Real Time Communication System Powered by AI for Specially Abled Team Leader: SUMITHA M

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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.

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

1. LITRETURE SURVEY:
   1. Existing System & 2.2.References:
2. 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).

1. 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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1. 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.

1. 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

1. 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.

1. IDEATION & PROPOSED SOLUTION:
   1. Empathy Map Canvas:

https://github.com/IBM-EPBL/IBM-Project-49962- 1660885834/tree/main/Project%20Design%20and%20planning/Ideation/empathy%20 map

* 1. Ideation and Brainstroming :

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

* 1. 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

1. 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
2. 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
  1. 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)

1. 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.
  1. TRIGGERS(TM)
  2. 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.

1. REQUIREMENTS & ANALYSIS
   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

* 1. 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.

1. PROJECT DESIGN:
   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:

:

* 1. Solution & Technical Architecture:
  2. User Stories:

User Type Functional Requirement

(Epic) 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

1. PROJECT PLANNING & SCHEDULING:
   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 .
  1. Sprint Delivery Schedule: https://github.com/IBM-EPBL/IBM-Project-49962-

1660885834/tree/main/Project%20Development%20Phase

1. 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

* 1. Getting the Results From HTML Page:

<!DOCTYPE html>

<html>

<head>

<title>html page</title>

</head>

<body>

<h1>video streaming</h1>

<img id="video" src="{{ url\_for('video\_feed') }}">

</body>

</html>

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

def gen():

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

1. 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

1. 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

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

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])