Real-Time Communication System Powered by AI for Specially Abled

K.Ramakrishnan College Of Engineering
Students:
R.Aishwarya-811519104006
V.Bhagavathi Sree - 811519104015
V.Gowshil Narmadha-811519104036
G.Kayalvizhi - 811519104054

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1.INTRODUCTION

1.1 Overview

People get to know one another by sharing their ideas, thoughts, and experiences with those around them. There are numerous ways to accomplish this, the best of which is the gift of "Speech." Everyone can very convincingly transfer their thoughts and understand each other through speech. It will be unjust if we overlook those who are denied this priceless gift: the deaf and dumb. In such cases, the human hand has remained the preferred methodof communication.

1.2 Purpose

The project's purpose is to create a system that translates sign language into a human-understandable language so that ordinary people may understand it.

2.LITERATURE SURVEY

2.1 Existing problem

Some of the existing solutions for solving this problem are:

Technology

One of the easiestways to communicate is throughtechnology such as a smart phone or laptop. A deaf person can type out what they want to say and a person who is blindor has low vision can use a screen reader to read the text out loud. A blind person can also use voice recognition software to convertwhat they are saying in to text so that a personwhois Deaf can then read it.

Interpreter

If a sign languageinterpreter is available, this facilitates easy communication if the person who is deaf is fluent in sign language.The deaf person and person who is blind can communicate with each other via the interpreter. The deaf person can use sign languageand the interpreter can speak what has been said to the person who is blind and then translate anythingspoken by the blind personinto sign languagefor the deaf person.

Just Speaking

Depending on the deaf person's level of hearingloss, they may be able to communicate with a blind person who is using speech. For example, a deaf person may have enough residualhearing (with or without the use of an assistive hearing device such as a hearing aid) to be able to decipher the speech of the person who is blind or has low vision. However,this is often not the most effectiveform of communication, as it is very dependent on the individual circumstances of both people and their environment (for example, some places may have too much background noise).

2.2 References

1. Environment Setup: https://www.youtube.com/watch?v=5mDYijMfSzs

2. Sign Languages Dataset: https://drive.google.com/file/d/1ITbDvhLwyTTkuUYfNjOKhcIZh7hDgi64/view?usp=sharing

3. Keras Image Processing Doc: https://keras.io/api/preprocessing/image/

4. Keras Image Dataset From Directory Doc: https://keras.io/api/preprocessing/image/#imagedatasetfromdirectory-function

5. CNN using Tensor flow: https://www.youtube.com/watch?v=umGJ30-15_A

6. OpenCV Basics of Processing Image: https://www.youtube.com/watch?v=mjKd1Tzl70I

2.3 Problem Statement Definition

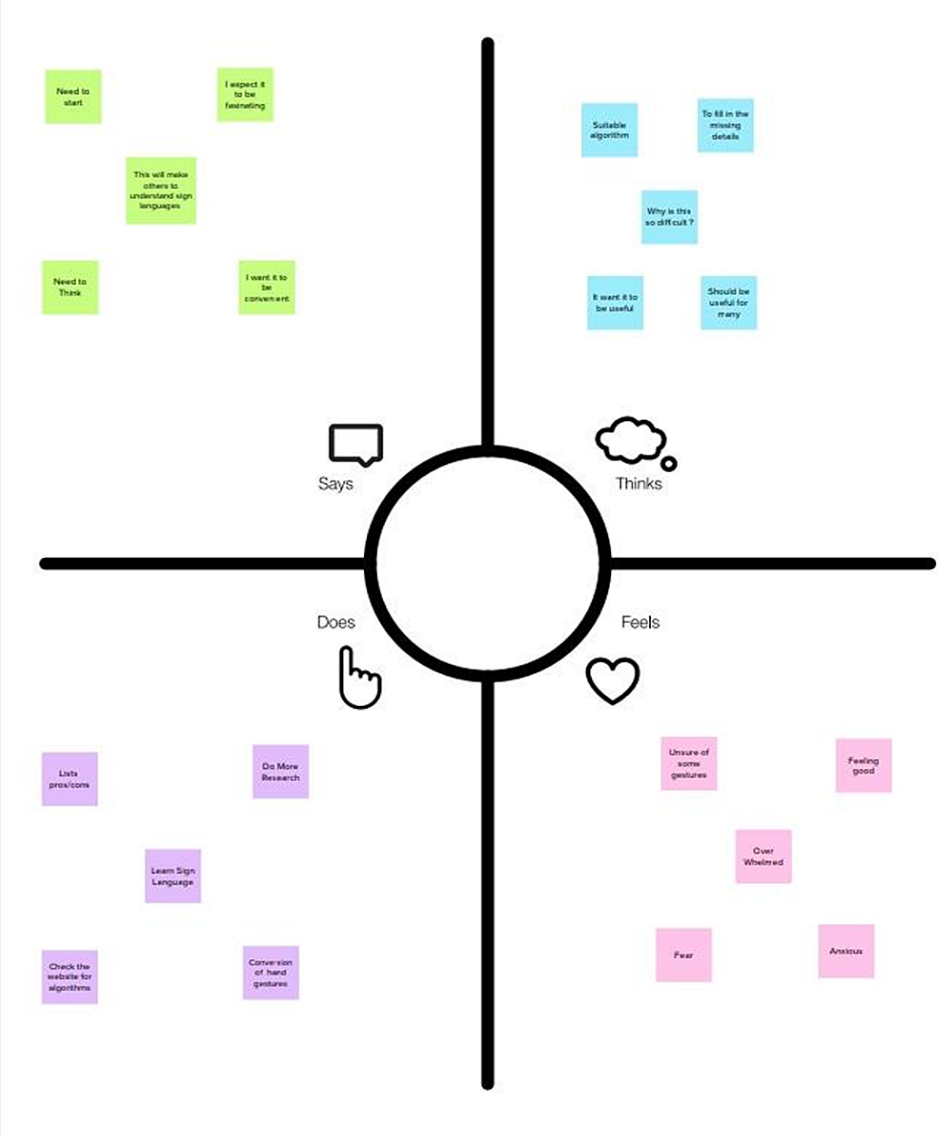
In our society, we have people with disabilities. The technology is developing day by day but no significant developments are undertaken for the betterment of these people. Communications between deaf-mute and a normal person has always been a challenging task. It is very difficult for mute people to 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

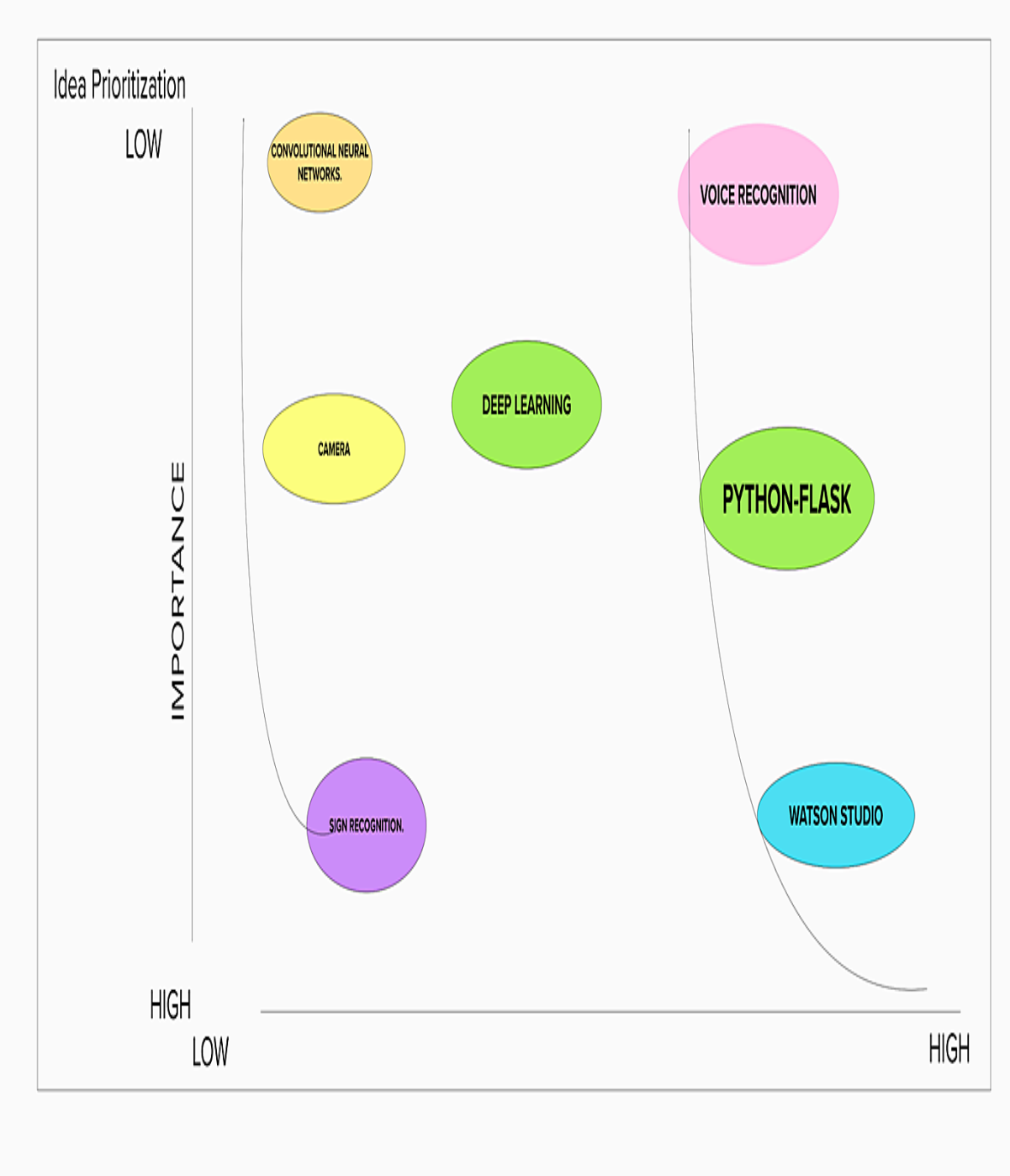
information using signs which get converted to human-understandable language and speech is given as output.

3. IDEATION & PROPOSED SOLUTION

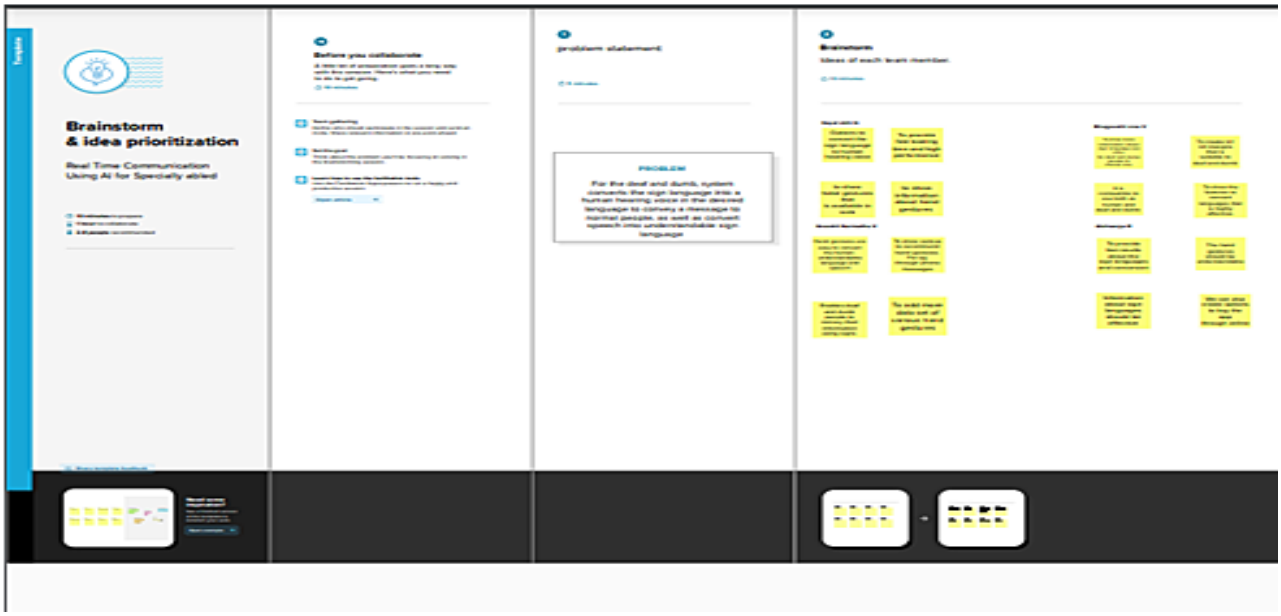
3.1 Empathy Map Canvas

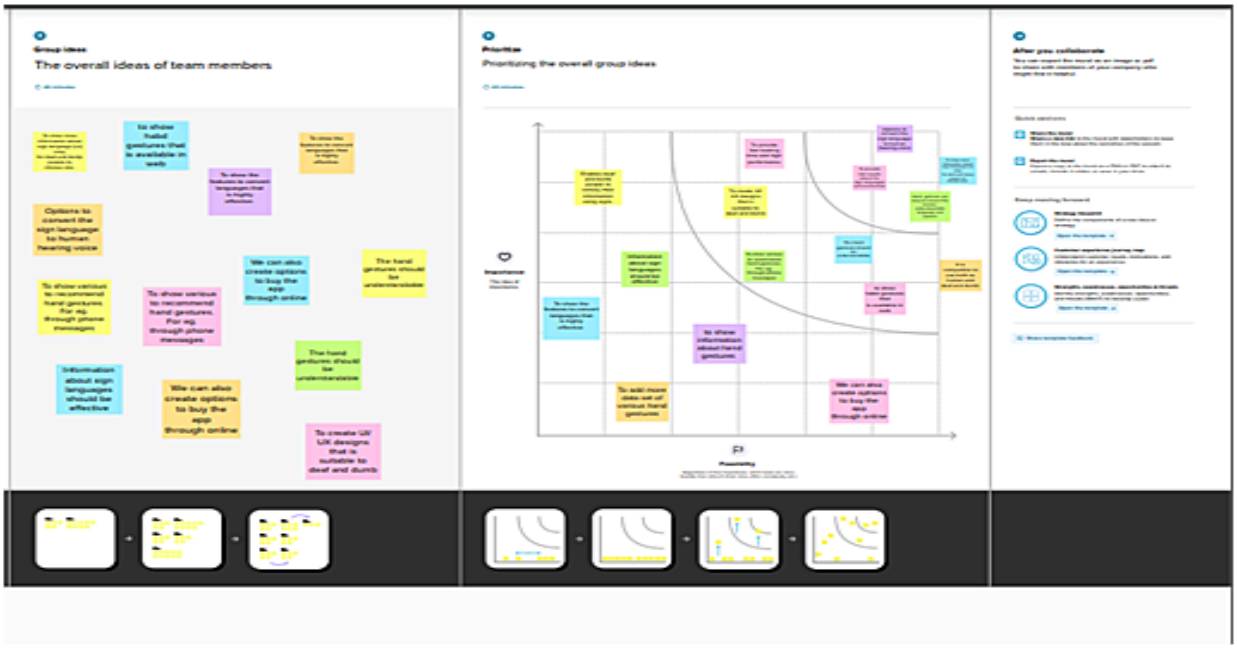


3.2 IDEA PREPARARTION



3.3 Ideation & Brainstorming





3.4 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to besolved)	The project aims to develop a system that convertssign language into a human hearing voice in the desired language to convey a message to normal people, as well as convert speech into understandable signlanguage for the deaf and dumb.
2.	Idea / Solution description	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 usesthis model. This app enables deaf and dumb people to convey their information using signs whichget converted to human-understandable language andspeech is givenas output.
3.	Novelty / Uniqueness	Most of the people are not aware of sign language, so the main motive of this project is to communicate between both specially abled and human language using the concept of Artificial Intelligence.
4.	Social Impact/ Customer Satisfaction	The main problem is that an ordinary person would easily misunderstand the meaning conveyed. The advancement in AI and computer vision can be adapted to recognize and learn the sign language. The modern systems can help an ordinary person to recognize and understand thesign language. This article presents a method which is related to the recognition of hand gestures usingdeep learning
5.	Business Model(Revenue Model)	There will not be any profit from this project. It isfully service based application.
6.	Scalability of the Solution	The application can be integrated with other mobile devices to improve user interaction and make the system more robust. The accuracy of the program can be further improvised by using neuralnetworks.

3.5 Problem Solution fit

4. REQUIREMENT ANALYSIS

4.1 Functional requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story/ Sub-Task)
FR-1	User Registration	Registration can be done by using the user details through the application.
FR-2	User Confirmation	Confirmation viaEmail Confirmation via OTP
FR-3	User details storage	Storing userdetails via database
FR-4	Scanning hand sign images	Uploading imagesof hand signs via camera
FR-5	Predicting images	Comparing the human wordswith the hand sign images.
FR-6	Search resultsof hand sign	Searching the relevant word for the sign language

4.2 Non-Functional requirements

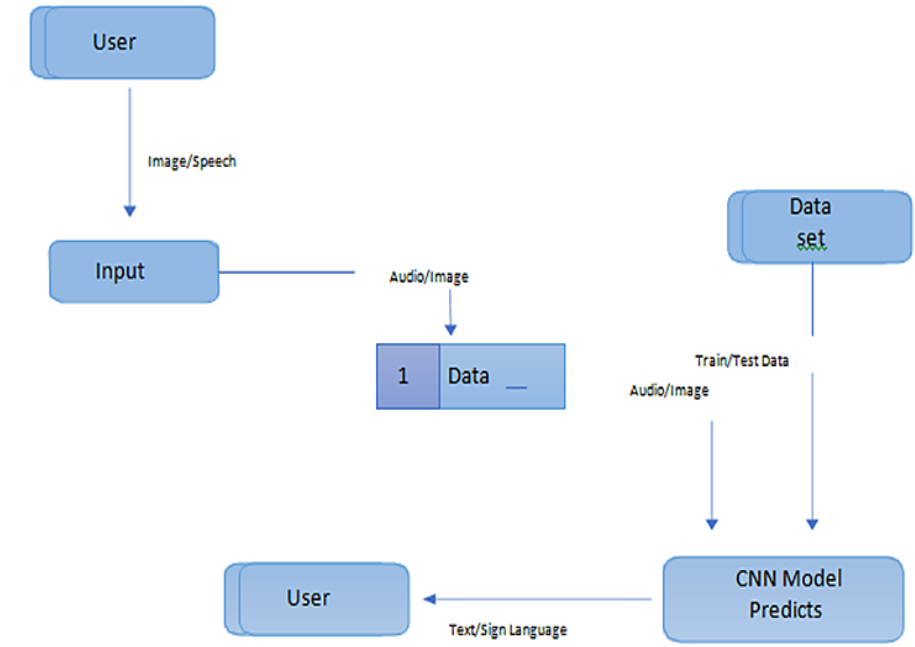
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Scanning imagesof sign language and storing the words of human language
NFR-2	**Security**	Encrypt the user detailsand use a firewall to store user details securely.
NFR-3	**Reliability**	Predicting the sign language commands and convert it to humanlanguage and vice versa.
NFR-4	**Performance**	Displaying immediate results by analysing database.
NFR-5	**Availability**	It canbe easily accessible from anywhere at anytime

NFR-6	**Scalability**	Accurate results will be obtained.

5.PROJECT DESIGN

5.1 Data Flow Diagrams

5.2



Solution & Technical Architecture

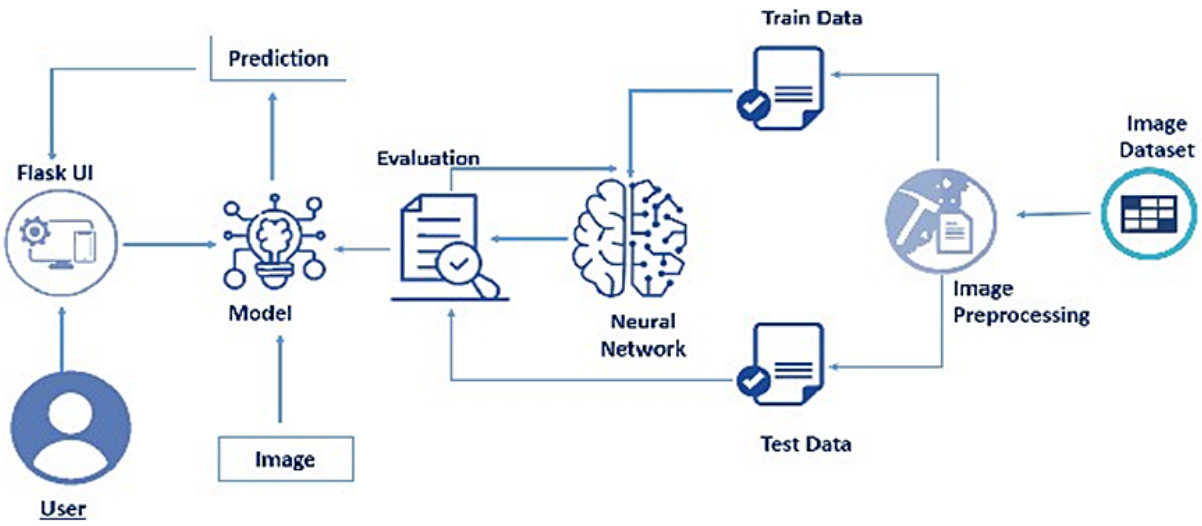


Table-5.2.1 : Components &Technologies:

S.No	Component	Description	Technology
1.	User Interface	By Web UI, the user interacts with the web applicationand fulfilthe user requirements with good user experience	HTML, CSS, JavaScript etc.
2.	Application Logic-1	User register themselves and once logged in,given with various features.	Java / Python
3.	Application Logic-2	deaf and dumb people want to communicate with people , by contacting usingthe web	IBMWatson STT service
4.	Application Logic-3	This web enables deaf and dumb people to convey their information using signs whichget converted to human-understandable language and speech is givenas output.	IBM WatsonAssistant
5.	Database	SQLData Type	MySQL
6.	Cloud Database	-	-
7.	File Storage	File storagerequirements	Other Storage Service or Local Filesystem
8.	External API-1	To validate the user	UserId API
9.	External API-2	-	-
10.	Machine Learning Model	The images which will be used for building the model,Imagepre-processing includes zooming, shearing, flipping to increase the robustness of the model afterit is built	Object Recognition Model
11.	Infrastructure (Server/ Cloud)	Application Deployment on Local SystemLocal ServerConfiguration:	Local

Table-5.2.2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	List the open-source frameworks used: Angular JS	Technology of Opensource framework JAVASCRIPT and PYTHON
2.	Security Implementations	List all the security / access controls implemented, useof firewalls etc. SHA-256 to protect user details.	SHA-256
3.	Scalable Architecture	Justify the scalability of architecture (3 – tier) This improves scalability, because application servers can be deployed on many machines. The database does make longer connections with every user	Presentation Layer – React JS (HTML, CSS ,JS) Application Layer– Flask (Python) Data
4.	Availability	Justify the availability of application (use of load balancers, lets you evenly distribute network traffic to prevent failure caused by overloading a particular resource. This strategy improves the performance and availability of applications, websites, databases, and other computing resources)	-

5.	Performance	Design the application carefully to be component based and encapsulated. This can help in creating a scalable application providing flexibility in deploymentand making it possible to partition the application andsubstitute other component implementations during deployment..	-

5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story/ Task	Acceptance criteria	Priority	Release
Deaf and muteperson	Gesture recognition	USN-1	The user wouldddo the gestures and thesystem wouldcapture it.	User is able to operate thesystem easily	High	Sprint-1
		USN-2	The gestures thatare done by the user, is instantly storedinside the database.	User is able to see the gestures getting recorded	High	Sprint-1
		USN-3	Then the storedgestures would be processedoneby one and finally it would be converted into the desired output.	User can instantly see thegestures being converted into speech.	Low	Sprint-2
		USN-4	The gestures areconverted into textwhich is understood by a normal person.	Anyone can easily communicate withan ordinary man	High	Sprint-1
Ordinary person	speech	USN-1	The speaker would speak the desired message thatis needed to be conveyed to the specially abled.	I am able to operate thesystem easily	High	Sprint-1

		USN-2	The system recordsthe speech or sign language	I am able to see the speech getting recorded	High	Sprint-1
		USN-3	The reordered voice message that are stored in the database are converted into the desiredoutput.	I can instantly see the speech beingconverted into gestures.	Low	Sprint-2
		USN-4	At last, the speech thathas been converted into gestures can be easilyunderstandable bythe specially abled.	I can easilycommunicate with a specially abled.	High	Sprint-1

6.PROJECT PLANNING& SCHEDULING

6.1 Sprint Planning

Pre-Requisites	M-01	The following software concepts and packages, including Deep Learning, Python, CNN, Python Flask, IBM Cloudland DB, and Watson Studio, should havebeen familiar to us by thetime we finished this project.	Yes
Project Structure	M-02	To create a project structure that mustbe adhered to when creatinga conversation engine	Yes
Collection of Data	M-03	The dataset collection is separated into a train set and a test set in order to acquire data for image preprocessing. The training and testing procedures involve individually assembling thetwo files and putting themto the test.	Yes

Image Preprocessing	M-04	Importing the Image Data Generator libraries and utilizing its capabilitieswith the testset and training set	Yes
Model Building	M-05	The procedures include initialising the model, adding convolution layers, pooling layers, flatten layers, denser layers,compiling the model,fitting the data, and savingthe model.	Yes
Test the model	M-06	Import the packages, save the model, load the test image, perform imagepre-processing, and make predictions aboutit.	Yes

Application layer	M-07	Create the HTMLpages and theflask application.	Yes
Train CNN model	M-08	Sign up forIBM Cloud and prepare the Image Classification Model.	Yes
IdeationPhase	M-09	Preparation of an empathymap, information gathering,literature review, and ideation	Yes
ProjectDesign Phase-I	M-10	Problem-solution fit,solution architecture, and creation ofthe suggested solution	Yes

Project Design Phase-II	M-11	Preparation of the technological stack architecture, functional requirements, data flow diagrams, and customerjourney mapping	Yes
Project PlanningPhase	M-12	Create a sprintdelivery plan, an activity list,and a milestone list.	Yes
Project DevelopmentPhase	M-13	Project Development for Sprints1,2,3, and 4 is delivered	Yes

6.2 Estimation

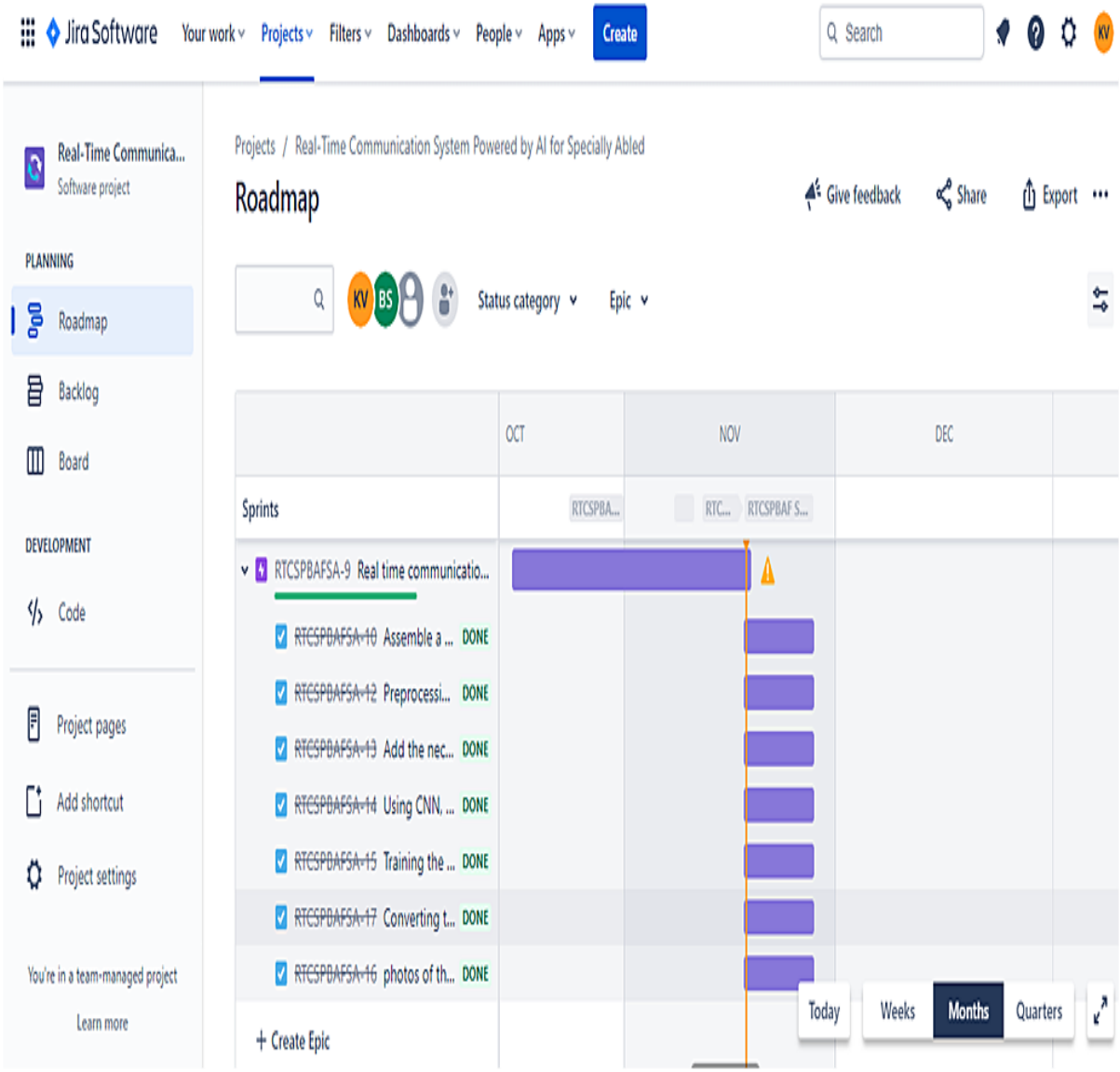
Activity Number	Activity	Sub Activity	Assigned To	Status
1.	**Pre-Requisites**		Kayalvizhi G Bhagavathi Sree V Gowshil Narmadha V Aishwarya R	Completed
2.	**PROJECT STRUCTURE**	Structure Brainstorming and	Gowshil Narmadha V	Completed

		Preparation	Aishwarya R	
3.	**Collection ofData**	Dataset download structure	Kayalvizhi G Bhagavathi Sree V	Completed
4.	**Image Preprocessing**	Import the Image Data Generate or Library and applying Image Data Generator Functionality totrainset and testset.	Kayalvizhi G Bhagavathi Sree V Gowshil Narmadha V Aishwarya R	Completed
5	**Model Building**	Initializing of the modelAdding Convolution Layers Pooling Layers Flatten and dense Layer	Kayalvizhi G Bhagavathi Sree V Gowshil Narmadha V Aishwarya R	Completed

6.	**Test of the Model**	Import the packages andsave the model, Load the test image,preprocess it and predict it.	Bhagavathi Sree V Gowshil Narmadha V	In progress
7.	**Applicati on Layer**	Build the flask application and the HTMLpages	Kayalviz hi G Aishwar ya R	In progress
8.	**Train of CNN model in IBMcloud**	Train image classific ation model and register forIBM cloud.	Gowshil Narmadha V Aishwarya R	Completed
9.	**Ideati on Phase**	Literatu re Review, Empat hy map, Ideation of the project.	Kayalvizhi G Bhagavathi Sree V Gowshil Narmadha V Aishwarya R	Completed

Sprint	Total Story Points	Duration	Sprint StartDate	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date(Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	8	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	5	04 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	7	11 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	5	18 Nov 2022

6.3 Reports from JIRA



7.CODING & SOLUTIONING

7.1 Web Application

```
<!DOCTYPE html>
<html lang="en">

<head>
    <meta charset="utf-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0, shrink-to-fit=no">
    <title>SmartBridge_WebApp_VideoTemplate</title>
    <link rel="stylesheet" href="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/css/bootstrap.min.css">
    <link rel="stylesheet" href="https://use.fontawesome.com/releases/v5.12.0/css/all.css">
    <link rel="stylesheet" href="assets/css/Banner-Heading-Image.css">
    <link rel="stylesheet" href="assets/css/Navbar-Centered-Brand.css">
    <link rel="stylesheet" href="assets/css/styles.css">
</head>

<body style="background: rgb(39,43,48);">
    <nav class="navbar navbar-light navbar-expand-md py-3" style="background: #212529;">
        <div class="container">
            <div></div><a class="navbar-brand d-flex align-items-center" href="#"><span
                    class="bs-icon-sm bs-icon-rounded bs-icon-primary d-flex justify-content-center align-items-center me-2 bs-icon"><i
                        class="fas fa-flask"></i></span><span style="color: rgb(255,255,255);">Real-Time Communication
                    System Powered By AI for Specially Abled</span></a>
            <div></div>
        </div>
    </nav>
    <section>
        <div class="d-flex flex-column justify-content-center align-items-center">
            <div class="d-flex flex-column justify-content-center align-items-center" id="div-video-feed"
                style="width: 640px;height: 480px;margin: 10px;min-height: 480px;min-width: 640px;border-radius: 10px;border: 4px dashed rgb(255,255,255) ;">
                <img src="{{ url_for('video_feed') }}" style="width: 100%;height: 100%;color: rgb(255,255,255);text-align: center;font-size: 20px;"
                    alt="Camera Access Not Provided!">
```

```
                alt="Camera Access Not Provided!" />
            </div>
        </div>
        <div class="d-flex flex-column justify-content-center align-items-center" style="margin-bottom: 10px;"><button
                class="btn btn-info" type="button" data-bs-target="#modal-1" data-bs-toggle="modal">Quick Reference
                -<strong> ASL Alphabets</strong></button></div>
    </section>
    <section>
        <div class="container">
            <div class="accordion text-white" role="tablist" id="accordion-1">
                <div class="accordion-item" style="background: rgb(33,37,41);">
                    <h2 class="accordion-header" role="tab"><button class="accordion-button" data-bs-toggle="collapse"
                            data-bs-target="#accordion-1 .item-1" aria-expanded="true"
                            aria-controls="accordion-1 .item-1"
                            style="background: rgb(39,43,48);color: rgb(255,255,255);">About The Project</button></h2>
                    <div class="accordion-collapse collapse show item-1" role="tabpanel" data-bs-parent="#accordion-1">
                        <div class="accordion-body">
                            <p class="mb-0">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.<br><br>Currently, Sign Recognition is available <strong>only for
                                    alphabets A-I</strong> 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.</p>
                        </div>
                    </div>
                </div>
                <div class="accordion-item" style="background: rgb(33,37,41);">
                    <h2 class="accordion-header" role="tab"><button class="accordion-button collapsed"
```

```
                    <div class="accordion-body">
                        <p class="mb-0">Students at K.Ramakrishnan College Of Engineering
                            Program.<br><br>1. <strong>Aishwarya.R</strong> 811519104006<br>2.
                            <strong>Bhagavathi sree.V</strong> 811519104015<br>3. <strong>Gowshil Narmadha.V</strong> 811519104036<br>4. <strong>Kayalvizhi.G</strong> 8115
                        </p>
                    </div>
                </div>
            </div>
        </div>
    </section>
    <div class="modal fade" role="dialog" tabindex="-1" id="modal-1">
        <div class="modal-dialog" role="document">
            <div class="modal-content">
                <div class="modal-header">
                    <h4 class="modal-title">American Sign Language - Alphabets</h4><button type="button"
                        class="btn-close" data-bs-dismiss="modal" aria-label="Close"></button>
                </div>
                <div class="modal-body"><img src="{{ url_for('static', filename='img/ASL_Alphabets.png') }}" width="100%"></div>
                <div class="modal-footer"><button class="btn btn-secondary" type="button"
                        data-bs-dismiss="modal">Close</button></div>
            </div>
        </div>
    </div>
    <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/js/bootstrap.bundle.min.js"></script>
</body>

</html>
```

7.2 Camera

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{
 "cells": [
  {
   "cell_type": "markdown",
   "metadata": {},
   "source": [
    "import cv2 import numpy as np from tensorflow.keras.models import\n",
    "load_model from tensorflow.keras.preprocessing import image\n",
    "\n",
    "class Video(object): def **init**(self): self.video =\n",
    "cv2.VideoCapture(0) self.roi_start = (50, 150) self.roi_end = (250, 350)\n",
    "self.model = load_model('asl_model.h5') \\# Execute Local Trained Model\n",
    "\\# self.model = load_model('IBM_Communication_Model.h5') \\# Execute IBM\n",
    "Trained Model self.index=\\['A','B','C','D','E','F','G','H','I'\\] self.y\n",
    "= None def **del**(self): self.video.release() def get_frame(self):\n",
    "ret,frame = self.video.read() frame = cv2.resize(frame, (640, 480)) copy\n",
    "= frame.copy() copy = copy\\[150:150+200,50:50+200\\] \\# Prediction Start\n",
    "cv2.imwrite('image.jpg',copy) copy_img = image.load_img('image.jpg',\n",
    "target_size=(64,64)) x = image.img_to_array(copy_img) x =\n",
    "np.expand_dims(x, axis=0) pred = np.argmax(self.model.predict(x),\n",
    "axis=1) self.y = pred\\[0\\] cv2.putText(frame,'The Predicted Alphabet\n",
    "is:'+str(self.index\\[self.y\\]),(100,50),cv2.FONT_HERSHEY_SIMPLEX,1,(0,0,0),3)\n",
    "ret,jpg = cv2.imencode('.jpg', frame) return jpg.tobytes()"
   ]
  }
 ],
 "nbformat": 4,
 "nbformat_minor": 5,
 "metadata": {}
}
```

8.TESTING

8.1 The American Sign Language Comprehension Test (ASL-CT)

It is a 30-item multiple-choice test that measures ASL receptive skills and is administered through a website. This article describes the development and psychometric properties of the test based on a sample of 80 college students including deaf native signers, hearing native signers, deaf non-native signers, and hearing ASL students. The results revealed that the ASL-CT has good internal reliability ($\alpha = 0.834$). Discriminant validity was established by demonstrating that deaf native signers performed significantly better than deaf non-native signers and hearing native signers. Concurrent validity was established by demonstrating that test results positively correlated with another measure of ASL ability ($r = .715$) and that hearing ASL students' performance positively correlated with the level of ASL courses they were taking ($r = .726$). Researchers can use the ASL-CT to characterize an individual's ASL comprehension skills, to establish a minimal skill level as an inclusion criterion for a study, to group study participants by ASL skill (e.g., proficient vs. nonproficient), or to provide a measure of ASL skill as a dependent variable.

8.1.1 Concurrent Velocity

	Percent correct (%)	$Mean_{raw}$	SD_{raw}
Deaf native signers	86.67	26.00	2.03
Hearing native signers	72.00	21.60	4.98
Deaf non-native signers	70.50	21.15	5.67
Hearing ASL students	63.34	19.00	3.37

8.2 UserAcceptance Testing

Multiple assistive technologies can help the deaf and mute such as speech-to-text, speech-to visual and sign language. In this study, an offline assistive mobile communication application is developed for the deaf, hard of hearing, mute, and person without disabilities. This can be used as a tool to break the barrier of communication between the people without disabilities and the deaf/mute. Both American Sign Language (ASL) and Filipino Sign Language (FSL) were applied in the developed system that will help the intended users communicate in their everyday activities. The developed system called “BridgeApp” were designed according to the gathered user need of a deaf community based on their specific everyday activity. A thorough system testing was conducted in order to make sure that the mobile app will be ready to use and will aid them in their day to day communication needs. The user acceptance testing results have proven that the system in this study can effectively assist in clear communication between both deaf and mute, as well as to those hearing and speaking individuals

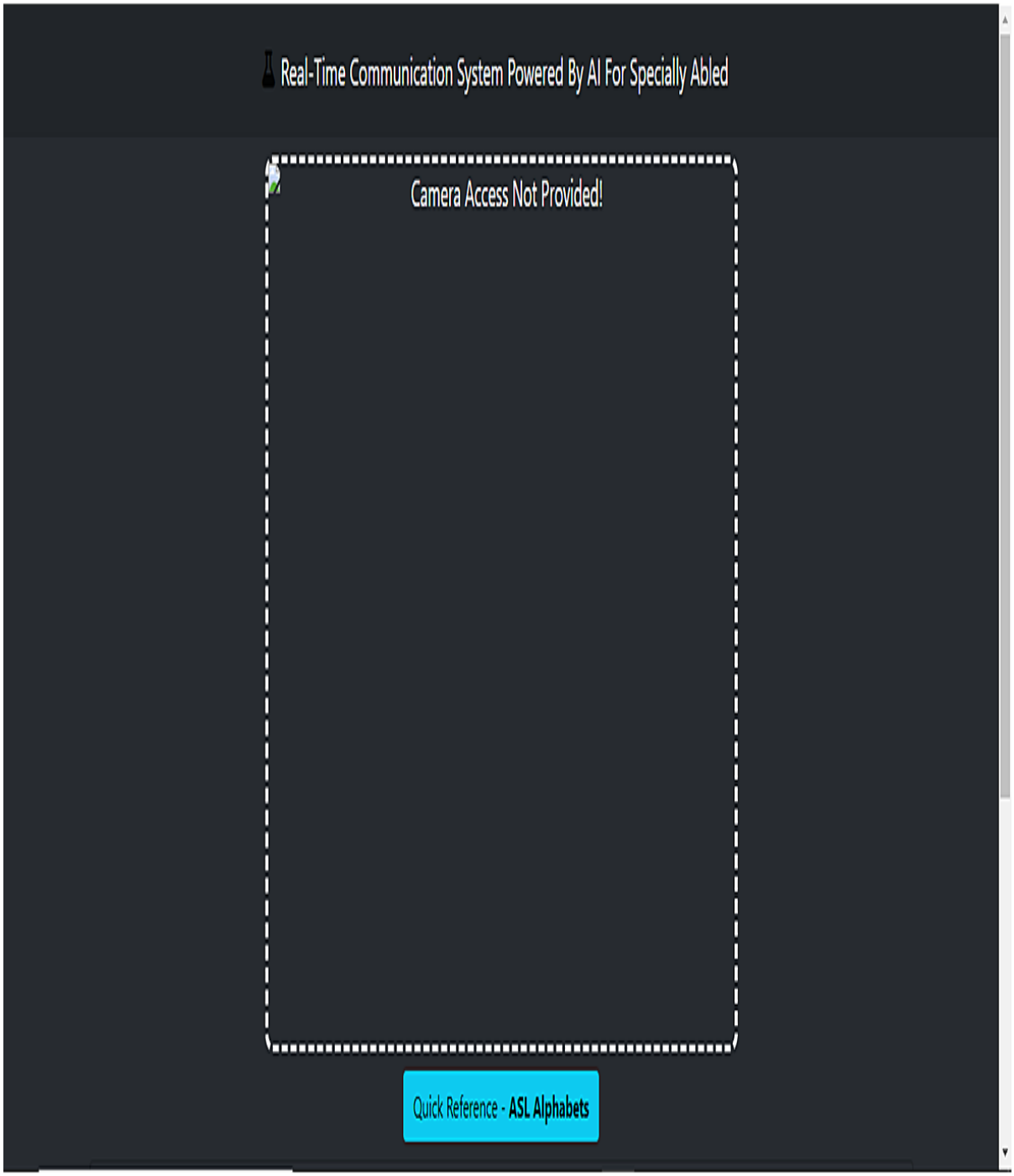
8.3 User testing

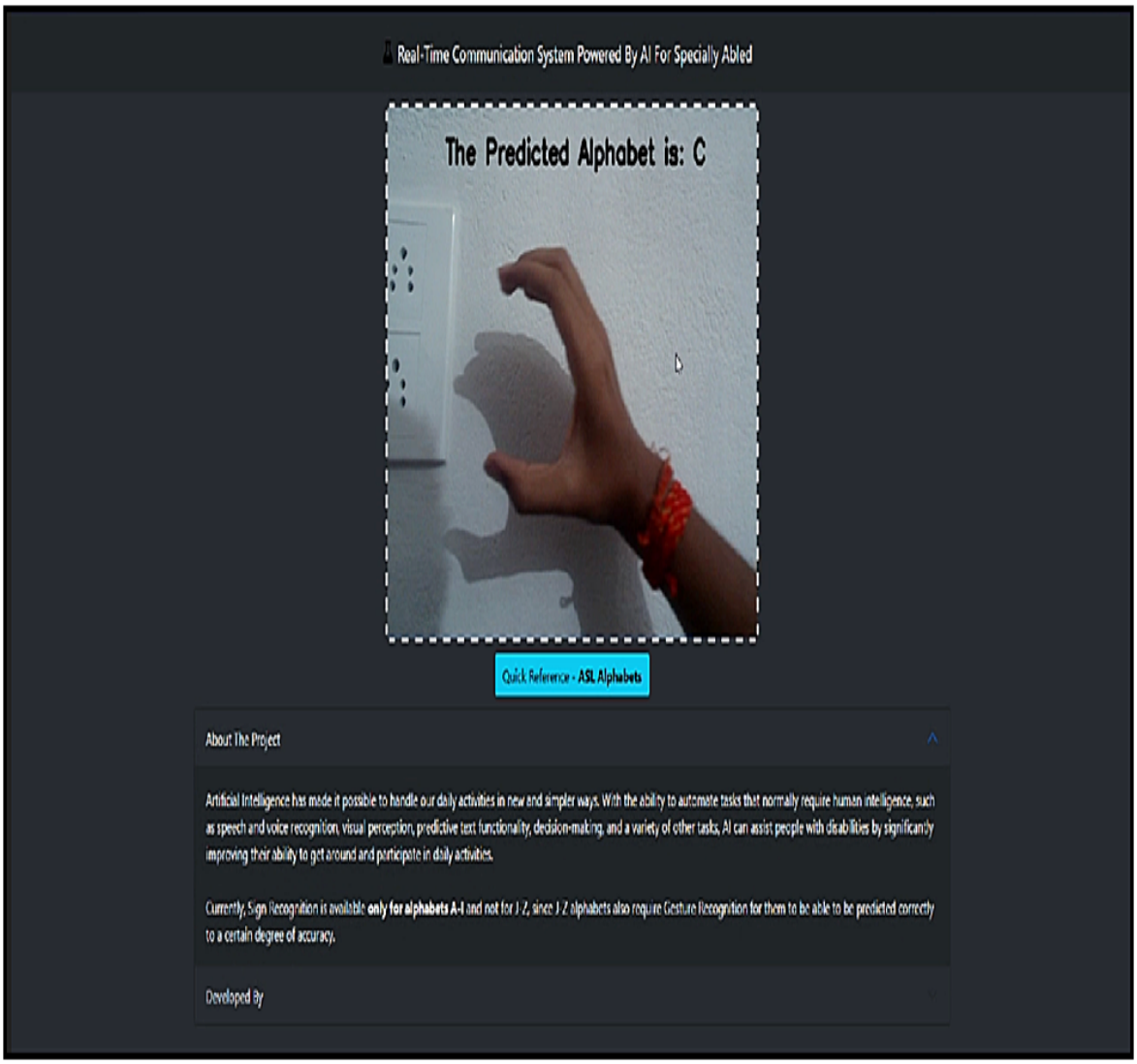
No amount of developer inspection and screening can substitute for the raw clash between a user and a web site. Given the difficulties of understanding all the subtle interactions between web content and assistive technology and the difficulties of approximating the experience of users with disabilities, this goes double for users with disabilities. If at all possible, you should test your site with real users with disabilities. This can be done on a large and expensive scale, but do not underestimate the benefits of doing even small-scale user testing.

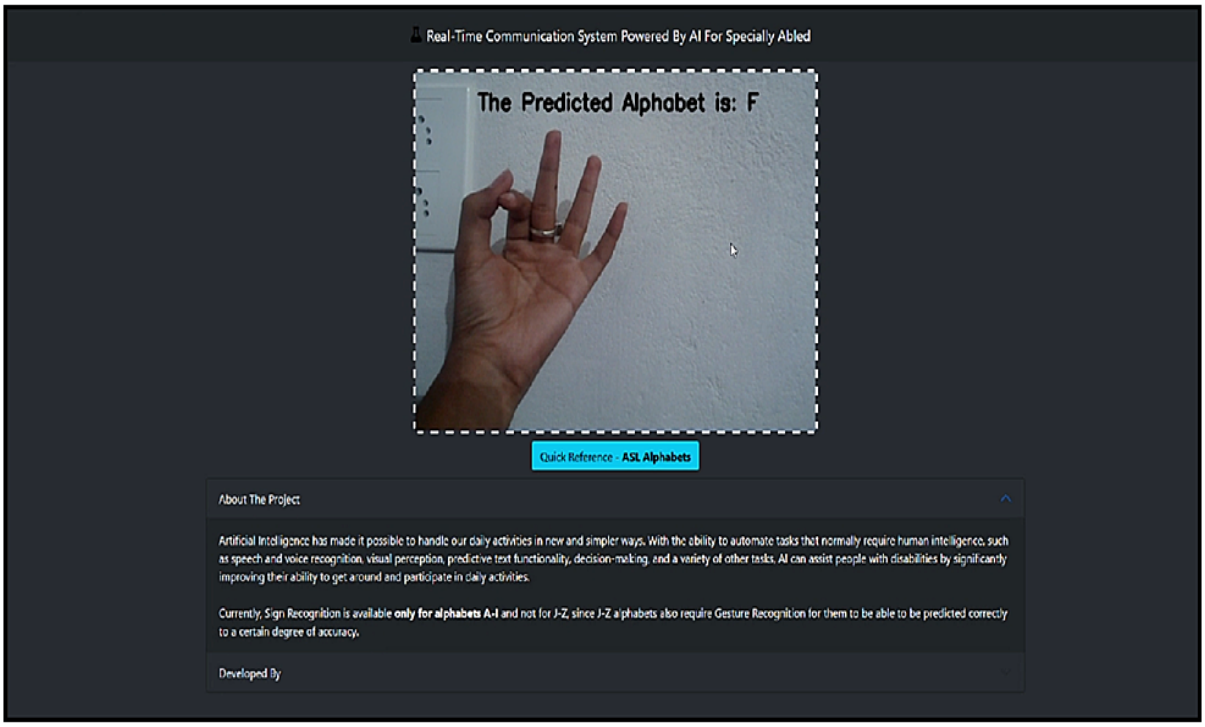
9.RESULTS

9.1 Performance Metrics

The proposed procedure was implemented and tested with set of images. The set of 15750 images of Alphabets from “A” to “I” are used for training database and a set of 2250 images of Alphabets from “A” to “I” are used for testing database. Once the gesture is recognize the equivalent Alphabet is shown on the screen.Some sample images of the output are provided below:


Real-Time Communication System Powered By AI For Specially Abled
Camera Access Not Provided!
Quick Reference - ASL Alphabets


Real-Time Communication System Powered By AI For Specially Abled
The Predicted Alphabet is: C
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


Real-Time Communication System Powered By AI For Specially Abled
The Predicted Alphabet is: F
Quick Reference - ASL Alphabets
About The Project
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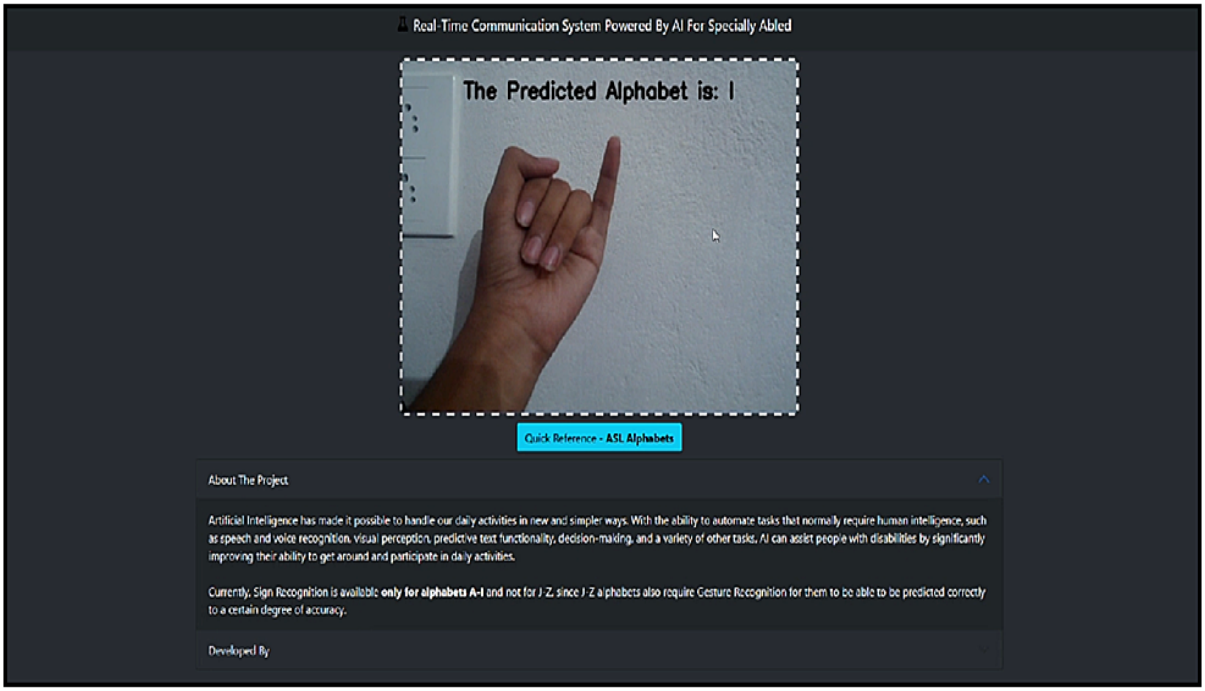
Currently, Sign Recognition is available only for alphabets A-I and not for J-Z, since J-Z alphabets also require Gesture Recognition for them to be able to be predicted correctly to a certain degree of accuracy.
Developed By


Real-Time Communication System Powered By AI For Specially Abled
The Predicted Alphabet is: I
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

10. ADVANTAGES & DISADVANTAGES

Advantages:

1. It is possible to create a mobile application to bridge the communication gap betweendeaf and dumb persons and the general public.

2. As different sign language standards exist, their datasetcan be added, and the user canchoose which sign language to read.

Disadvantages:

1. The current model only works from alphabets A to I.

2. In absence of gesture recognition, alphabets from J cannot be identified as they requiresome kind of gesture input from the user.

3. As the quantity/quality of images in the datasetis low, the accuracy is not great, but thatcan easily be improved by change in dataset.

11.CONCLUSION

Sign language is a useful tool for facilitating communication between deaf and hearing people. Because it allows for two-way communication, the system aims to bridge the communication gapbetween deaf people and the rest of society. The proposed methodology translates language into English alphabets that are understandable to humans.

This system sends hand gestures to the model, who recognises them and displays the equivalent

Alphabet on the screen. Deaf-mute people can use their hands to perform sign language, which

will then be converted into alphabets, thanks to this project.

12. FUTURE SCOPE

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 the specially abled people such as deafand dumb. With 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.

13.APPENDIX

13.1 GitHub &Project Demo Link

Github: https://github.com/IBM-EPBL/IBM-Project-8348-1658915782

Demo Link: