

**VEL TECH HIGH TECH Dr. RANGARAJAN Dr. SAKUNTHALA
ENGINEERING COLLEGE**

Real-Time Communication System Powered by AI for Specially Abled

TEAM ID: PNT2022TMID22143

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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

AI may also allow people with disabilities to fully control their environments—not only at home but also in the classroom and the workplace. Full-scale automation may not yet be practical, but progress is being made. Some organizations are already using AI to assess conformance to accessibility guidelines. IBM aims to improve the fairness, accountability and trustworthiness of AI-based applications. Given the diversity of people's abilities, these must be an integral part of every AI solution lifecycle.

LITERATURE SURVEY

2.1 Existing problem

People with disabilities, such as the deaf and the dumb, find it challenging to communicate their emotions or any information to others. They experience a different sense of themselves while in a setting.

2.2 References

1. Abhishek, K. S., Qubeley, L. C. F., & Ho, D. (2016, August). Glove-based hand gesture recognition sign language translator using capacitive touch sensor. In 2016 IEEE International Conference on Electron Devices and Solid-State Circuits (EDSSC) (pp. 334-337). IEEE. <https://doi.org/10.1109/EDSSC.2016.7785276>.
2. Ahmed, M. A., Zaidan, B. B., Zaidan, A. A., Salih, M. M., & Lakulu, M. M. B. (2018). A review on systems-based sensory gloves for sign language recognition state of the art between 2007 and 2017. *Sensors*, 18(7), 2208. <https://doi.org/10.3390/s18072208>
3. Anderson, R., Wiryana, F., Ariesta, M. C., & Kusuma, G. P. (2017). Sign language recognition application systems for deaf-mute people: A review based on input-process-output. *Procedia computer science*, 116, 441-448.
4. (CSIT) (pp. 171-174). IEEE. 13. Darabkh, K. A., Haddad, L., Sweidan, S. Z., Hawa, M., Saifan, R., & Alnabelsi, S. H. (2018). An efficient speech recognition system for armdisabled students based on isolated words. *Computer Applications in Engineering Education*, 26(2), 285-3013
5. Gomes, S. L., Rebouças, E. D. S., Neto, E. C., Papa, J. P., de Albuquerque, V. H., Rebouças Filho, P. P., & Tavares, J. M. R. (2017). Embedded real-time speed limit sign recognition using image processing and machine learning techniques. *Neural Computing and Applications*, 28(1), 573-584.

2.3 Problem Statement Definition

1

Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

🕒 5 minutes

PROBLEM

How might we [It is very difficult for mute people to convey their message to normal people,]??

PROBLEM

How might we [going to overcome the user's privacy]?

PROBLEM

How might we [Regional areas have their own specific variations—just like accents or slang—leading to further difficulty of understanding sign language]?

PROBLEM

How might we [people around them start avoiding them due to misunderstanding]?



Key rules of brainstorming

To run a smooth and productive session



Stay in topic.



Encourage wild ideas.



Defer judgment.



Listen to others.



Go for volume.



If possible, be visual.

IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

Empathy Map



3.2 Ideation & 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!



NAVEESH KUMAR.D

We should make a software which translates the actions to words

We can build a software for them

We can let others know the users language to get better understanding of them

We should give prioritization for the specially abled

Manoj.K

Encrypt the source of the code.

Secure the data-in-transit.

Use latest cryptographic techniques.

Perform penetration tests.

MURUGESAN.S

Creating a software with one universal language and other regional languages

Can give a action name in many different languages

Feeding Required data to the software

Convert actions to words which all people could understand

BHARATHRAJ.M

Misunderstanding or couldn't able to understand is the main issue

The person who knows the sign language only understand them

Create an application which makes all people to understand their feeling

The software must be capable of effectively tarnishing all of their deeds.

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 can break it up into smaller sub-groups.

🕒 20 minutes

Generate an App idea

Start to create an idea and collecting required software products to implement the idea

The software will be based on image processing.

Implementation

We are going to create the software using python programming

Implementing image processing by using Python libraries like OpenCv etc..

TIP

Add customizable tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mural.

Features of the software

The software's primary goal is to develop a tool that translates sign language motions into words.

when the actions are made, the software will go through all the images which will be fed to the

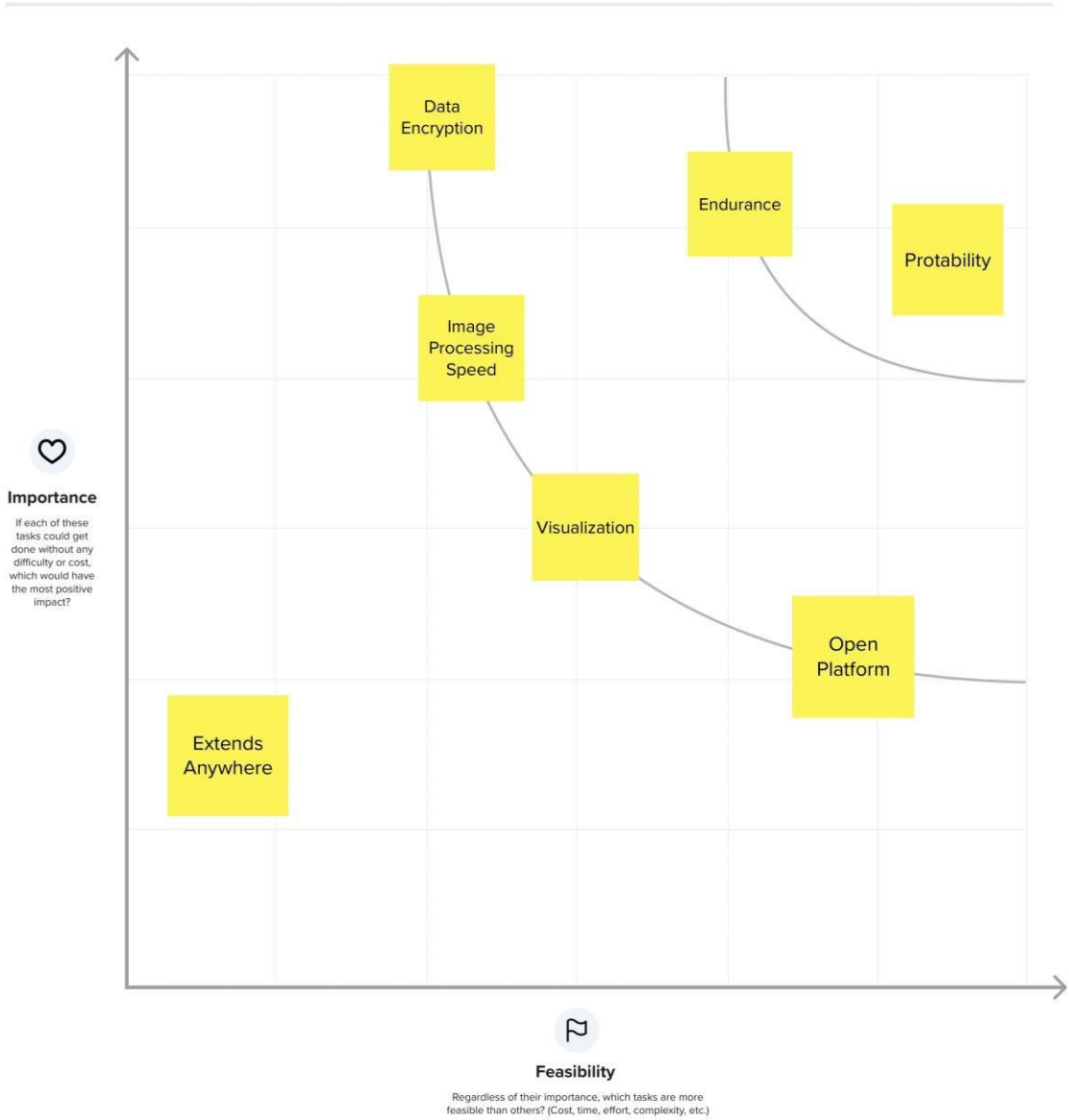
software will decide and proceed with the word according to the instruction given

4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

🕒 20 minutes



3.3 Problem Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Communication between a normal person and a dumb person has never been easy. Dumb people find it incredibly challenging to communicate with average people. Because hand sign language is not taught to the general public.
2.	Idea / Solution description	Therefore, we are using a convolution neural network to develop a model that is trained on various hand motions. A feature that makes use of this concept has been developed.
3.	Novelty / Uniqueness	Due to this capability, people with cognitive disabilities can communicate by utilising signs, which are then translated into speech and understood by others.
4.	Social Impact / Customer Satisfaction	It might be quite challenging for them to communicate during crisis situations. When other kinds of communication, like speech, are not possible, the human hand has continued to be a common choice. To have a proper communication between a normal person and a handicapped person in any language, a voice conversion system with hand gesture recognition and translation will be helpful.
5.	Business Model (Revenue Model)	Cost, viability from a financial standpoint, product as a service (model), and offer.
6.	Scalability of the Solution	While technology is constantly evolving, some substantial advancements are also being made for the benefit of these people.

3.4 Problem Solution fit

Define CS, fit into CC Focus on J&P, tap into BE, understand RC	1. CUSTOMER SEGMENT(S) Who is your customer? Deaf-mute and dumb persons of all ages. CS	6. CUSTOMER CONSTRAINTS What constraints prevent your customers from taking action or limit their choices of solutions? 1. Is the application going to be compensated or unpaid? 2. Will that be affordable and easy to handle?	5. AVAILABLE SOLUTIONS Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? Applying what is learned to familiar situations Convolution of the Alexa net using ear pictures as the basis, a neural network for human recognition. As a tool to aid in the educational process, speech recognition software enables computer operation by voice for students with arm disabilities. AS	Explore AS, different Focus on J&P, tap into BE, understand RC
	2. JOBS-TO-BE-DONE / PROBLEMS Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides. J&P 1. They are unable to communicate their feelings or thoughts to the public. 2. They might be misjudged and undervalued.	9. PROBLEM ROOT CAUSE What is the real reason that this problem exists? What is the back story behind the need to do this job? RC Normal people cannot understand sign language because they are unfamiliar with it	7. BEHAVIOUR What does your customer do to address the problem and get the job done? BE When compared to other forms of technology, sign language is simpler to understand and helps persons with disabilities communicate successfully.	
	3. TRIGGERS What triggers customers to act? TR They desire to enjoy society like would regular folks.	10. YOUR SOLUTION If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality. If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour. Consequently, we are using a convolution neural network to develop a model that is trained on various hand movements. This model is used to create a feature. SL	8. CHANNELS of BEHAVIOUR 8.1 ONLINE What kind of actions do customers take online? Extract online channels from #7 8.2 OFFLINE What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development. Systems that allow people and businesses to work together to achieve individual CH	

REQUIREMENT ANALYSIS

4.1 Functional requirement

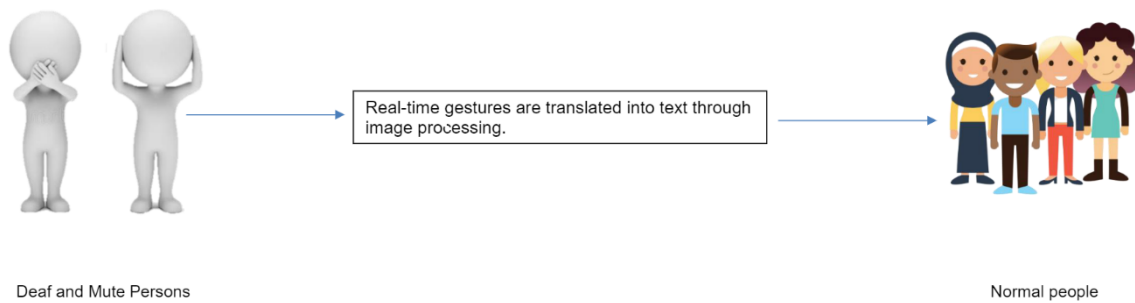
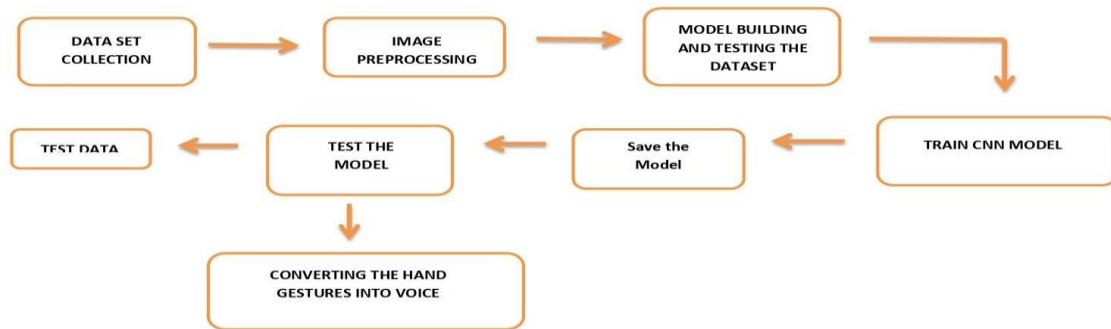
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through Google account .
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP Password received via Gmail .
FR-3	User Login	Login 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 text is generated as an output in system for normal people from sign language data provided

4.2 Non-Functional requirements

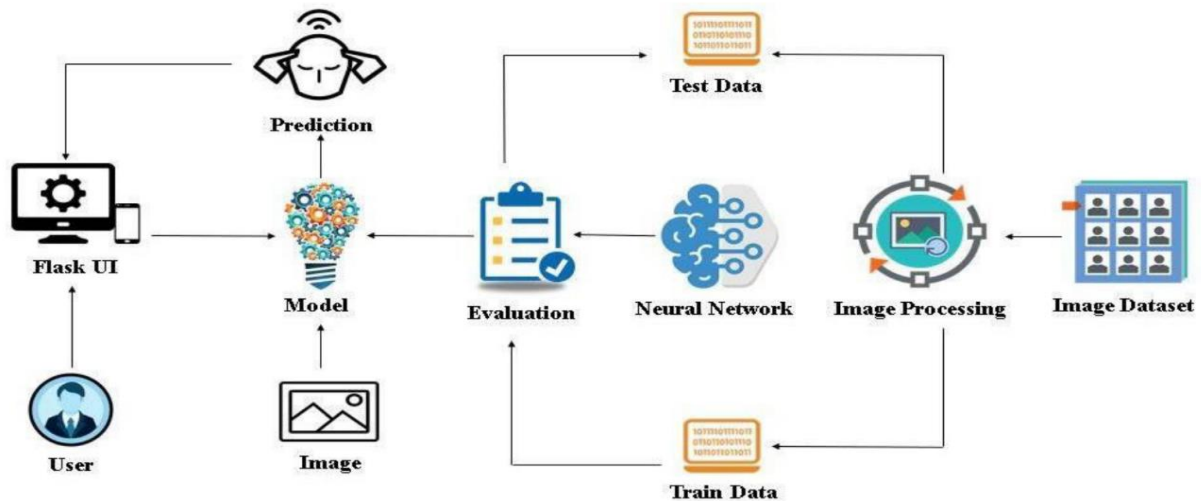
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Users can communicate with regular people morereadily by adding images with text and enabling them to interpret conversations between people using sign language.
NFR-2	Security	Data exchanged by the deaf and dumb will be highly secure because a third party won't be involved.
NFR-3	Reliability	Performance will be consistent throughout theusage of website and easy accessible
NFR-4	Performance	Utilizing sign language and assistance technologies will result in better performance.
NFR-5	Availability	All smart phone users with good internet access should find it simple to use.
NFR-6	Scalability	Since it will be placed on smartphones, there won't be a need for a separate device, handling will be more practical.

PROJECT DESIGN

5.1 Data Flow Diagram



5.2 Solution & 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	Sprint-2
		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
	Dashboard					
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 customer questions and assisting with customer issues.		High	Sprint-1
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

PROJECT PLANNING & SCHEDULING

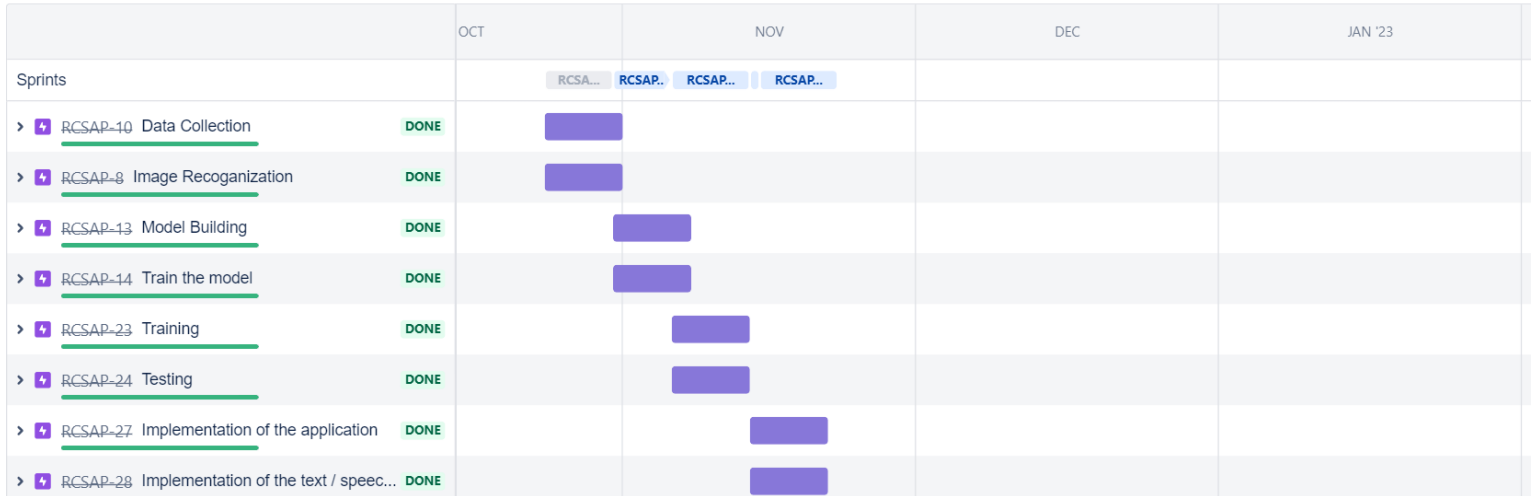
6.1 Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data Collection	USN-1	Collect Dataset.	8	High	Naveesh Kumar. D Manoj. K
Sprint-1	Image Recognition	USN-2	Image preprocessing.	8	High	Naveesh Kumar. D Manoj. K Murugesan. S
Sprint-2	Model Building	USN-3	Import the required libraries, add the necessary layers and compile the model.	10	High	Naveesh Kumar. D
Sprint-2	Train the model	USN-4	Training the image classification model using CNN.	9	Medium	Manoj. K
Sprint-3	Training	USN-5	Training the model.	9	High	Naveesh Kumar. D
Sprint-3	Testing	USN-6	Testing the model's performance.	10	High	Murugesan. S Bharathraj. M
Sprint-4	Implementation of the application	USN-7	Converting the input sign language images into English alphabets.	9	Medium	Murugesan. S Bharathraj. M Naveesh Kumar. D Manoj. K
Sprint-4	Implementation of the text / speech processing	USN-8	Converting English alphabets into voice.	9	High	Naveesh Kumar. D Manoj. K

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 Nov 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 Reports from JIRA



Date - October 24th, 2022 - October 31st, 2022



Velocity report

[How to read this report](#)



CODING & SOLUTIONING

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'
```

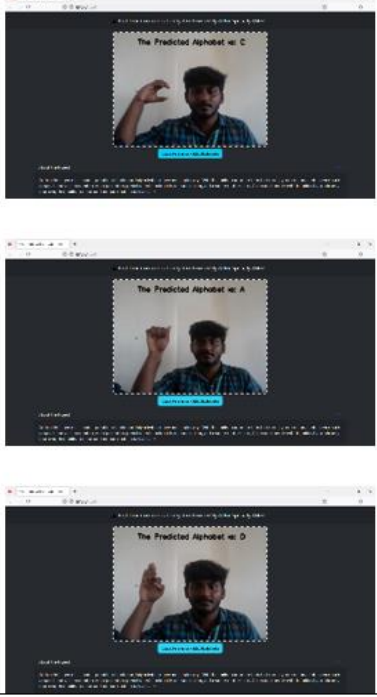
Utilizing image processing to transform an image to text.

TESTING

				Date	17-Nov-22								
				Team ID	PNT2022TMD22143								
				Project Name	Real-Time Communication System								
				Maximum Marks	4 marks								
Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation(Y/N)	BUG ID	Executed By
Webpage_TC_001	Functional	Home Page	Verify user is able to see the application interface with camera window and reference		1.Enter URL 2.Paste the URL in Local Browser 3.Wait till the camera opens	http://127.0.0.1:5000/	Website interface with Camera window should open	Working as expected	Pass	Got the expected output			NAVEESH KUMAR.D, MANOJ.K,BHARATHRAJ. M,MURUGESAN.S
Webpage_TC_002	UI	Home Page	Verify the UI elements in the website interface		1.Enter URL 2.Paste the URL in Local Browser 3.Wait till the camera opens 4. Now show the hand Gestures, by refering the 'American Alphabet Image' by clicking on reference button	http://127.0.0.1:5000/	1. Camera with reference button and project description and developed by, should open. 2. Now the Image processing should recognize the hand gestures done by the user	Working as expected	Pass	Got the expected output			NAVEESH KUMAR.D, MANOJ.K,BHARATHRAJ. M,MURUGESAN.S

RESULTS

9.1 Performance Metrics

S.No.	Parameter	Values	Screenshot
1.	Model Summary	<p>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.</p>	
2.	Accuracy	<p>Training Accuracy - 0.9981</p> <p>Validation Accuracy -0.9747</p>	<pre>Epoch 1/100 438/438 [=====] 135s 287s/step - loss: 0.2300 - accuracy: 0.5303 - val_loss: 0.3428 - val_accuracy: 0.3787 - (lr: 0.0001) Epoch 2/100 438/438 [=====] 135s 287s/step - loss: 0.4930 - accuracy: 0.5156 - val_loss: 0.3185 - val_accuracy: 0.3764 - (lr: 0.0001) Epoch 3/100 438/438 [=====] 135s 287s/step - loss: 0.8102 - accuracy: 0.5102 - val_loss: 0.3414 - val_accuracy: 0.3662 - (lr: 0.0001) Epoch 4/100 438/438 [=====] 135s 287s/step - loss: 0.8116 - accuracy: 0.5062 - val_loss: 0.4277 - val_accuracy: 0.3476 - (lr: 0.0001) Epoch 5/100 438/438 [=====] 135s 287s/step - loss: 0.8110 - accuracy: 0.5050 - val_loss: 0.4080 - val_accuracy: 0.3476 - (lr: 0.0001) Epoch 6/100 438/438 [=====] 135s 287s/step - loss: 0.8099 - accuracy: 0.5072 - val_loss: 0.3284 - val_accuracy: 0.3622 - (lr: 0.0001) Epoch 7/100 438/438 [=====] 135s 287s/step - loss: 0.8040 - accuracy: 0.5036 - val_loss: 0.3265 - val_accuracy: 0.3564 - (lr: 0.0001) Epoch 8/100 438/438 [=====] 135s 287s/step - loss: 0.8070 - accuracy: 0.5070 - val_loss: 0.4074 - val_accuracy: 0.3752 - (lr: 0.0001) Epoch 9/100 438/438 [=====] 135s 287s/step - loss: 0.8020 - accuracy: 0.5080 - val_loss: 0.4074 - val_accuracy: 0.3752 - (lr: 0.0001) Epoch 10/100 438/438 [=====] 135s 287s/step - loss: 0.8027 - accuracy: 0.5080 - val_loss: 0.3668 - val_accuracy: 0.3812 - (lr: 0.0001)</pre>

10ADVANTAGES:

- In order to interact with others, it presents a new and improved interface for persons with disabilities.
- It introduces a new technique to solve new problems.
- Implement of AI improves work efficiency so reduce the duration of time to accomplish a task in comparison to humans.
- Increasing accessibility,
- Low Cost.

11 DISADVANTAGES:

- CNN do not encode the position and orientation of object.
- Lack of ability to be spatially invariant to the input data.
- Lots of training data is required.
- Accuracy of system may vary depending upon light intensity changes.
- Also, accuracy depends upon distance between camera and object.

12.CONCLUSION

The proposed communication system between Deaf and Dumb people and ordinary people are aiming for it when bridging the communication gap between two societies. Several work is done earlier in this area, but this paper adds in complete two - sided communication in an efficient manner because the system is implemented as an AI software. So, it really serves its needs in all aspects. The above strategies prove to be efficient In terms of time and accuracy. Further improvements can be done in the implementation of the communicator with other sign language such as American Sign Language, Accent recognition for different accents throughout Globe, recognition of emotions in sign language and language Translation.

13.FUTURE SCOPE

- Proposed systems scope is related with education of deaf and dumb peoples. These people face many problems when normal person could not understand their language. They were facing communication gap with normal peoples.
- For communication of a deaf and dumb person with a second person, a mediator is required to translate sign language of person. But a mediator is required to know the sign language used by deaf and dumb person. But this is not always possible since there are multiple sign languages for multiple languages. So, to understand all sign languages, Hand gestures of deaf and dumb peoples by normal peoples this system is proposed. System gives output in the form of text.

14.APPENDIX

SourceCode : [Click Here](#)

GitHub Link : [click here](#)

Project Demo Link: [Click Here](#)