Real-Time Communication System Powered by AI for Specially Abled

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1. INTRODUCTION

1.1 Project 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 method of communication.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

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. Implementing predictive model technology to automatically classify Sign Language symbols can be used to create a form of real-time captioning for virtual conferences like Zoom meetings and other such things. This would greatly increase access of such services to those with hearing impairments as it would go hand-in-hand with voice-based captioning, creating a two-way communication system online for people with hearing issues.

2. LITERATURE SURVEY

JOURNAL	AUTHOR	DATE	DESCRIPTION	ADVANTANGES	DISADVANTAGES
Artificial Intelligence enabled virtualsixth sense application forthe disabled	Aditya Sharma , Aditya Vats ,Shiv Shankar Dash and Surinder Kaur.	Januar y2020	Object tracking, recognition & classification, and character recognition in offlinemode and guarded the app to shrink thesize of the app	It provided a one-stop-shop solution toall the sections of differently-abled people. Integration has provided a seamless User interface/experience for the initial setup	Lack of Higher accuracy of the implementation through the use of custom models for object detection
Integrating Artificial ntelligence nternet of hing 5G for NextGeneration martgrid:A SSurve Tren dhallenges and Pr ospect	Ebenezer Esenogho, Karim Djouani And Anish MKurien	Januar y6, 2022	Future Grid that leverage disruptive technologies like AI, IoT and 5G for robustreliability, security, resilience, and overall system performance.	Enhance the transition of several integrated solutionsfrom blockchain to Internet Of Things , and 5G.	System is not truly smart or intelligent without the infusion ofAI/ML strategies
D-Talk: Sign Language Recognition System for People with Disability using Machine Learning and	Rayan Mohammed Shleh , Reem Arahim Al Beeshr Muhammad Shman Tariq	Septe mber 2020	D- talk use machine learning model accuracy in figuring out which model is best at distinguishing connections	Different sign languageeandards exist, their at aset and the user cho which sign language to read.	The code is dependingon skin color and contour to find the right sign. developers narrow the tasks to only one task which is browse websites only

Image Processing					
Edge Artificial Intelligence for 6G: Vision, Enabling Technologies, and Applications	Khaled B. Letaief , Yuanming Shi , JianminLu, and Jianhua Lu.	1, Januar y2022	Key wireless communication techniques, effectiveresource management approaches and holistic network architectures to design scalable and trustworthy edge AI systems.	Embedding low-power, low-latency,reliable, and trustworthy intelligence into thenetwork edge is an inevitable trend anddisruptive shift in both academia and industry.	Lack of Multidisciplinary spanning wireless communication machine learning operation research domain applications, regulations and ethics.
Guest Editorial Special Issue onArtificial Intelligence andMachine Learning for Networking and Communications	Prosper Chemouil, Pan Hui, Wolfgang Kellerer,YongLi, Rolf Stadler, Dacheng Tao, Yonggang Wen, and Ying Zhang,	6, June 2019	AI-based radio propagation technologies in the integration of sensing and communications, how to control propagation signals using reconfigurable intelligent surfaces with AI support	Channel sparsity inhigh-frequency propagation well considered during the AI network design.	Lack of many concrete proposals on AI-based channel parameter estimation and characterization

3.1 Existing Problem

Depending on the deaf person's level of hearing loss, they may be able to communicate with a blind person who is using speech. For example, a deaf person may have enough residual hearing (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 effective form 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)

3.2 References

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

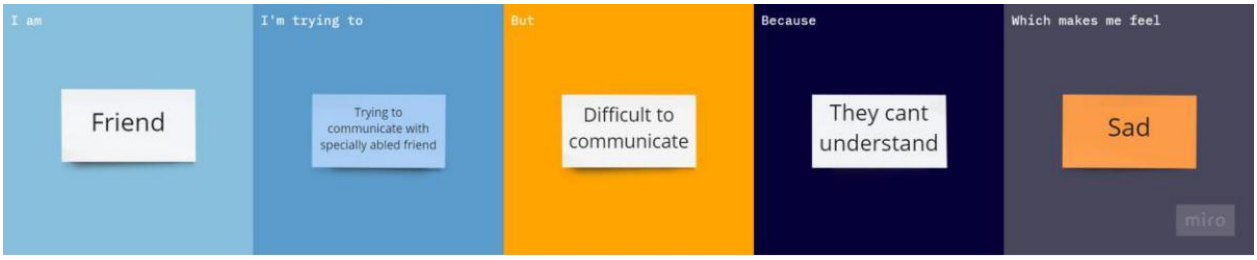
2. Dataset: https://drive.google.com/file/d/1ITbDvhLwyTTkuUYfNjOKhcIZh7hDgi64/view?usp=sharing

3. CNN using Tensorflow: https://www.youtube.com/watch?v=umGJ30-15_A

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

2.3 Problem Statement Definition

Problem Statement 1

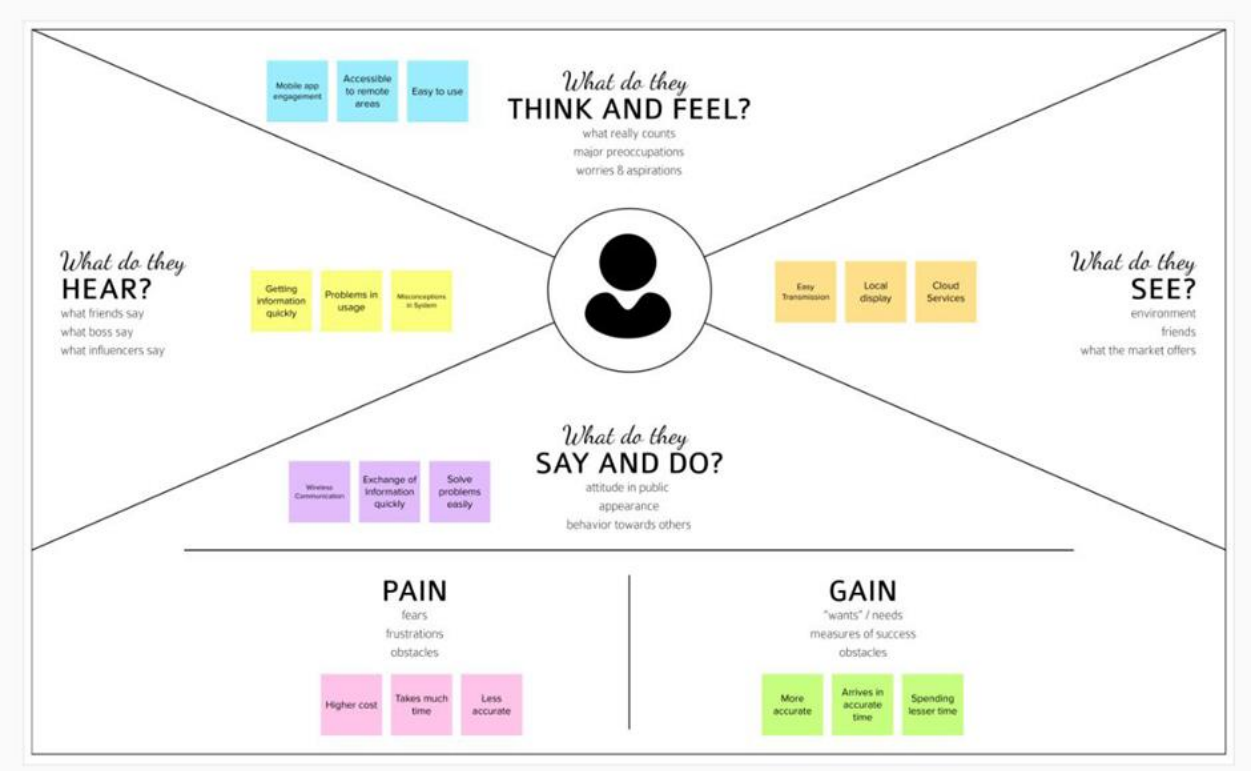


Problem Statement 2

Problem Statement 3

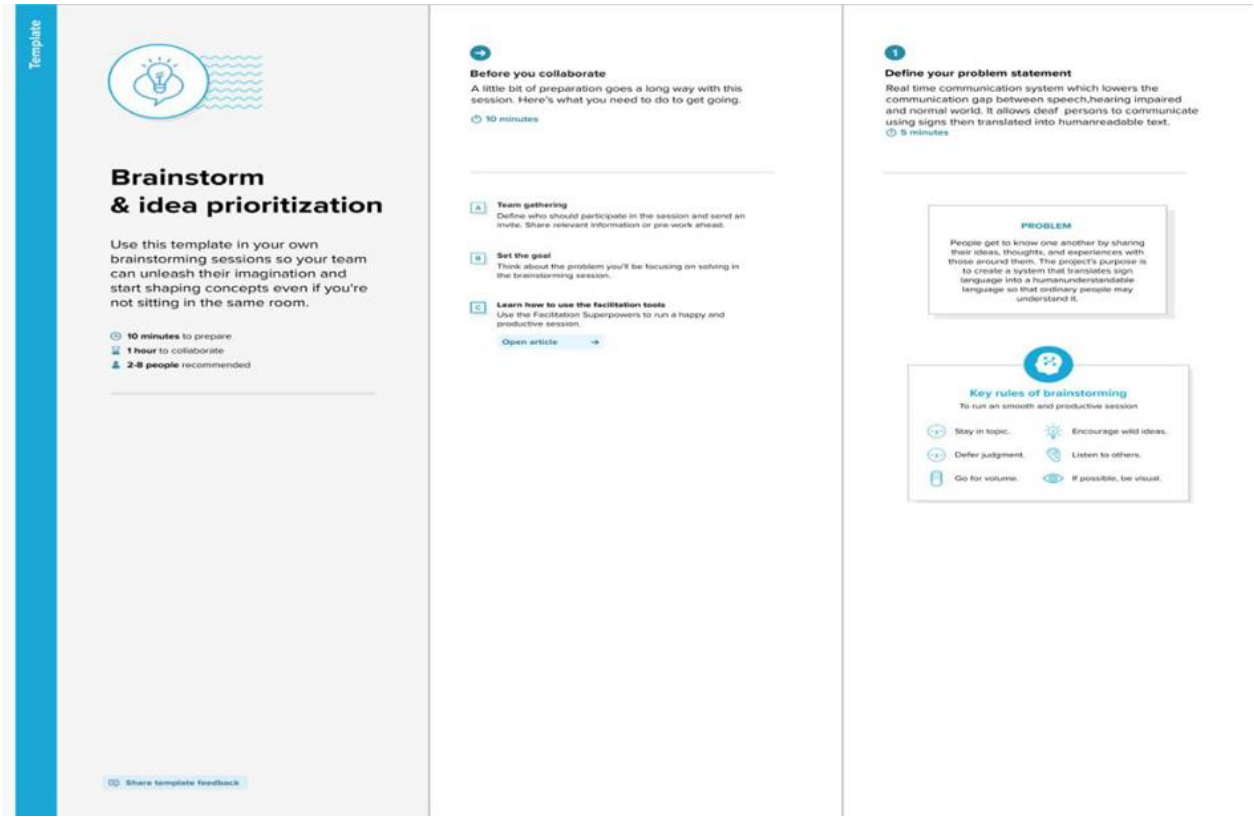
3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

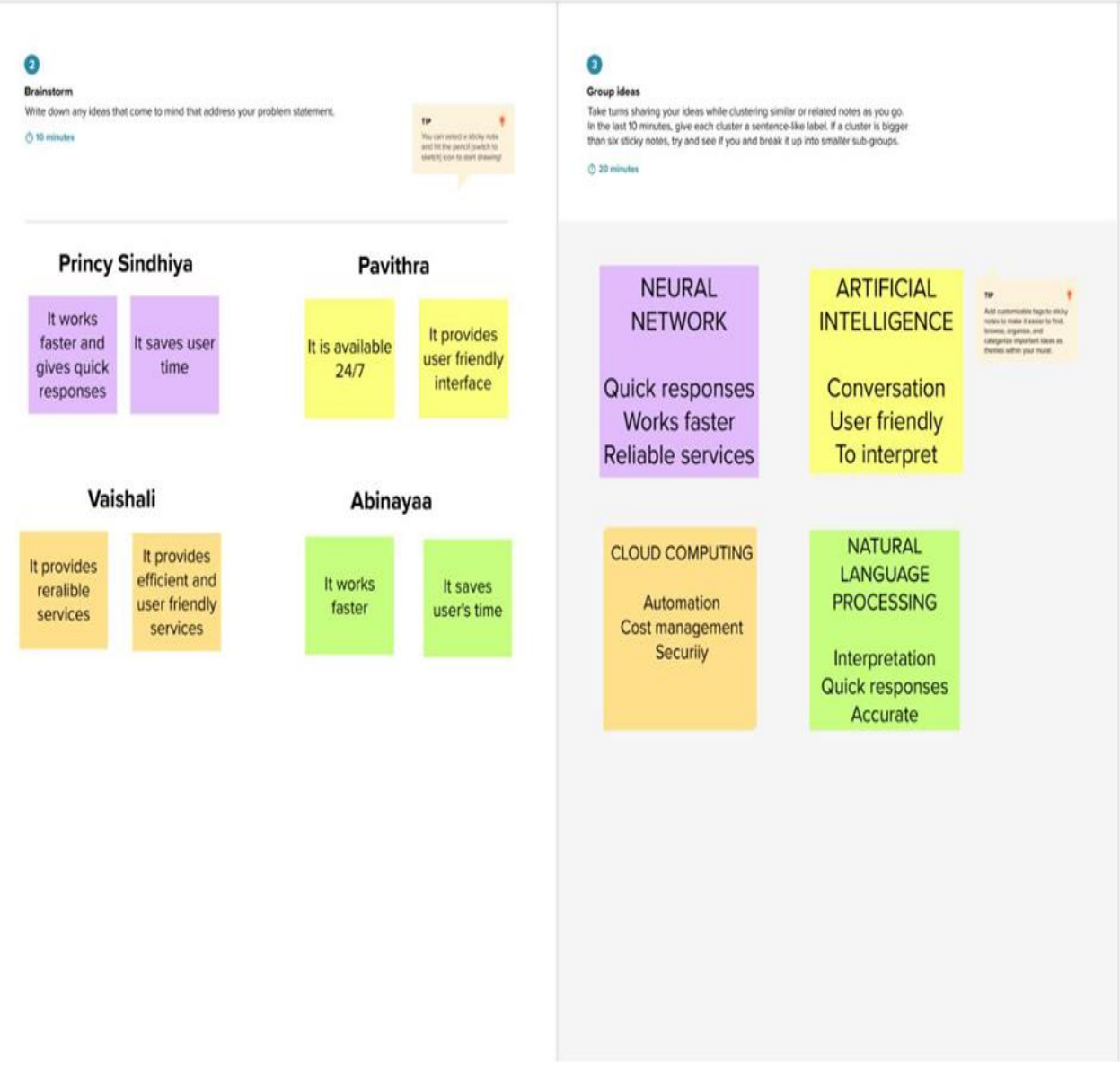


3.2 Ideation and Brainstorming

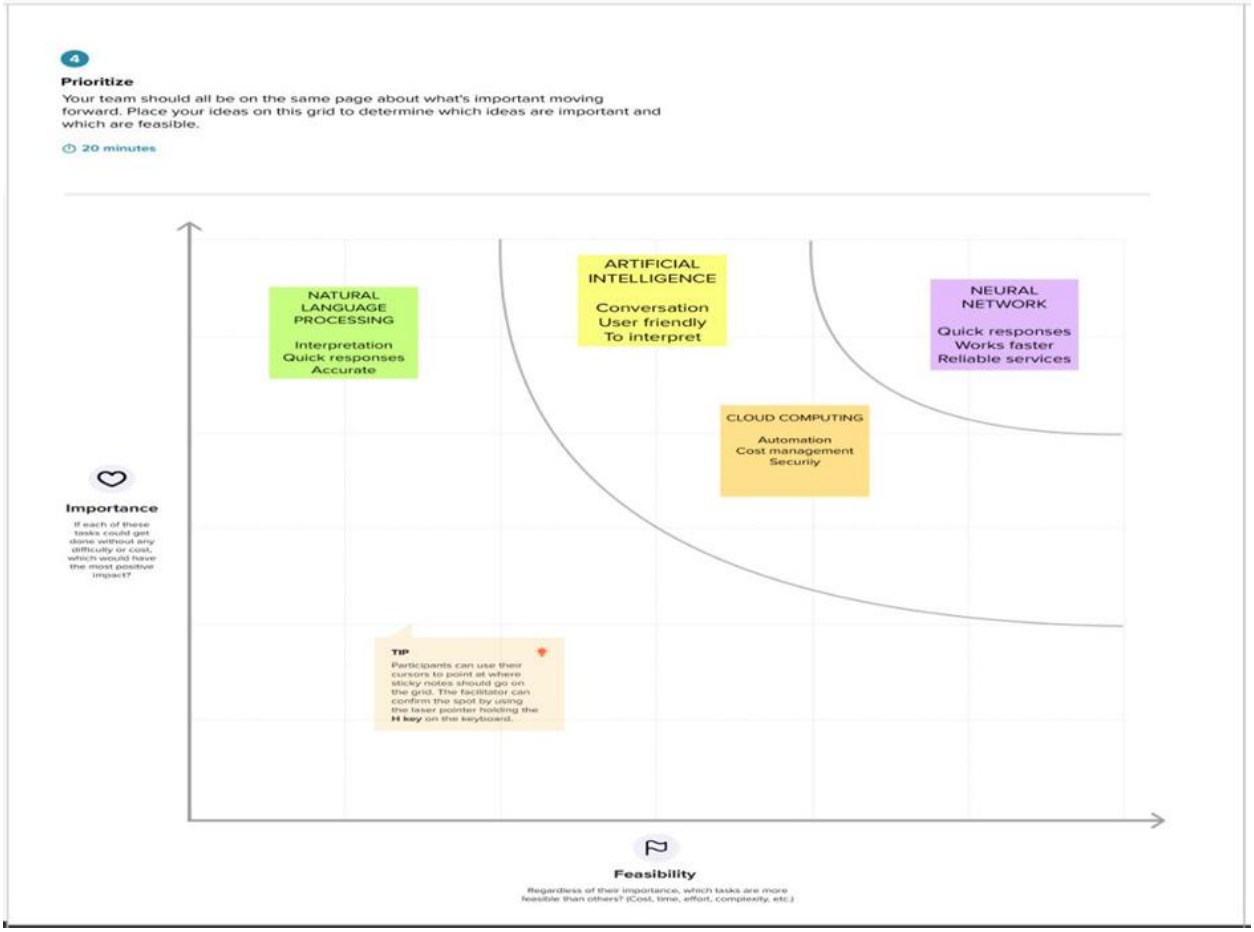
Step 1 : Team Gathering , Collaboration



Step 2 : Brainstorm idea listing and Grouping



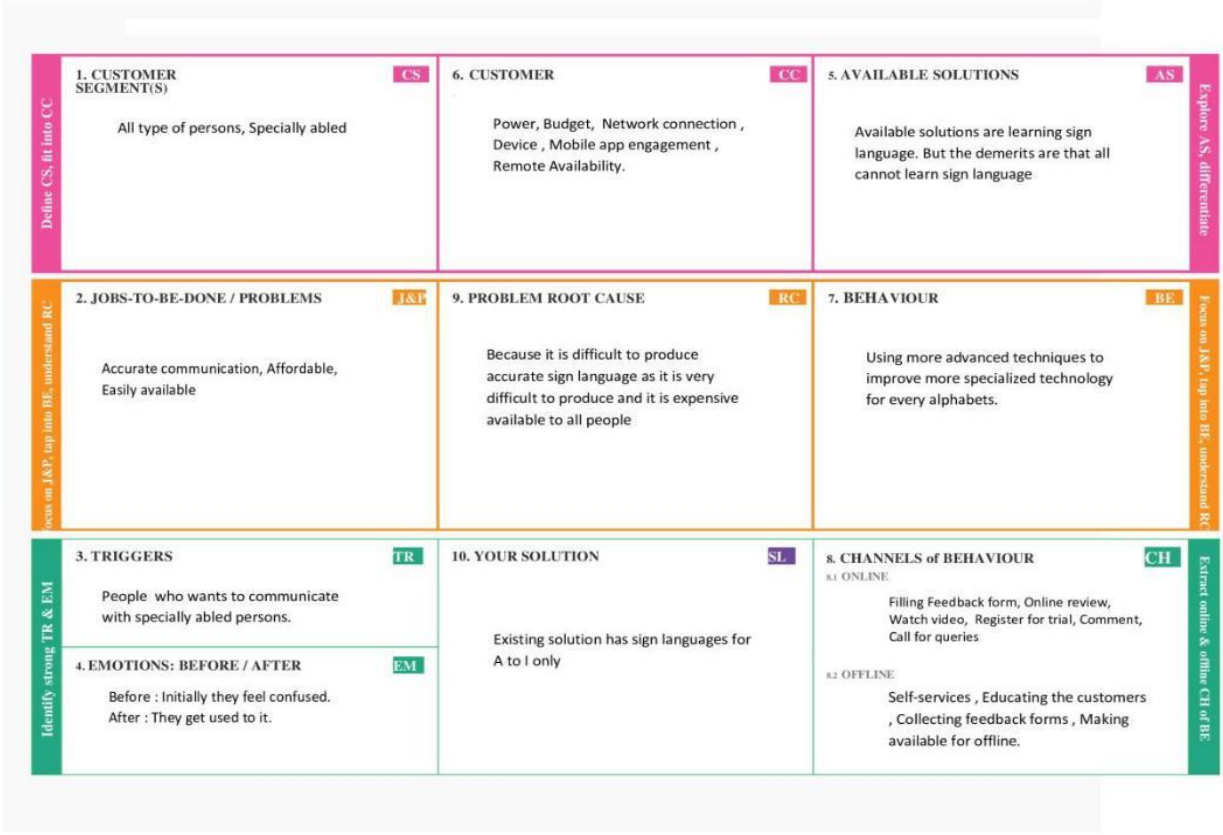
Step 3 : Idea Prioritization



3.3 Proposed Solution

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. In such cases, the human hand has remained the preferred method of communicationThe 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. A system that translates sign language into a Human understandable language so that ordinary people may understand it.

3.4 Problem Solution Fit



4. REQUIREMENT ANALYSIS

4.1 Functional Requirements

FR No.	Functional Requirement (EPIC)	Sub Requirement (Story / Sub Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Uploading Image	Upload image through camera Upload image through gallery
FR-4	Text to Speech	Select speech icon to convert the respective text for sign language
FR-5	Whiteboard	Use whiteboard to share the message by drawing
FR-6	Emergency Templates	Select emergency templates icon to pass the message quickly

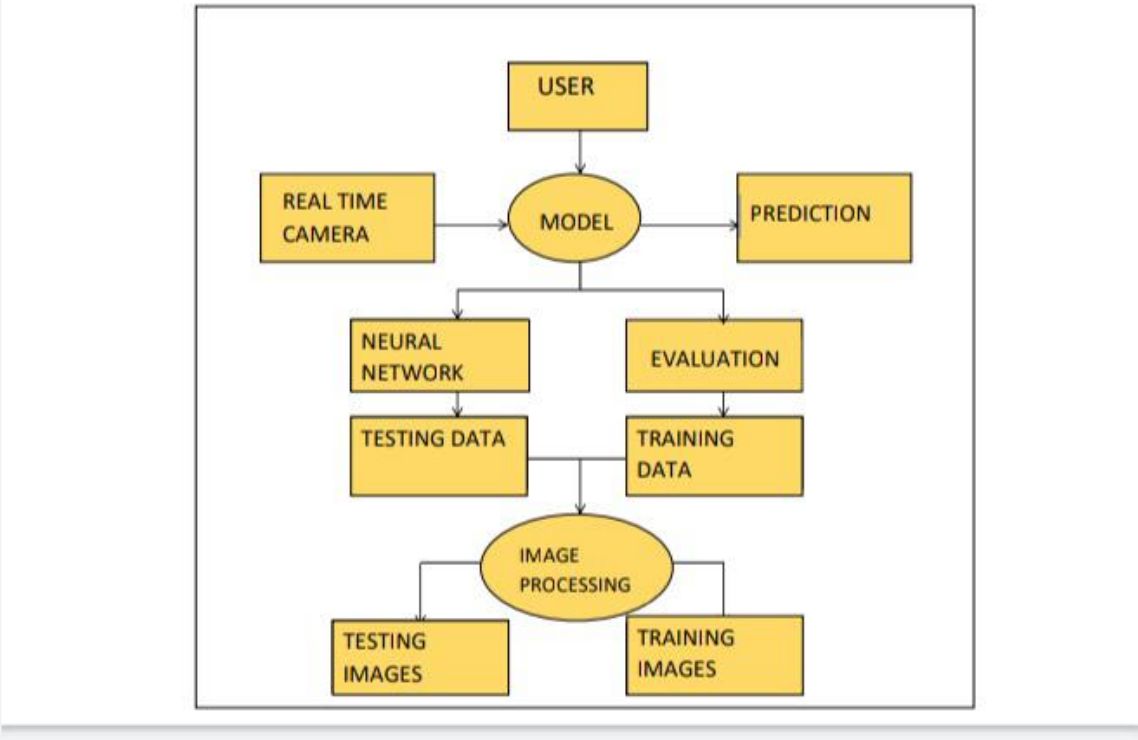
4.2 Non Functional Requirements

FR No	Non-Functional Requirements	Description
NFR-1	Usability	Client can undoubtedly upload the image and this application is planned in a manner here, client can without much of a stretch discover some predefined layouts
NFR-2	Security	Clients should sign in into an app only then proceed for further process.So unapproved access will be kept away from at max.
NFR-3	Reliability	This application has robust adaptation to noncritical failure and regardless of whether an error happens likewise it recuperates rapidly.
NFR-4	Performance	This application will rapidly transfer and process the images since it predicts the gestures through signing utilizing CNN model and it gives high accuracy.

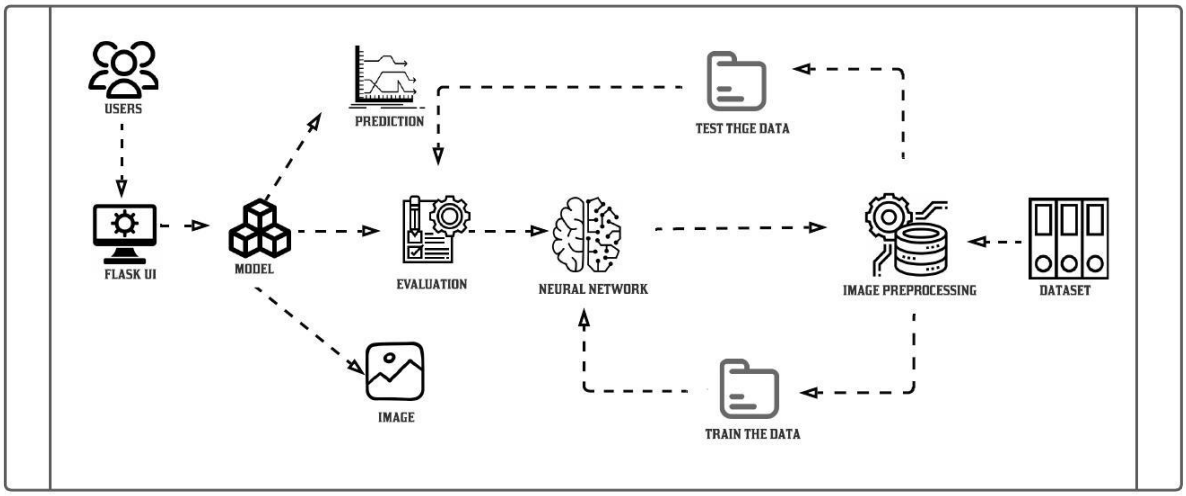
NFR-5	Availability	The predefined formats will be accessible to all clients and furthermore have whiteboard choice. This application is planned such that it is straightforward and accessible to all clients.
NFR-6	Scalability	Engineers can add new form a stand it will build adaptability and this application has premium elements where client approach google maps and google duo.

5. PROJECT DESIGN

5.1 Data Flow Diagrams



5.2 Solution and Technical Architecture



5.3 User Stories

- As an admin , give user Id and provide account to the user.
- As an admin , I can see the dashboard of Account.
- As an admin , I can create a Account for All users.
- As a Co-admin , Manage all accounts and answer the queries of the Customer.
- As a Co-admin , I can see the dashboard of the User.
- As a user, I can register for Application, through Facebook and Gmail.

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning and Estimation

Sprint	Functional Requirement (EPIC)	User Story Number	User Story/ Task	Story Points	Priority
Sprint 1	Dataset Collection	USN - 1	Collect Dataset for building model	9	High
Sprint 2	Image Preprocessing	USN - 2	Perform Preprocessing techniques on the Dataset	8	Medium
Sprint3	Model Building	USN - 3	Import the Required libraries, add the necessary layers and compile the model.	10	High
Sprint 4	Training and Testing the Model	USN - 4	Training the model and testing the model's	7	Medium

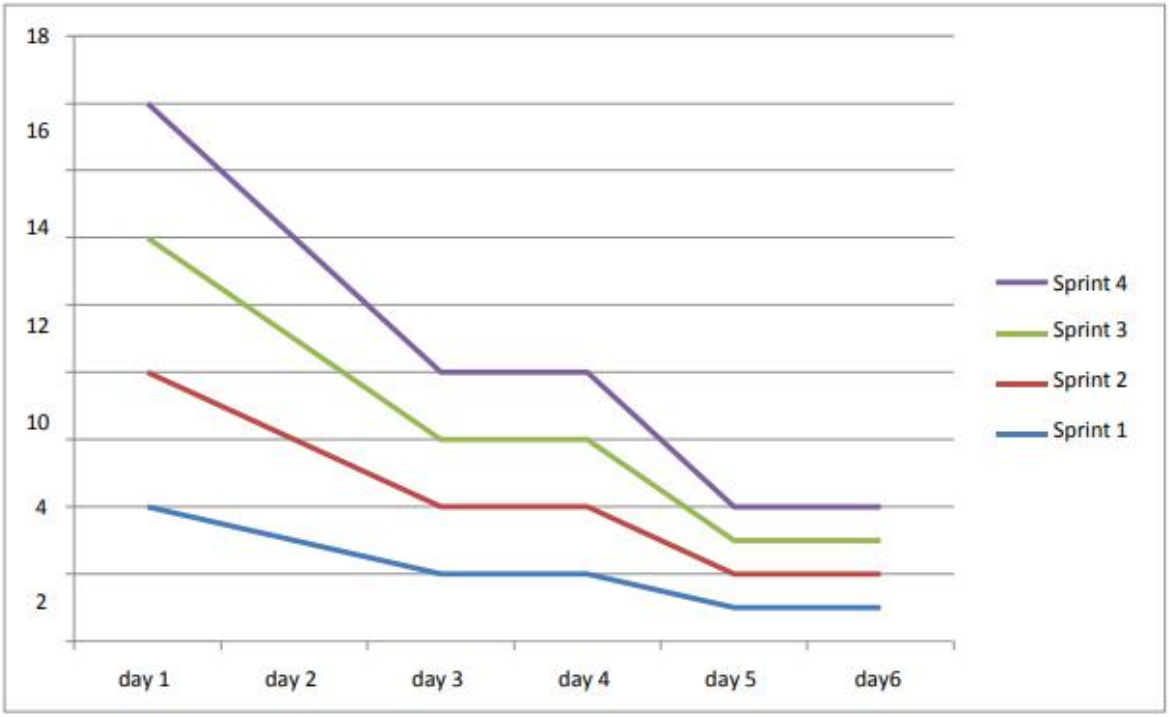
			performance		
Sprint 5	Application Development	USN - 5	Converting the input gesture image into English Alphabets.	9	High

6.2 Sprint Delivery Schedule

Sprint	**Total Story Points**	**Duration**	**Sprint Start Date**	**Sprint End Date**	**Story points Completed (as on Planned End Date)**	**Sprint Release Date (Actual)**
Sprint 1	17	6 Days	24 Oct 2022	29 Oct 2022	17	29 Oct 2022
Sprint 2	17	6 Days	31 Oct 2022	05 Nov 2022	17	05 Nov 2022
Sprint 3	9	6 Days	07 Nov 2022	12 Nov 2022	9	12 Nov 2022
Sprint 4	8	6 Days	14 Nov	19 Nov	8	19 Nov

			2022	2022		2022

Burn down Chart:

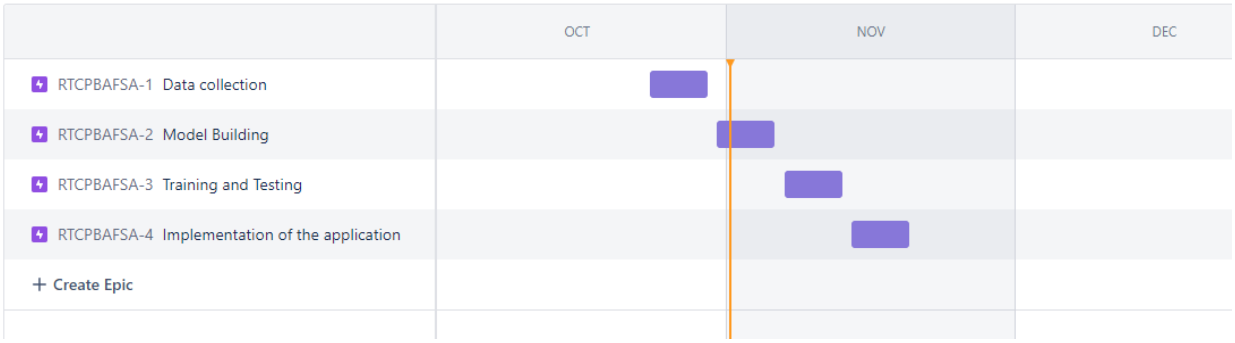


Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

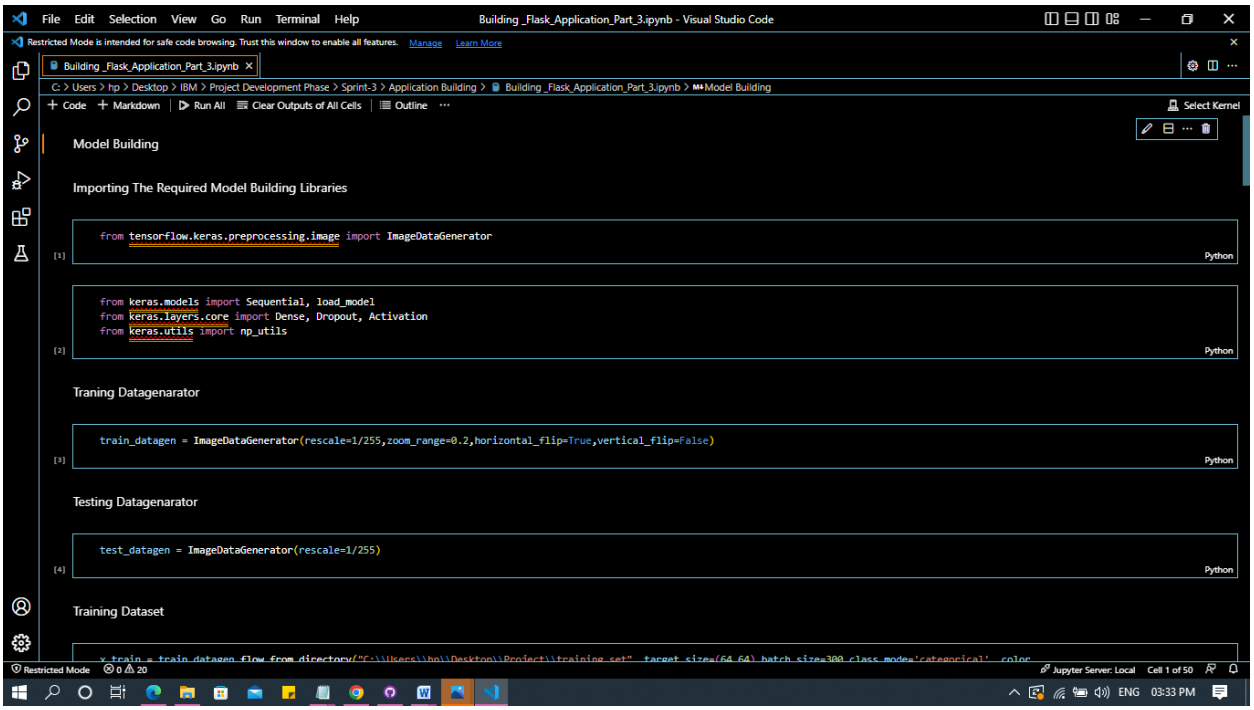
6.3 Reports From JIRA

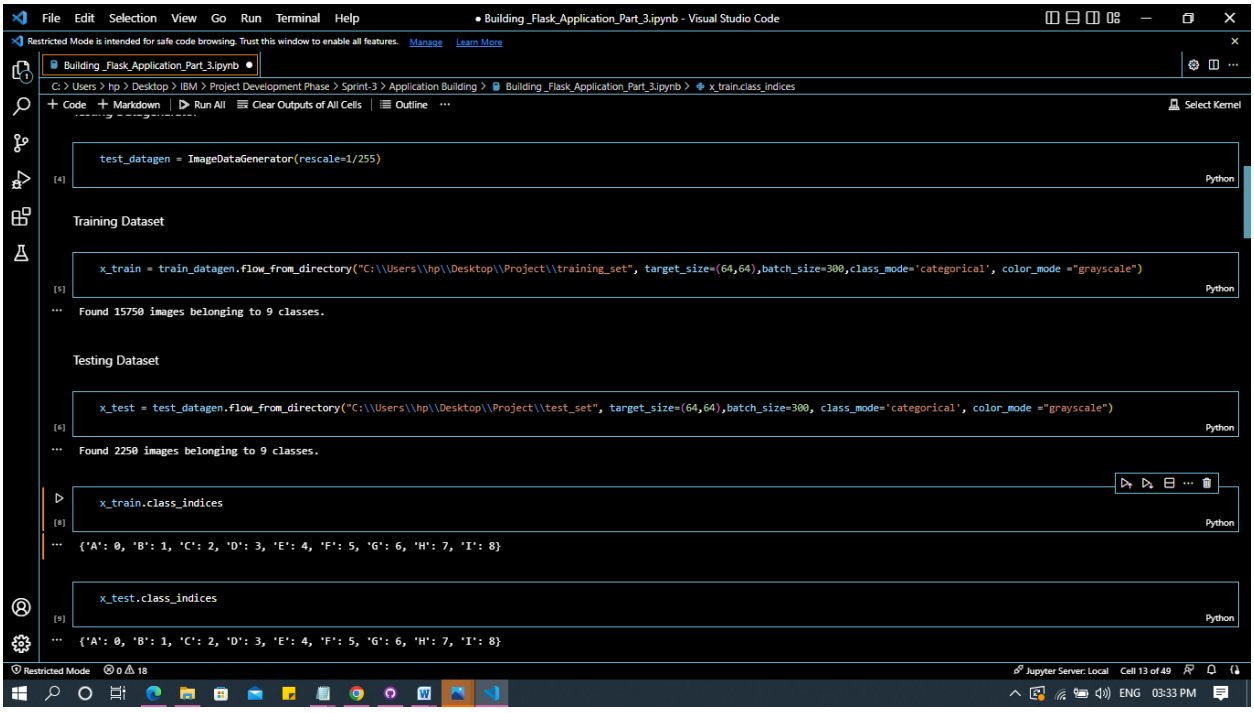


7. CODING & SOLUTIONING

7.1 Feature 1

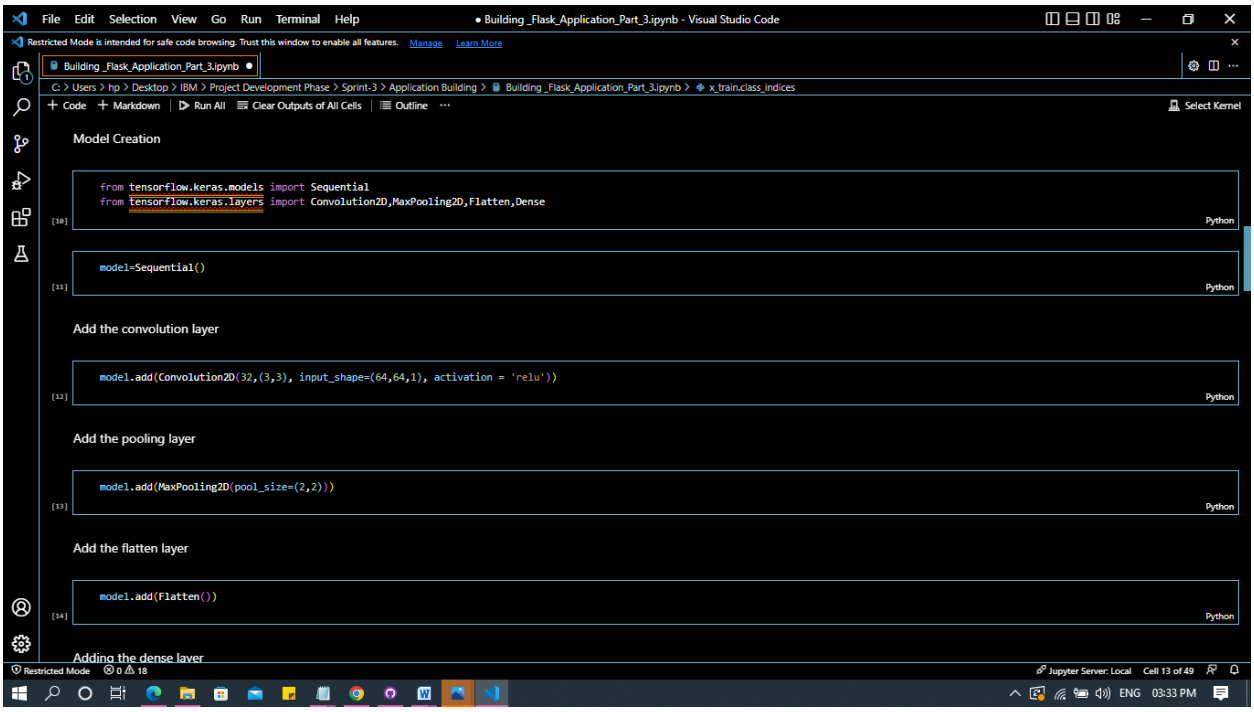
Image Preprocessing

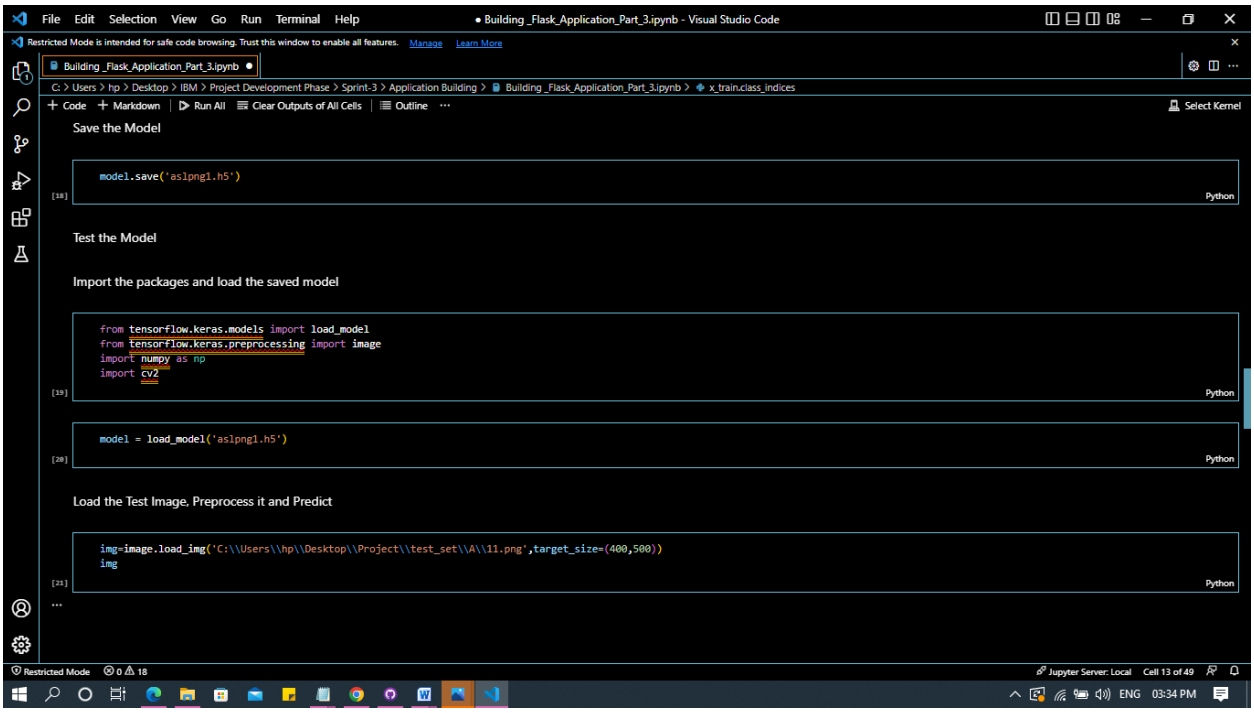




7.2 Feature 2

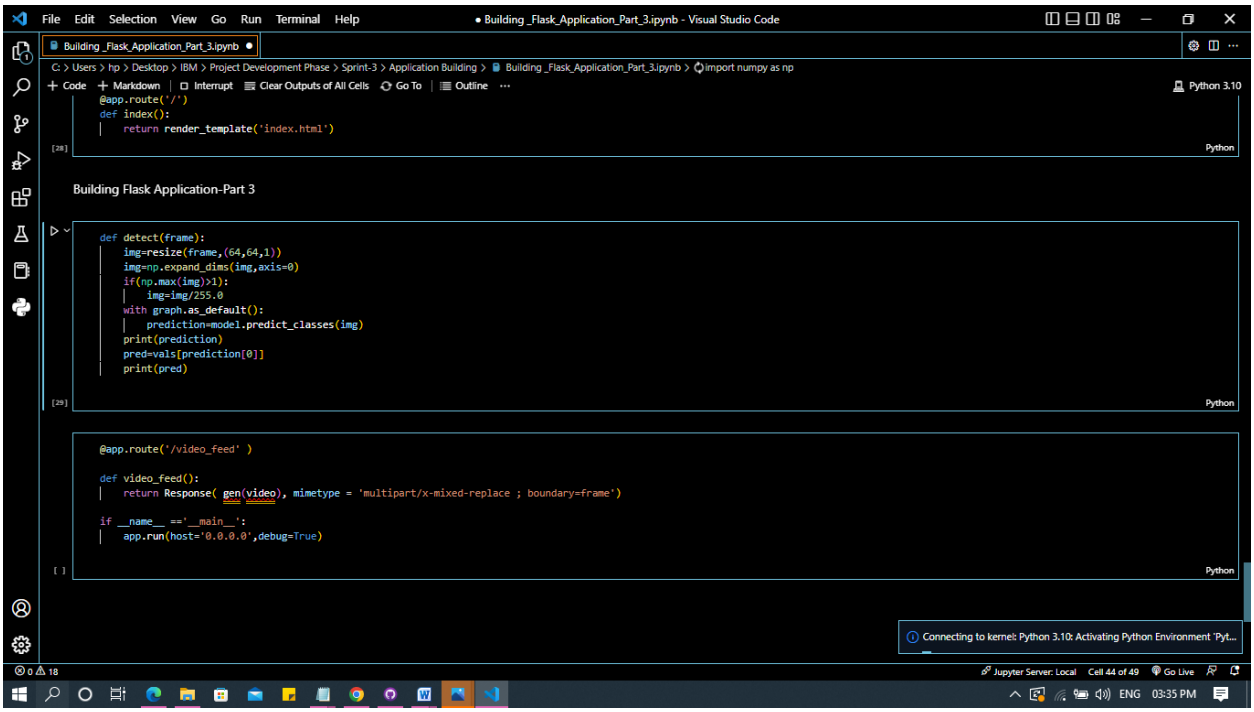
Model Building





7.3 Feature 3

Application Building



8. TESTING

8.1 Performance Testing

S.No	Parameter	Values
1	Model Summary	Value for Model Summary is 90
2	Accuracy	Training Accuracy -80 Validation Accuracy - 88

8.2 User Acceptance Testing Sprint

1. Purpose of Document

The project's purpose shows the number of resolved or closed bugs at each severity level, and how they were resolved , the number of test cases that have passed, failed, and untested

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By design	5	4	2	0	11
External	2	3	7	1	13
Fixed	4	4	2	1	11
Not Reproduced	0	3	1	0	4
Skipped	0	0	1	1	2
Won't Fix	0	2	2	1	5
Totals	11	16	15	4	92

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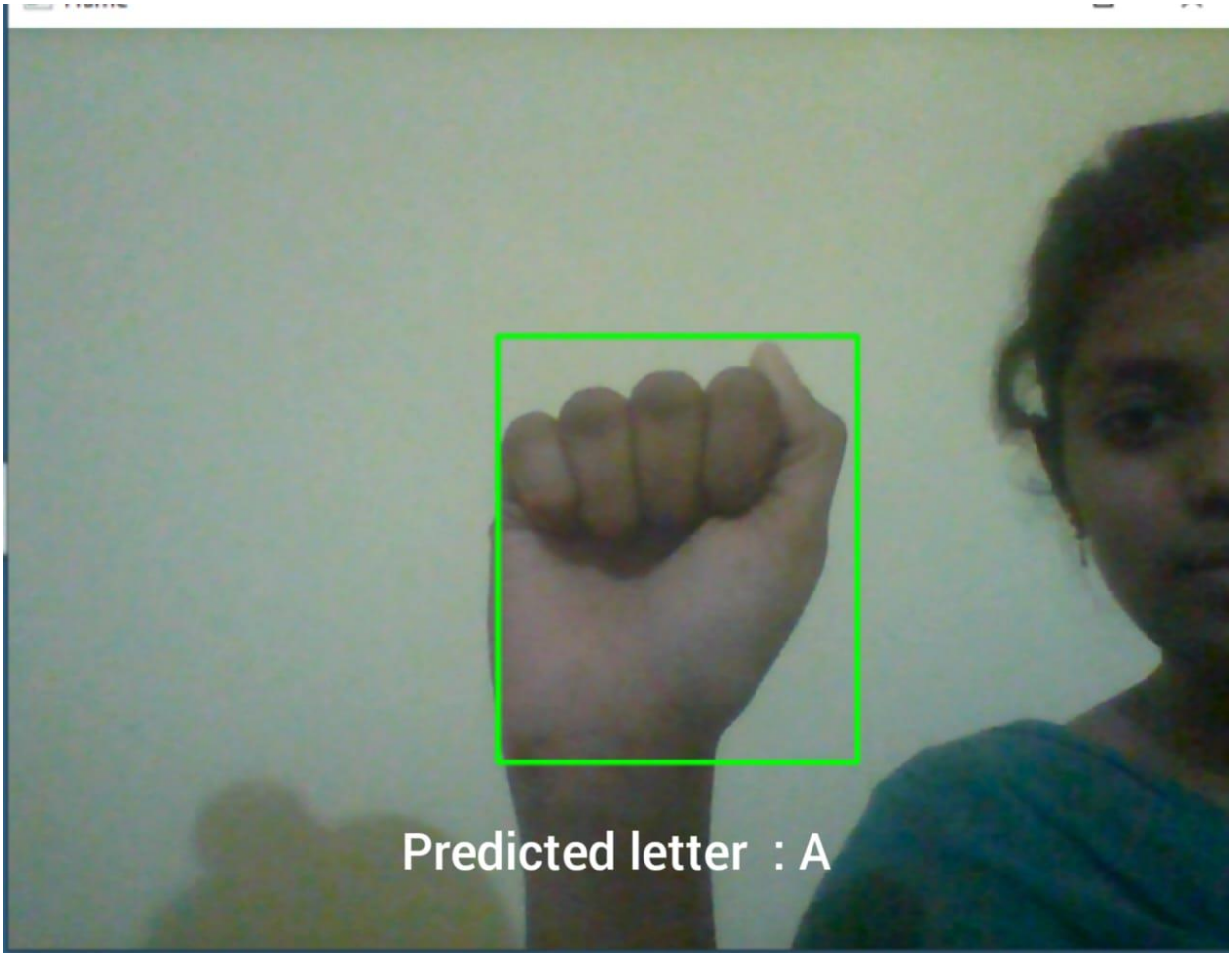
2 Defect Analysis

This report shows the number of resolved or closed bugs at each severity Level how they were resolved

Section	Total Cases	Not Tested	Fall	Pass
Print Engine	4	0	1	3
Client App	30	0	2	28
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	7	0	2	5
Final Reporting Output	4	0	0	4
Version Control	2	0	0	2

9. RESULT




```
1/1 [==============================] - 0s 10ms/step
Predicted Character 1:  A
Confidence 1:  50.203394889831 54
```

9.1 Performance Metrices

Confusion matrix and classification report

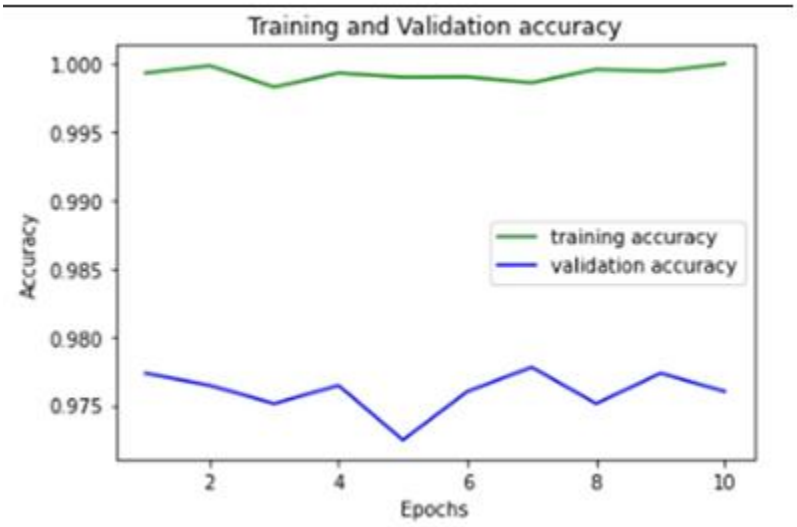
```
Confusion Matrix
[[38 31 33 26 29 22 31 19 21]
 [31 28 25 27 26 26 33 26 28]
 [22 18 28 34 30 36 33 21 28]
 [32 21 23 34 30 24 42 22 22]
 [29 23 29 18 25 30 32 30 34]
 [20 29 27 26 32 25 32 22 37]
 [27 30 26 32 21 31 33 26 24]
 [26 41 25 26 24 26 30 25 27]
 [25 29 33 28 33 30 29 14 29]]

Classification Report
              precision    recall  f1-score   support

           A       0.15      0.15      0.15       250
           B       0.11      0.11      0.11       250
           C       0.11      0.11      0.11       250
           D       0.14      0.14      0.14       250
           E       0.10      0.10      0.10       250
           F       0.10      0.10      0.10       250
           G       0.11      0.13      0.12       250
           H       0.12      0.10      0.11       250
           I       0.12      0.12      0.12       250

    accuracy                           0.12      2250
   macro avg       0.12      0.12      0.12      2250
weighted avg       0.12      0.12      0.12      2250
```

Accuracy



10. ADVANTAGES & DISADVANTAGES

Advantages:

1. It provided a one stop-shop solution to all the sections of differently-abled people
2. Enhance the transition of several integrated solutions from blockchain to Internet Of Things , and 5G.

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Disadvantages:

1. Lack of Higher accuracy of the implementation through the use of custom models for object detection
2. System is not truly smart or intelligent without the infusion of AI/ML strategies
3. The code is depending on skin color and contour to find the right sign.

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 gap between 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 deaf and dumb. With the 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

- GitHub : https://github.com/IBM-EPBL/IBM-Project-43496-1660717417

- Project Demo: https://www.veed.io/view/f7d04977-014b-44af-b613-fbbd9295693b?sharingWidget=true&panel=share