantage is normal people can easil communicate to PwD.
● PwD people can easily express their feelings to everyone

DISADVANTAGES

● Lack of knowledge on using the application
● Working under low light camera may be a disadvantages.

11.CONCLUSION:

To Develop a model which is very useful to communicate to normal people by using hand signal and gestures Disabled people experience a great deal of difficulty with day-to-day activities Normal people who not able to communicate with disabled peoples can now easily get communicate with them. It will be the great impact and provide a satisfaction.. A person who needs this model can afford at low price and this

provide a income. This advanced technology make life easier and will get great demand in market of technology.

●   FUTURE SCOPE

●   A new module can be developed that working under low light condition.
●   CNN algorithm can be tuned more to get an accurate result that desired.

12.APPENDIX:

Source Code:

```
#webstreaming.py
import numpy as np import cv2 import os from keras.models import load_model
from flask import Flask, render_template, Response, jsonify, request from camera
import VideoCamera from keras.preprocessing import image
global graph global writer from skimage.transform import resize

writer = None model = load_model('Balaji.h5') vals = ['A', 'B', 'C', 'D', 'E', 'F', 'G', 'H', 'I'] app =
Flask(__name__) print("[info] accessing video stream...") vs = cv2.VideoCapture(0)
def detect(jpeg):
    img = resize(jpeg, (64, 64, 3))
    copy = img.copy()
    copy = copy[150:150 + 200, 50:50 + 200]
    cv2.imwrite('image.jpg', copy)
    copy_img = image.load_img('image.jpg')
    x = image.img_to_array(copy_img)
    x = np.expand_dims(x, axis=0)
    prediction = np.argmax(model.predict(x), axis=1)
    pred = vals[prediction[0]]    print("it indicates : ", pred)
    return pred
video_camera = None global_frame = None
@app.route('/') def index():
    return render_template('index.html')
def gen():
    global video_camera
```

```python
        global global_frame
        if video_camera == None:
            video_camera = VideoCamera()
        while True:
            frame = video_camera.get_frame()
            if frame != None:
                global_frame = frame
                yield (b'--frame\r\n'
                       b'Content-Type: image/jpeg\r\n\r\n' + frame + b'\r\n\r\n')
            else:
                yield (b'--frame\r\n'
                       b'Content-Type: image/jpeg\r\n\r\n' + global_frame + b'\r\n\r\n')
                img = resize(frame, (64, 64))
                x = image.img_to_array(img)
                x = np.expand_dims(x, axis=0)
                prediction = np.argmax(model.predict(x), axis=1)
                pred = vals[prediction[0]]        print("it indicates : ", pred)
@app.route('/video_feed') def video_feed():
    return Response(gen(), mimetype='multipart/x-mixed-replace; boundary=frame')
if __name__ == '__main__':
    app.run(host='0.0.0.0', debug=True)




#camera.py
import cv2
class VideoCamera():    def __init__(self):        # Open a camera
        self.cap = cv2.VideoCapture(0)
    def __del__(self):
        self.cap.release()
    def get_frame(self):
        ret, frame = self.cap.read()
        if ret:
            ret, jpeg = cv2.imencode('.jpg', frame)
            return jpeg.tobytes()
        else:
            return None
```

```
#index.html
<!DOCTYPE html>
<html>
<head>
  <title>html page</title>
</head>
<body>
  <h1>video streaming</h1>
  <img id="video" src="{{ url_for('video_feed') }}">
</body>
</html>
```

```
#train.ipynb

#%%
from keras.preprocessing.image import ImageDataGenerator train_datagen =
ImageDataGenerator(rescale = 1./225,
shear_range=0.2,zoom_range=0.2,horizontal_flip=True) test_datagen =
ImageDataGenerator(rescale = 1./225)
#%%
x_train =
train_datagen.flow_from_directory('Dataset/training_set',target_size=(64,64),
batch_size=300,class_mode='categorical', color_mode ="grayscale")
#%%
x_test =
train_datagen.flow_from_directory('Dataset/test_set',target_size=(64,64),
batch_size=300,class_mode='categorical', color_mode ="grayscale")
#%%
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
```

```python
from keras.layers import Flatten
#%%
model=Sequential()
#%%
model.add(Convolution2D(32,(3,3), input_shape=(64,64,1), activation =
'relu'))
#%%
model.add(MaxPooling2D(pool_size=(2,2)))
#%%
model.add(Flatten())
#%%
model.add(Dense(units=512,activation='relu'))
model.add(Dense(units=9,activation='softmax'))

#%%
model.compile(loss='categorical_crossentropy', optimizer='adam', metrics=['accuracy'])
#%%
model.fit_generator(x_train, steps_per_epoch=24,
epochs=10,validation_data=x_test,validation_steps=40)
#%%
model.save('Balaji.h5')

#test.ipynb
from keras.models import load_model import numpy as np import cv2
model=load_model('Balaji.h5')
from skimage.transform import resize def detect(frame):
    img = resize(frame,(64,64,1))     img = np.expand_dims(img,axis=0)
    if(np.max(img)>1):
        img = img/255.0
    prediction = model.predict(img)
    print(prediction)
    predictions = np.argmax(model.predict(img), axis=1)
    print(predictions[0])
```