VEL TECH HIGH TECH DR. RANGARAJAN DR. SAKUNTHALA ENGINEERING COLLEGE

Real-Time Communication System Powered by AI for Specially Abled

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REAL TIME COMMUNICATION POWERED BY AI FOR SPECIALLY ABLED

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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.

1.2 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

2.1 Existing Problem

In 2020 proposed an idea for a D-talk sign language recognition system for people with disabilities using machine learning and image processing. This paper shows how artificial intelligence is being used to help people who are unable to do what most people do in their everyday lives. Aligned with communication, D-talk is a system that allows people who are unable to talk and hear to be fully understood, allowing them to learn their language more easily and for the people that would interact and communicate with them. This system provides detailed hand gestures that show the meaning at the bottom so that everyone can understand them. This research teaches readers about the system and what it can do for people who are struggling with what they are not capable of, as well as the technical terms used to describe how the system works . This project forms a base infrastructure which can later be augmented with addition of different Sign Languages and integrating with other hearing impaired aid systems.

2.2 References

1.D-Talk: Sign Language Recognition System for People with Disability using Machine Learning and Image Processing (Bayan Mohammed Saleh, Reem Ibrahim, and Muhammad Usman)

2.Sign Language Recognition System for People with Disability using Machine Learning and Image Processing (Bayan Mohammed Saleh, Ibrahim Al-Beshr, Muhammad Usman Tariq)

3.Real-time Communication System for the Deaf And Dumb (Kedar Potdar , Gauri Nagavkar)

4.Smart Communication for Differently Abled People (Bhavani, B. Poornima, M. Surya Bharathi, M. Saraswathi)

5.AI Improving the Lives of Physically Disabled (Hemshree Madaan, Shubham Gupta)

6.Application of Machine Learning Techniques for Improving Learning Disabilities (Poornappriya, R Gopinath)

7.Glove based gesture recognition sign language translator using capacitive touch sensor (Abhishek KS, Qubeley S)

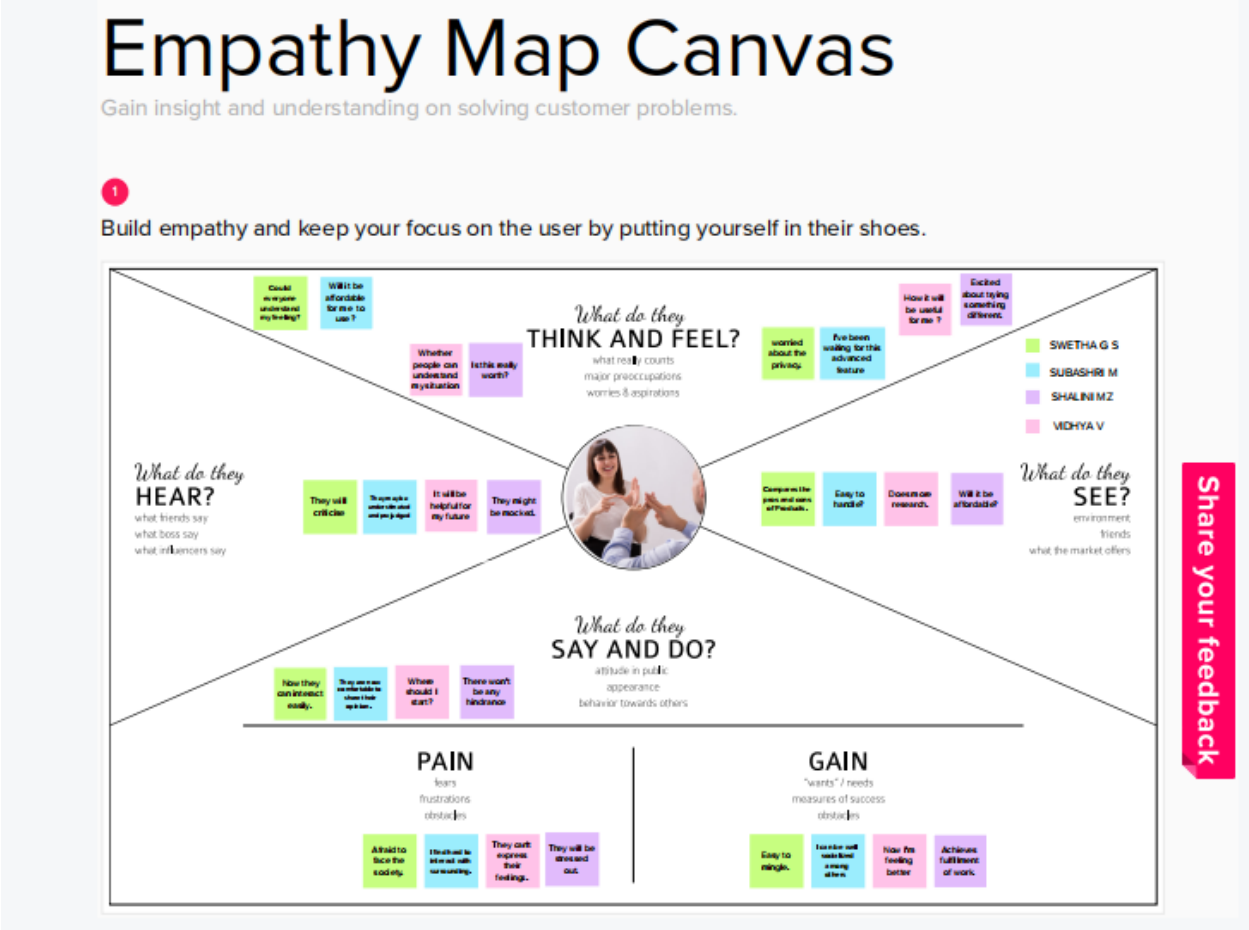
8.Deaf talk using 3D animated sign language (software : Microsoft kinect) (M.Ahmed)

2.3 Problem Solution Definition

Specially abled people especially hearing and speech impaired persons struggle to explain themselves clearly and lack adequate communication with other people. They consequently have to deal with a lot of problems in this regard. They utilise sign language, which is highly common among them, to communicate. Therefore, a qualifed translator is necessary.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

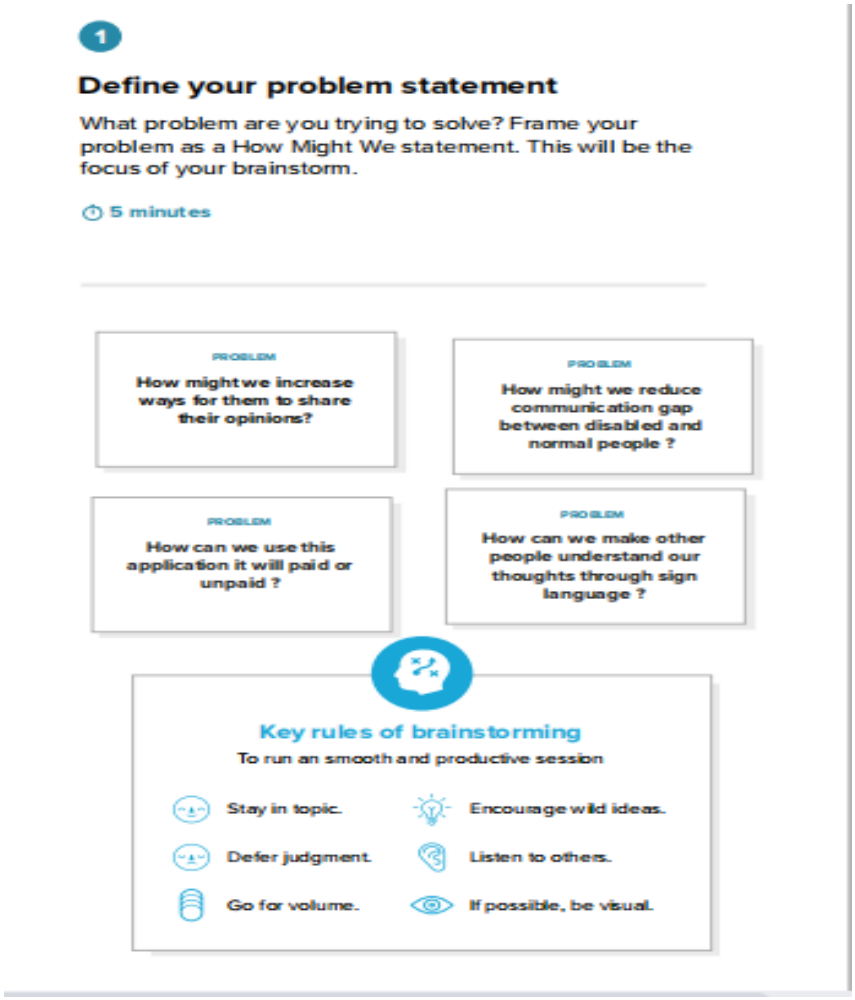


3.2 IDAETION & BRAINSTORMING

IDEATION

Problem Statement (PS)	I am (customer)	I'm trying to	But	Because	Which makes me feel
	A dumb person	Communicate in effective with all.	Sometimes my ideas and thoughts are taken in wrong	Normal people don't have any idea about how we communicate	Stressed and disturbed
	A deaf - mute person	Communicate with normal people without any difficulty.	Others can't understand my feeling and make me as odd one.	Application/technology that I use are not familiar among all people.	Uncomfortable and can't express my feelings.

BRAINSTORMING



2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

10 minutes

TIP

You can select a sticky note and hit the pencil [switch to sketch] icon to start drawing!

SWETHA G S

Specialized adaptive hardware and software translate Morse code into a form that computers understand so that standard software can be used. Speech input provides another option for individuals with disabilities.

Software is made to translate sign language to words.

Ava is an instant transcription app that uses AI to instantly transcribe the conversation of a group of people. Its algorithm adds punctuation, the name of the person who is talking and the necessary vocabulary from the user's dictionary.

Braille keyboard and Braille display device: These are keyboards with Braille lettering, that can be used by blind or visually impaired users.

SHALINI M Z

Augmentative and alternative communication devices help people with communication disorders to express themselves. It can range from a simple picture board to a computer program that synthesizes speech from text.

The glove sensors convey the degree of flexion in each finger of the hand. Additionally an accelerometer sensor was placed on top of the gloves to acquire the orientation of the hand.

Optical Character Recognition allows people with a vision impairment to scan printed text and receive a speech output

A face based communication system for disabled have also been developed

SUBASHRI M

Real-time captioning or translators for people with a hearing impairments using sign language.

Using sign language image processing is done and voice generates.

A system that provides detailed hand gestures that show the meaning at the bottom.

Speech recognition system allow user to control computers by speaking words and letters.

VIDHYA V

By using their manual-visual language they can use with these gadgets.

It is also done by gloves in which they are equipped with sensors

The visual language has been trained to the AI devices.

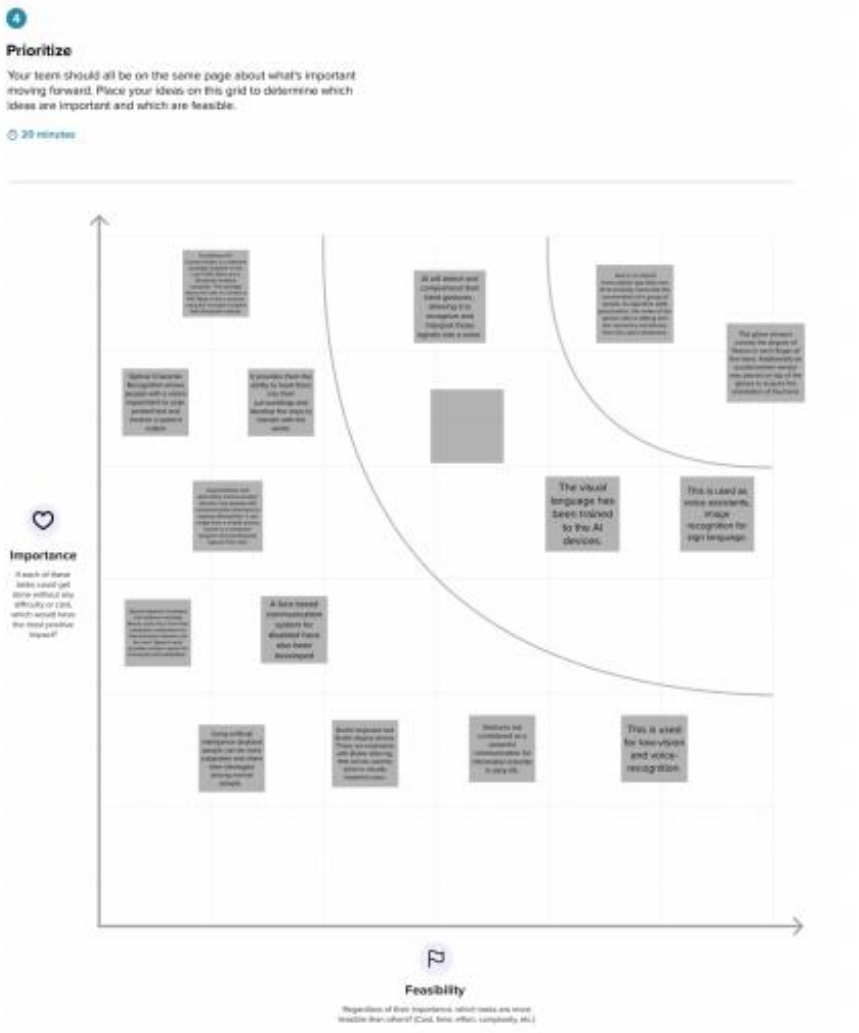
This is used as voice assistants, image recognition for sign language.

3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

20 minutes

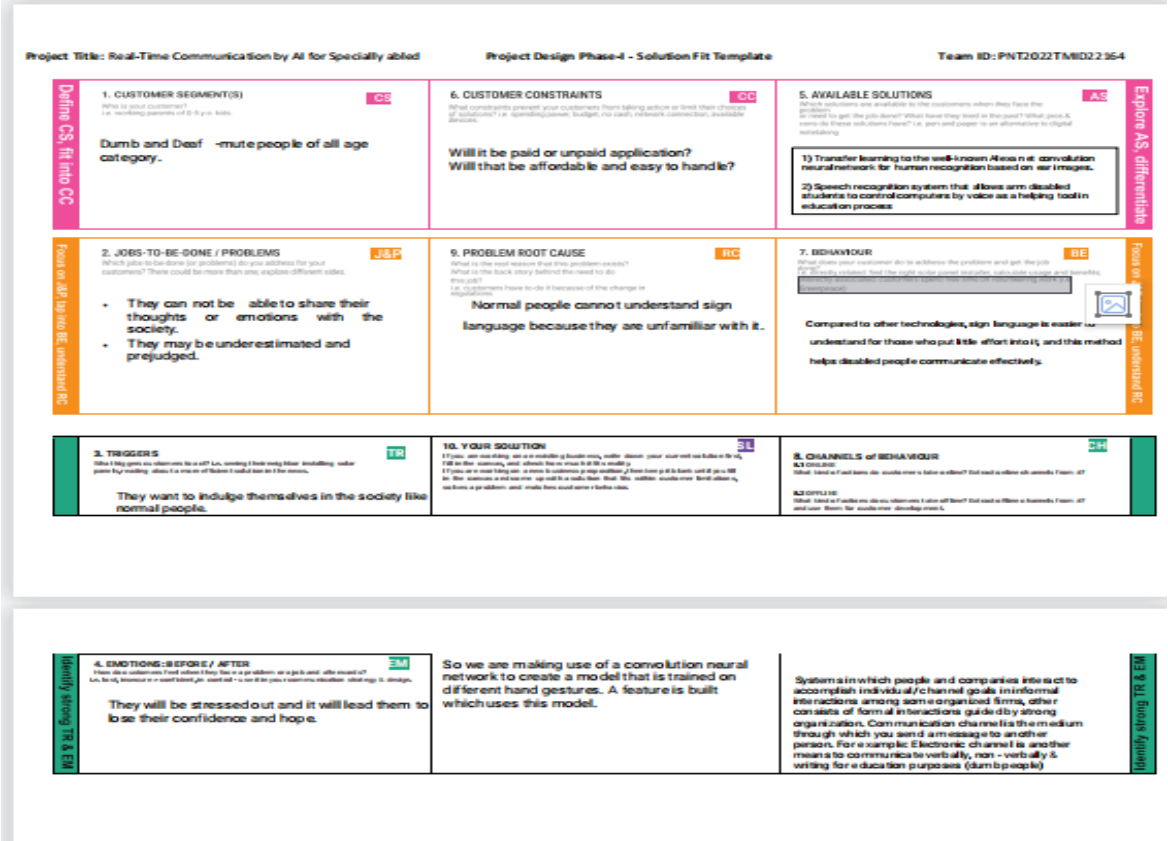


3.3 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	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
2.	Idea / Solution description	So we are making use of a convolution neural network to create a model that is trained on different hand gestures. Feature is built which uses this model.

3.	Novelty / Uniqueness	So the feature enables deaf and dumb people to convey their information using signs which get converted to human-understandable language and speech is given as output.
4.	Social Impact / Customer Satisfaction	In emergency times(situations) 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. So voice Conversion System with Hand Gesture Recognition and translation will be useful to have a proper conversation between a normal person and an impaired person in any language.
5.	Business Model (Revenue Model)	Cost,product as service (model),financial viability ,offering.
6.	Scalability of the Solution	The technology is developing day by day but some significant developments are also undertaken for the betterment of these people.

3.4 Problem Solution Fit



4. REQUIREMENT ANALYSIS

4.1 Functional Requirement

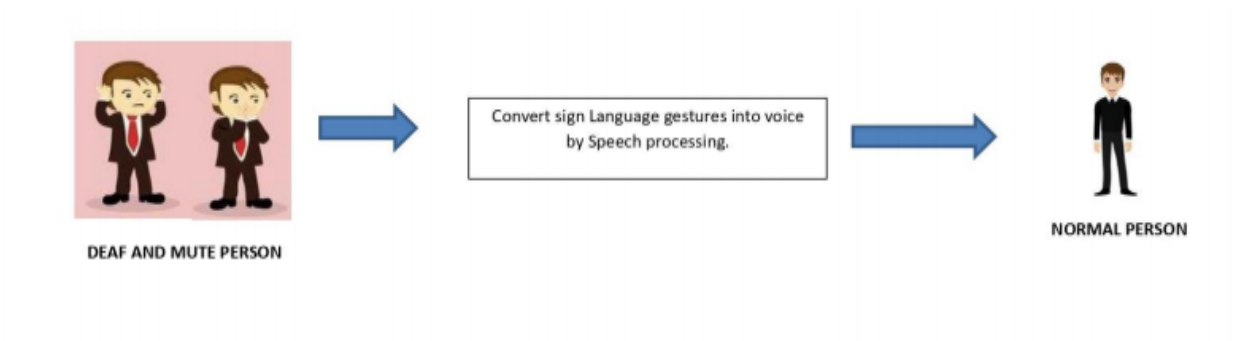
FR No	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through Google account .
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP Password received via Gmail .
FR-3	User Login	Login with the registered mail Id and password .
FR-4	User Data	Sign language is taken as user data and processed using required data / functions .
FR-5	User Voice	A voice is generated as an output for normal people from sign language data provided .

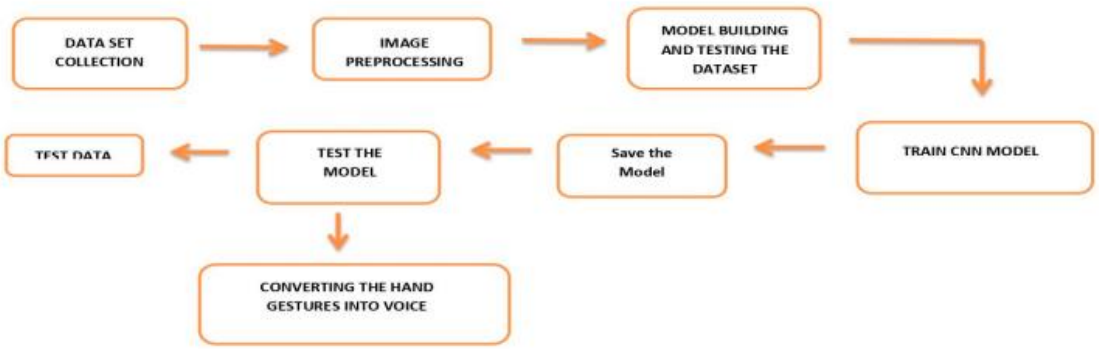
4.2 Non-Functional Requirement

NFR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Add Images with text and allow users to understand normal people conversation using sign language data and this makes them to interact with normal people easily .
NFR-2	**Security**	Data shared by deaf – mute and dumb people will be highly secured as no third party involved in it
NFR-3	**Reliability**	Performance will be consistent throughout the usage of website and easy accessible
NFR-4	**Performance**	Better performance will be provided through sign language and assistive technology .
NFR-5	**Availability**	It is meant to be easy for all smart phone users with good internet facility .
NFR-6	**Scalability**	Handling will be more convenient because it will be installed on smart phones; no separate device required

5. PROJECT DESIGN

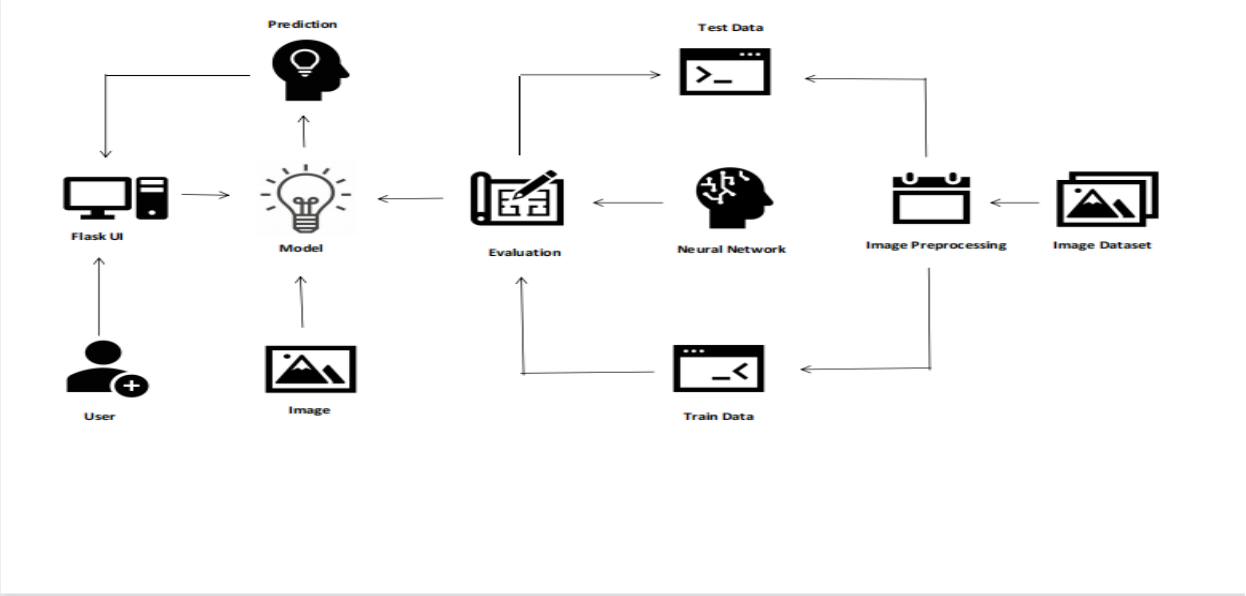
5.1 Data Flow Diagrams



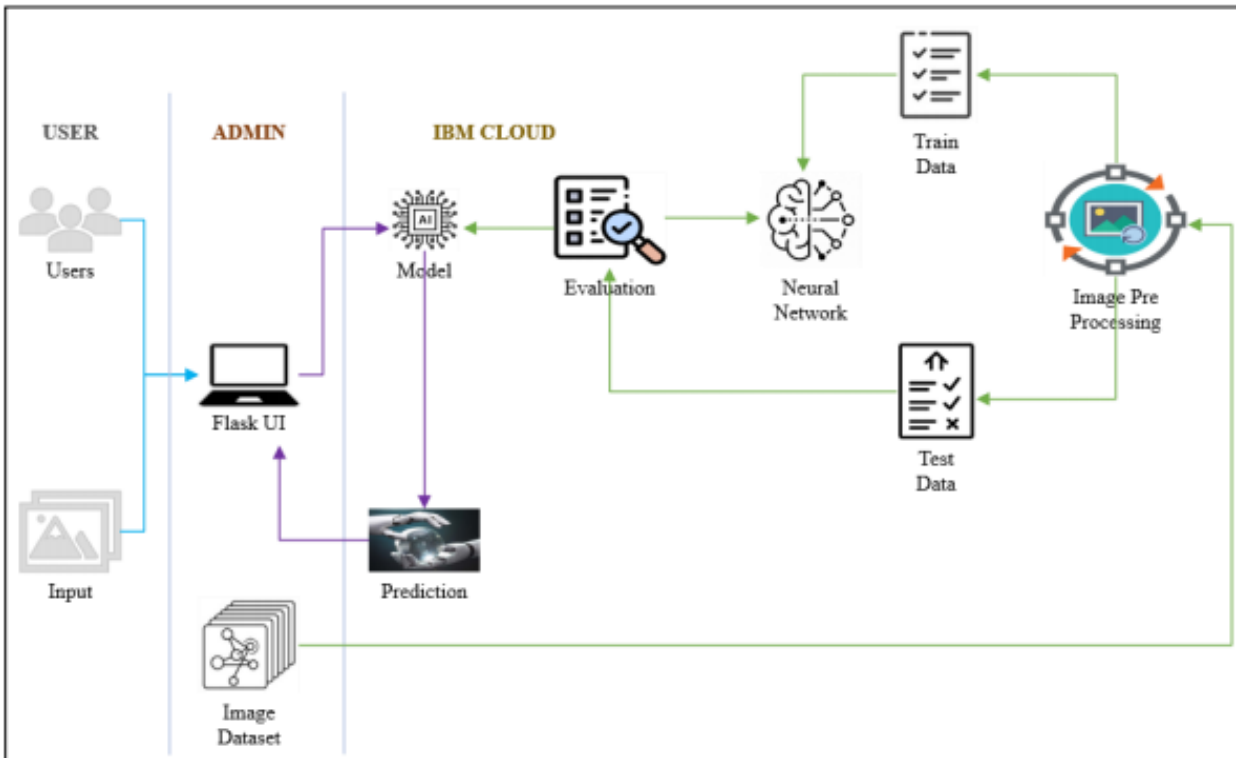


5.2 Solution & Technical Architecture

Solution Architecture



Technical Architecture



5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Low
		USN-4	As a user,I can register for the application through Gmail		Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password		High	Sprint-1
Customer (Web user)	Registration	USN-1	As a user, I can register in the website by entering my email, password and confirming by password.	I can receive verification email & then confirm.	High	Sprint -2
Customer Care Executive			We perform a number of duties, including answering phones, responding to		High	Sprint-1

			customer questions and assisting with customer issues.			
Administrator			He/she can manage and organise the application or the website built.		High	Sprint-1
			He/she will be responsible for helping the smooth running of the business by ensuring filing and documentation is kept up to date.		High	Sprint-1
			He/she manages and supervise the entire application or the website		High	Sprint-1
			He/she will be responding to queries, and providing customer service.		High	Sprint-2

6. PROJECT PLANNING AND ESTIMATION

6.1 Sprint Planning & Estimation

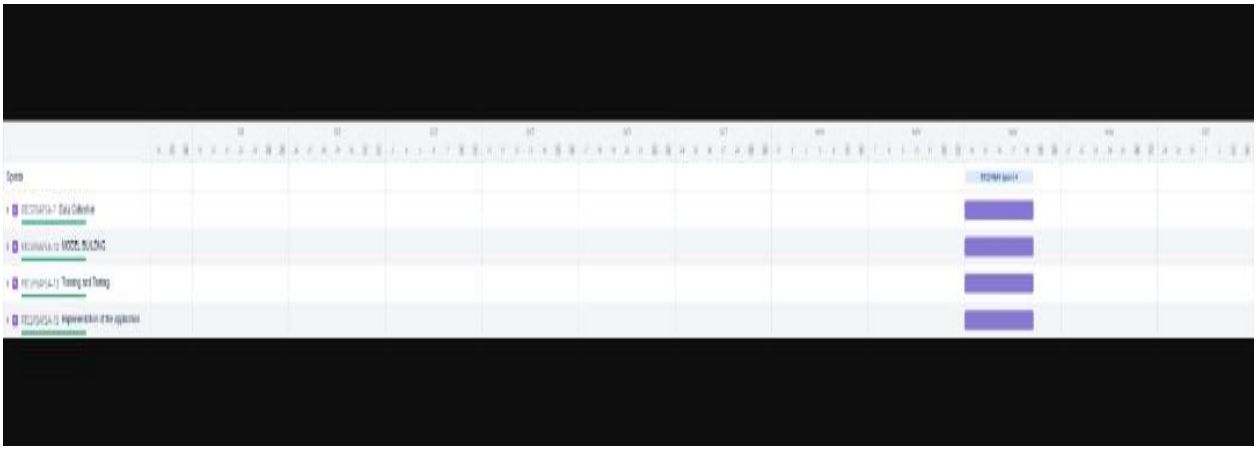
Sprint	Functional Requirement (Epic)	User Story Number	User Story/ Task	Story Points	Priority	Team Members
Sprint-1	Data Collection	USN-1	Collect Dataset.	8	Medium	VIDHYA V, SUBASHRI M
Sprint-1	Image Recognisation	USN-2	Image preprocessing.	8	Medium	SHALINI M.Z, SUBASHRI M
Sprint-2	Model Building	USN-3	Import the required libraries, add the necessary layers and	10	High	SWETHA G.S

			compile the model.			
Sprint-2	Train the model	USN-4	Training the image classification Model using CNN.	9	High	SHALINI M.Z , SUBASHRI M
Sprint-3	Training	USN-5	Training the model.	9	High	SHALINI M.Z, SWETHA G.S
Sprint-3	Testing	USN-6	Testing the model's performance.	10	High	SUBASHRI M, SWETHA G.S SHALINI M.Z
Sprint-4	Implementation of the application	USN-7	Converting the input sign language images into english alphabets.	9	Medium	SHALINI M.Z, SUBASHRI M
Sprint-4	Implementation of the speech processing	USN-8	Converting english alphabets into voice.	9	High	SWETHA G.S, SHALINI M.Z

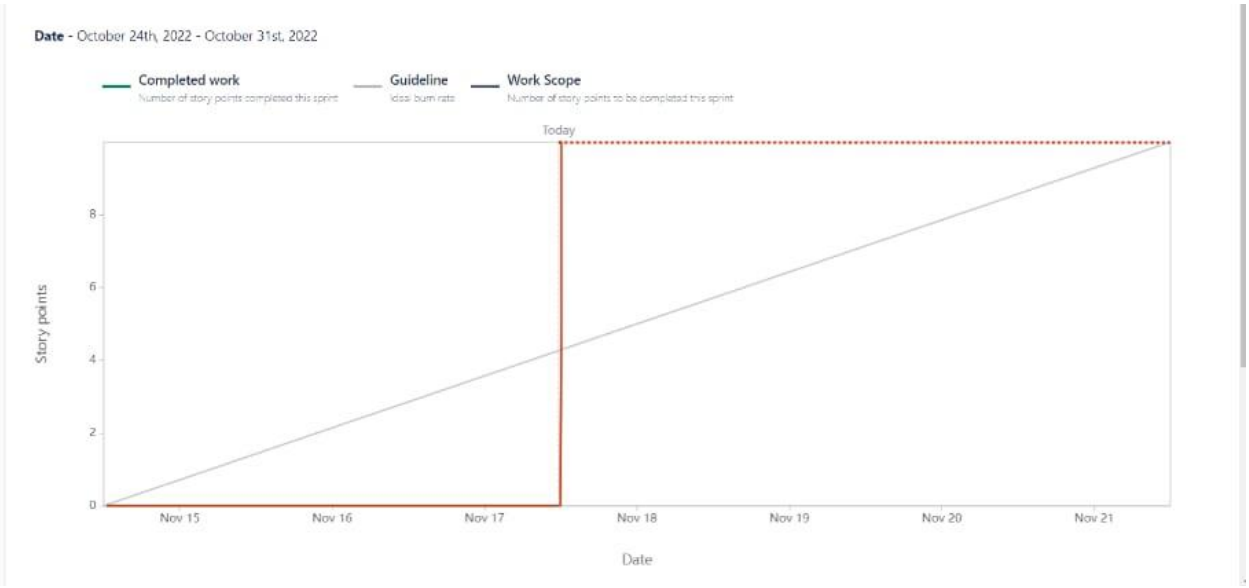
6.2 Sprint Delivery Schedule

Sprint	**Total Story Points**	**Duration**	**Sprint Start Date**	**Sprint End Date (Planned)**	**Story Points Completed (as on Planned End Date)**	**Sprint Release Date (Actual)**
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	16	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Oct 2022	19	04 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	11 Nov 2022	19	11 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	18 Nov 2022	18	19 Nov 2022

6.3 Report from JIRA



Burndown Graph



Velocity Graph

7.CODING AND SOLUTION

7.1 Feature

```
img=image.load_img("F.png",target_size=(64,64))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
y=np.argmax(model.predict(x),axis=1)
index=['A','B','C','D','E','F','G','H','I']
index[y[0]]
```

```
1/1 [==============================] - 0s 153ms/step
'F'
```

```
img=image.load_img("10.png",target_size=(64,64))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
y=np.argmax(model.predict(x),axis=1)
index=['A','B','C','D','E','F','G','H','I']
index[y[0]]
```

```
1/1 [==============================] - 0s 265ms/step
'C'
```

Utilizing image processing to transform an image to text.

TESTING

```
Epoch 1/10
158/158 [==============================] - 59s 370ms/step - loss: 0.3116 - accuracy: 0.9102 - val_loss: 0.2510 - val_accuracy: 0.9618 - lr: 0.0010
Epoch 2/10
158/158 [==============================] - 58s 368ms/step - loss: 0.0292 - accuracy: 0.9922 - val_loss: 0.2516 - val_accuracy: 0.9733 - lr: 0.0010
Epoch 3/10
158/158 [==============================] - 58s 369ms/step - loss: 0.0131 - accuracy: 0.9970 - val_loss: 0.2420 - val_accuracy: 0.9702 - lr: 0.0010
Epoch 4/10
158/158 [==============================] - 58s 369ms/step - loss: 0.0073 - accuracy: 0.9983 - val_loss: 0.3255 - val_accuracy: 0.9756 - lr: 0.0010
Epoch 5/10
158/158 [==============================] - 58s 368ms/step - loss: 0.0054 - accuracy: 0.9990 - val_loss: 0.3248 - val_accuracy: 0.9747 - lr: 0.0010
Epoch 6/10
158/158 [==============================] - 59s 370ms/step - loss: 0.0057 - accuracy: 0.9986 - val_loss: 0.3556 - val_accuracy: 0.9764 - lr: 0.0010
Epoch 7/10
158/158 [==============================] - 58s 368ms/step - loss: 0.0053 - accuracy: 0.9981 - val_loss: 0.2799 - val_accuracy: 0.9773 - lr: 0.0010
Epoch 8/10
158/158 [==============================] - 58s 369ms/step - loss: 0.0028 - accuracy: 0.9992 - val_loss: 0.2487 - val_accuracy: 0.9778 - lr: 0.0010
Epoch 9/10
158/158 [==============================] - 57s 363ms/step - loss: 0.0042 - accuracy: 0.9987 - val_loss: 0.3611 - val_accuracy: 0.9756 - lr: 0.0010
Epoch 10/10
158/158 [==============================] - 58s 369ms/step - loss: 0.0042 - accuracy: 0.9988 - val_loss: 0.4400 - val_accuracy: 0.9733 - lr: 0.0010
<keras.callbacks.History at 0x7f207f15bb50>
```

With accuracy of 0.9988

9.RESULT

9.1 Performance metrices:

Model Performance Testing:

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

S.No.	Parameter	Values	Screenshot
1.	Model Summary	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.	Accuracy	Training Accuracy –0.9981 Validation Accuracy –0.9749	Epoch 1/10 150/150 [==========] - 59s 370ms/step - loss: 0.0116 - accuracy: 0.9102 - val_loss: 0.1510 - val_accuracy: 0.9618 - lr: 0.0010 Epoch 2/10 150/150 [==========] - 58s 368ms/step - loss: 0.0292 - accuracy: 0.9922 - val_loss: 0.1518 - val_accuracy: 0.9755 - lr: 0.0010 Epoch 3/10 150/150 [==========] - 58s 369ms/step - loss: 0.0131 - accuracy: 0.9970 - val_loss: 0.2418 - val_accuracy: 0.9702 - lr: 0.0010 Epoch 4/10 150/150 [==========] - 59s 369ms/step - loss: 0.0073 - accuracy: 0.9983 - val_loss: 0.3255 - val_accuracy: 0.9756 - lr: 0.0010 Epoch 5/10 150/150 [==========] - 58s 368ms/step - loss: 0.0054 - accuracy: 0.9990 - val_loss: 0.3248 - val_accuracy: 0.9747 - lr: 0.0010 Epoch 6/10 150/150 [==========] - 59s 370ms/step - loss: 0.0057 - accuracy: 0.9986 - val_loss: 0.3556 - val_accuracy: 0.9764 - lr: 0.0010 Epoch 7/10 150/150 [==========] - 58s 368ms/step - loss: 0.0053 - accuracy: 0.9981 - val_loss: 0.1759 - val_accuracy: 0.9773 - lr: 0.0010 Epoch 8/10 150/150 [==========] - 58s 369ms/step - loss: 0.0020 - accuracy: 0.9992 - val_loss: 0.2487 - val_accuracy: 0.9778 - lr: 0.0010 Epoch 9/10 150/150 [==========] - 57s 363ms/step - loss: 0.0042 - accuracy: 0.9987 - val_loss: 0.3611 - val_accuracy: 0.9756 - lr: 0.0010 Epoch 10/10 150/150 [==========] - 58s 369ms/step - loss: 0.0042 - accuracy: 0.9988 - val_loss: 0.4480 - val_accuracy: 0.9733 - lr: 0.0010 <keras.callbacks.History at 0x7f2074150b50>

10.ADVANTAGES:

- Implementation of AI software in communication which enhances their understanding of sign language.
- This website makes the specially abled people to interact more effectively with normal people.
- Sharing of ideas and thoughts with normal people can be increased rapidly.
- Easy accessibility.
- Low cost.

11.DISADVANTAGE:

- It may be difficult to detect while the user is in motion.
- Accuracy may vary when the distance between the camera and user is larger.
- CNN do not encode the position and orientation of object.
- Lack of ability to be spatially invariant to the input data.
- Lots training data is required.

12.CONCLUSION:

As an overall conclusion of this project, "Realtime Communication Powered by AI for Specially Abled," we have come up with a solution for deaf-mute and dumb people to communicate in a more effective way with normal people. This project would enhance their communication with the help of a translator, which is used to convert sign language symbols into alphabets with the help of artificial intelligence software. The above strategies prove to be efficient in terms of time and accuracy. Further improvements can be made in the implementation of the communicator with other sign languages. This will pave the way for a better life for specially abled people in society.

13.Future Scope:

- Our proposed method of communication between specially abled and normal will be improved with further feature like text to voice conversion and recognize remaining alphabets which could definitely enhance the feature of the system.
- Communication between deaf-mute and dumb person with normal person, a mediator person is required to know the sign language used by them. But it is not possible always because there are sign languages in multiple languages. So, to understand all sign languages, hand gesture by deaf-mute and dumb people may be improved.

14.APPENDIX:

Source Code: click here

GitHub Link: click here

Project Demo Link: click here