Real-Time Communication System Powered by AI for Specially Abled

Done By

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Contributed by

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1. INTRODUCTION

1.1. PROJECT OVERVIEW

By sharing ideas, thoughts, and experiences with others, people get to know one another. There are many ways to accomplish this, but one of the finest is through the gift of "Speech." Through speech, everyone can effectively communicate their thoughts and understand each other. It would be unjust to overlook those who are denied this precious gift: the deaf and dumb. As a result, human hands remain the preferred means of communication in such cases.

1.2. PURPOSE

This project seeks to translate sign language into a language that ordinary people can understand, thereby making it accessible to all.

2. LITERATURE SURVEY

2.1. EXISTING PROBLEM

1. Face based Real Time communication for disable people. It has automated real time behaviour monitoring.
2. Communication learning user interface model for children with autism with goal directed design method.

Existing solutions to solving this problem include:

TECHNOLOGY:

Communicating via technology, such as a smartphone or laptop, is one of the easiest ways to do so. People with hearing disabilities can type their messages, and those with low vision and blindness can use a screen reader to read them aloud. People who are blind can also use voice recognition software to convert their speech into text so people who are deaf can read it.

INTERPRETER:

If a sign language interpreter is available, communication is simplified if the person who is deaf is fluent in sign language. An interpreter connects blind and deaf persons. The deaf person can communicate through sign language, and the interpreter can translate what is spoken to the visually impaired individual. The interpreter may then convert anything said by the blind individual into deafening sign language.

SPEAKING:

Depending on the amount of hearing loss, a deaf individual may be able to interact with a blind person via speech. For example, a deaf person may have enough residual hearing (with or without the assistance of an assistive hearing device such as a hearing aid) to understand the speech of a blind or poor vision person. However, this is not always the most successful mode of communication because it is highly reliant on both people's specific situations and their surroundings (for example, some places may have too much background noise).

2.2. REFERENCES

- Image Processing: https://keras.io/api/preprocessing/image/
- Model Building: https://youtu.be/umGJ30-15_A
- OpenCV: https://www.youtube.com/watch?v=mjKd1Tzl70I
- Flask App: https://www.youtube.com/watch?v=lj4I_CvBnt0
- IBM cloud account registration: https://www.youtube.com/watch?v=4y_zD-0Q3F8&feature=emb_imp_woyt
- CNN deployment: https://www.youtube.com/watch?v=BzouqMGJ41k

TITLE	AUTHORS	DESCRIPTION	ADVANTAGES	DISADVANTGES
DIABETES MONITORING PATCH FOR VISUALLY IMPAIRED PERSONS USING ARTIFICIAL INTELLIGENCE **YEAR:** JANUARY 2021	GOPIRAJAN PV, SHOBANA MAHALINGAM, MANICKAM M, REVATHI A.	PATCH USES AN AI ALGORITHM FOR ANALYZING DATA WHICH IS COLLECTED FROM THE BODY BY USING BIOSENSORS. PATCH COMPOSED OF GLUCOSE,TEMPERATURE, ULTRASONIC GPS SENSOR , BUZZER. HEARING LOUD SOUND OF BUZZER THE VISUALLY IMPAIRED PERSON CAN DECIDE IF ANALYZED RESULT IS ABNORMAL.	AUTOMATED RETENIAL SCREENING, PATIENT SELF MANAGEMENT TOOLS	HUMAN FACTORS, LIMITATION OF DESIGN
LOCATING RESTROOM FOR SPECIALLY ABLED PEOPLE USING AI AND MACHINE LEARNING **YEAR:** OCTOBER 2021	PRAGATI RAIZADA, SHAGUN SABOO, SRISHTI GUPTA,	APP DESIGNED WITH ASSISTANCE OF AI AND MACHINE LEARNING, VOICE RECOGNITION, MAPS LIVE, SIGN LANGUAGE INTERPRETATION. OVERALL PURPOSE IS TO LOCATE RESTROOMS AND KEEP HYGIENE IN CONSIDER FOR THOSE WHO ARE SPECIALLY ABLED.	USEFUL FOR SPECIALLY ABLED PERSON WHO ARE VISUALLY IMPAIRED TO LOCATE RESTROOM.	DUE TO LIMITATION OF DATA OR DESIGN THE VOICE RECOGNITION TO GUIDE PEOPLE TO LOCATE IS AN SERIOUS ISSUE.
COMMUNICA-TION LEARNING USER INTERFACE MODEL FOR CHILDREN WITH AUTISM WITH GOAL DIRECTED DESIGN METHOD **YEAR:** JULY 2019	FITRILIA SUSANTI, DANANG JUNAEDI, VERONIKHA EFFENDY	CHILDREN WITH AUTISM HAVE COMMUNICATION DISORDER THAT AFFECTS THE CHILDREN FACE DIFFICULTY INTERACTING & COMMUNICATING WITH THEIR ENVIRONMENT BOTH VERBALLY & NON VERBALLY.	IT PRODUCE A USER INTERFACE MODEL BASED ON ORGANIZATION GOAL AND GOAL OF AUTISTIC CHILDREN.	USER HAS TO WAIT 30 SECONDS TO LEARN ONE THING. DUE TO THIS CHILDREN WILL DISPLAY AUTISTIC ACTIVITIES BECAUSE THEY ARE BORED AND IMPATIENT.
FACE BASED REAL TIME COMMUNICATI--ON FOR SPEECH DISABLE PEOPLE **YEAR:** JANUARY 2011	ONG CHIN ANN, BEE THENG LAU, MARLENE LU.	TO ENHANCE COMMUNICATION OF DIABLED COMMUNITY. IT HAS AUTOMATED REAL TIME BEHAVIOUR MONITORING, DESIGNED AND IMPLEMENTED WITH UBIQUITOUS.	TO ASSIST PEOPLE IN COMMUNICATI--ON NEEDS, THEY IMPROVED REAL TIME BEHAVIOUR MONITORING APP.	IN THIS MODEL IT STILL FAILED TO DETECT HUMAN FACE IF BACKLIGHT IS TOO STRONG.

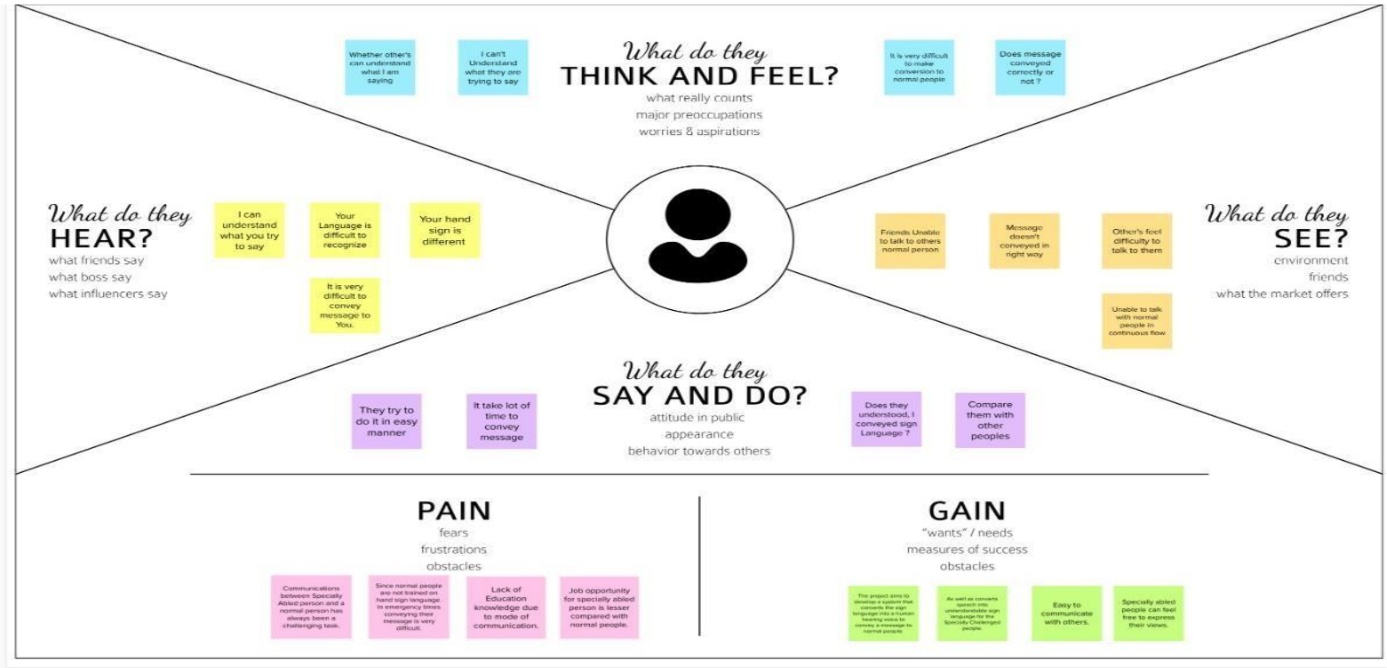
2.3. PROBLEM STATEMENT DEFINITION

This paper describes the system that overcomes the problem faced by the speech and hearing impaired. The objectives of the research are as follow:

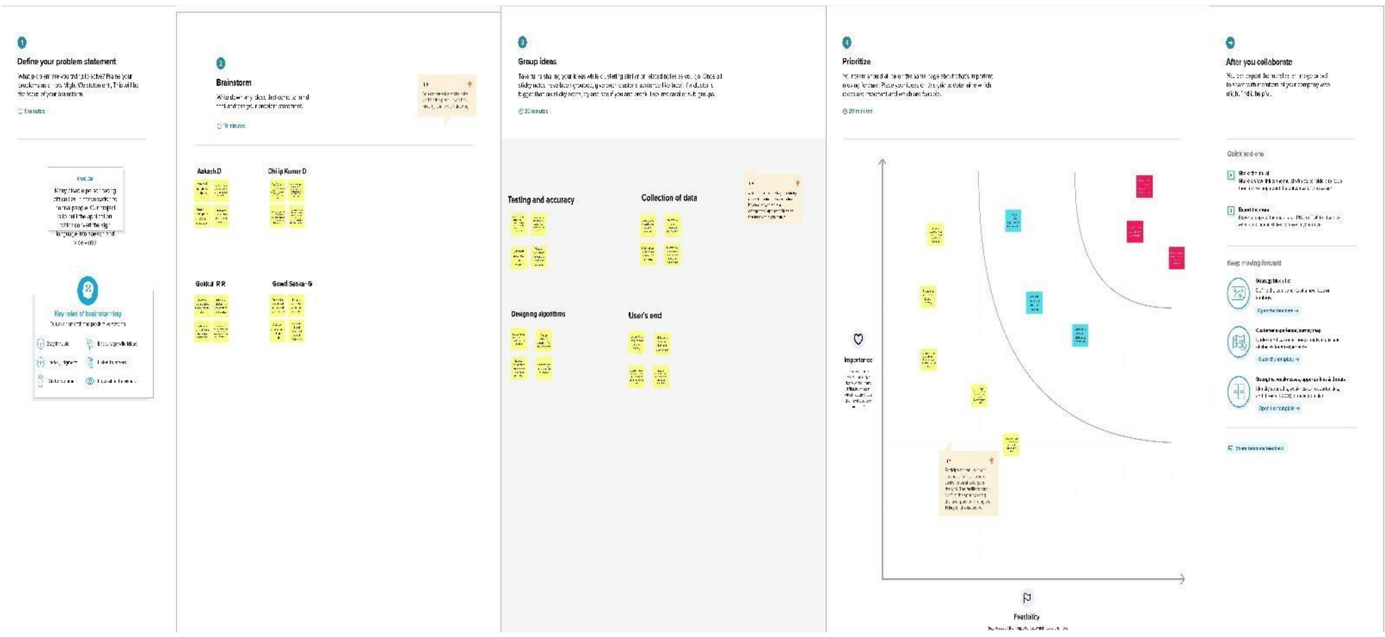
1. To design and develop a communication system that bridges the communication gap between speech-hearing impaired and other people.
2. A convolution neural network is used to train the model on a variety of hand gestures. We apply this paradigm to the creation of an app. Through this application, deaf and hard-of-hearing people may communicate using sign language, which is then converted into text that other people can understand.

3. IDEATION & PROPOSED SOLUTION

3.1. EMPATHY MAP CANVAS



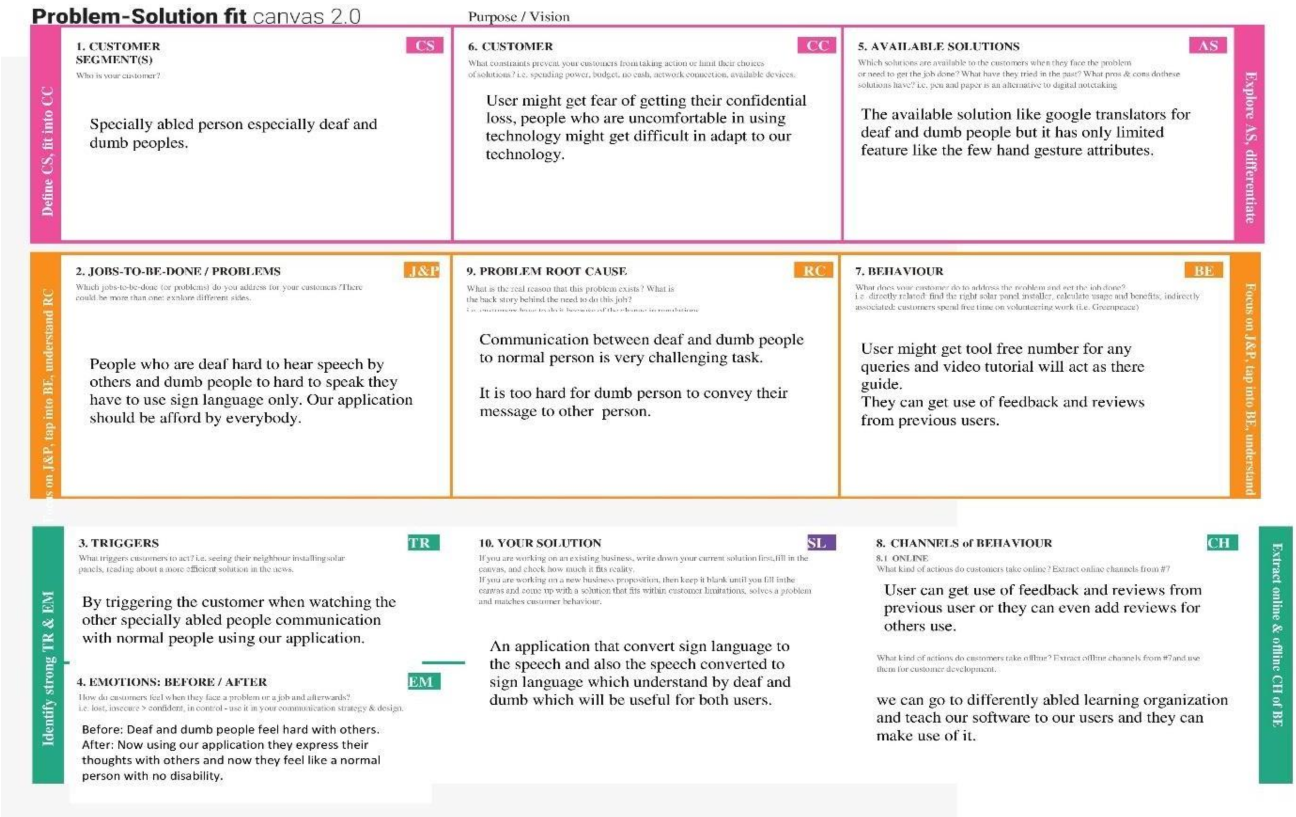
3.2. IDEATION & BRAINSTORMING



3.3. PROPOSED SOLUTION

1. Sign language is converted into the voice heard by normal people using this application.
2. Also, the speech is converted into sign language that can be understood by deaf and dumb individuals.
3. We use convolution neural networks (CNNs) to build and train our app.

3.4. PROBLEM SOLUTION FIT



4. REQUIREMENT ANALYSIS

4.1. FUNCTIONAL REQUIREMENT

1. **User Registration**
2. **User confirmation**
3. **Update profile**
4. **User Authentication**
5. **Report**

HARDWARE REQUIREMENTS:

Operating System	Windows, Mac, Linux
CPU (for training)	Multi Core Processors (i3 or above/equivalent)
GPU (for training)	NVIDIA AI Capable / Google's TPU
Webcam	Integrated or External with FullHD Support

SOFTWARE REQUIREMENTS:

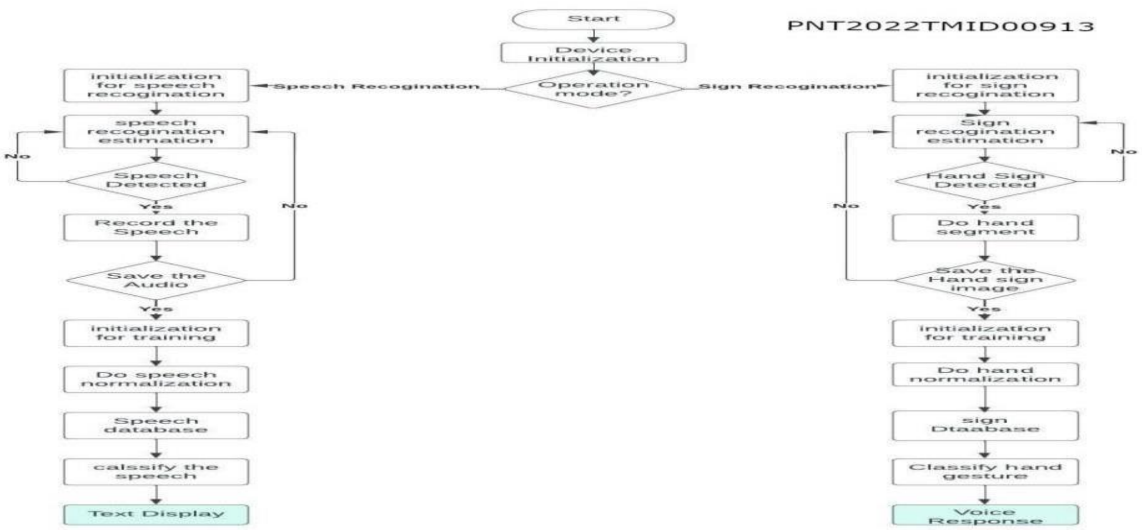
Python	v3.9.0 or above
Python Packages	flask, TensorFlow, OpenCV-python, keras, NumPy, pandas, virtualenv, pillow
Web Browser	Mozilla Firefox, Google Chrome or any modern web browser
IBM Cloud (for training)	Watson Studio - Model Training & Deployment as Machine Learning Instance

4.2. NON-FUNCTIONAL REQUIREMENT

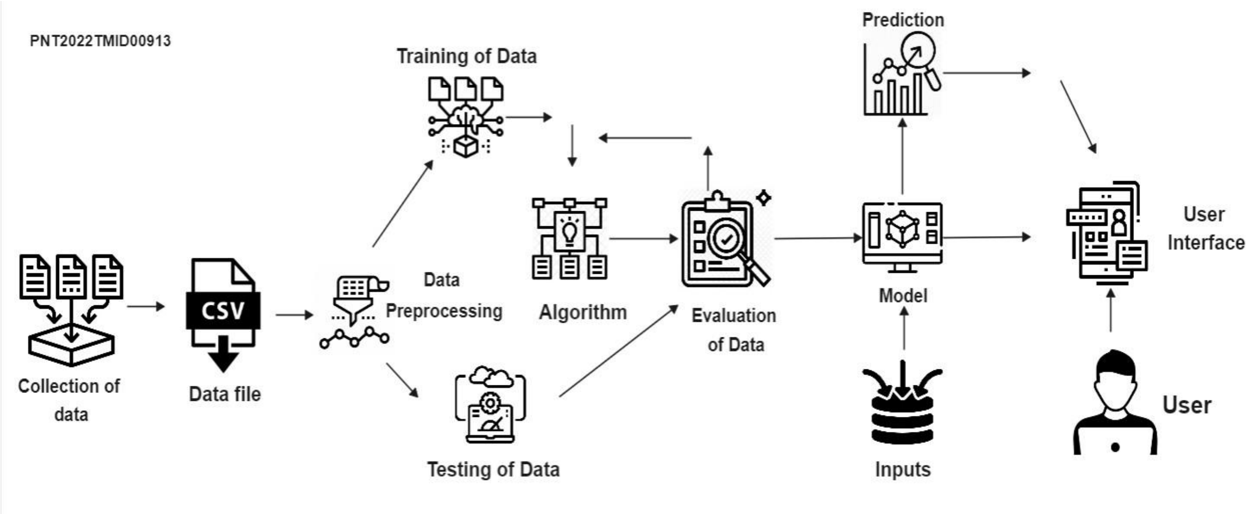
1. Usability
2. Security
3. Reliability
4. Performance
5. Availability
6. Scalability

5. PROJECT DESIGN

5.1. DATA FLOW DIAGRAMS



5.2. SOLUTION & TECHNICAL ARCHITECTURE



Components: Data collection, Image Processing, Training, Testing, Inputs, Prediction.

Characteristics: Open-source frameworks, Security Implementation, Scalable architecture.

5.3. USER STORIES

1. Users can register for the application by entering their email addresses, creating passwords, and confirming their passwords.
2. Upon registering for the application, the user will receive a confirmation email.
3. The User can click the convert sign button, which leads to the sign conversion function page.
4. A user can show hand signs in front of the camera, which detects them and converts them into text.
5. As a User, Once the text is obtained, I can select Speech mode to convert the text into speech.

6. 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	Registration	USN-1	User able to register by giving disability, mail id and fingerprint as a mode of password.	2	High	VIMAL, GURUPRAKASH
Sprint-1	Identity Confirmation	USN-2	User will get Identity confirmation mail.	2	High	GURUSABARISHKUMAR, MUKILESH
Sprint-2	Terms and Condition	USN-3	User asked to accept the following terms and conditions and privacy policies are explained.	2	Medium	VIMAL, GURUPRAKASH
Sprint-2	Alternate Registration Method	USN-5	User can use Gmail to register to application	2	Medium	VIMAL,MUKILESH
Sprint-1	Dashboard	USN-6	User land in dashboard of the application	1	High	GURUSABARISHKUMAR, MUKILESH
Sprint-3	Application	USN-7	User able to convert hand gesture into text	2	High	VIMAL, GURUPRAKASH
Sprint-4	Feedback	USN-8	User were asked of feedback of the application	1	Low	GURUSABARISHKUMAR, MUKILESH

6.2. SPRINT DELIVERY SCHEDULE

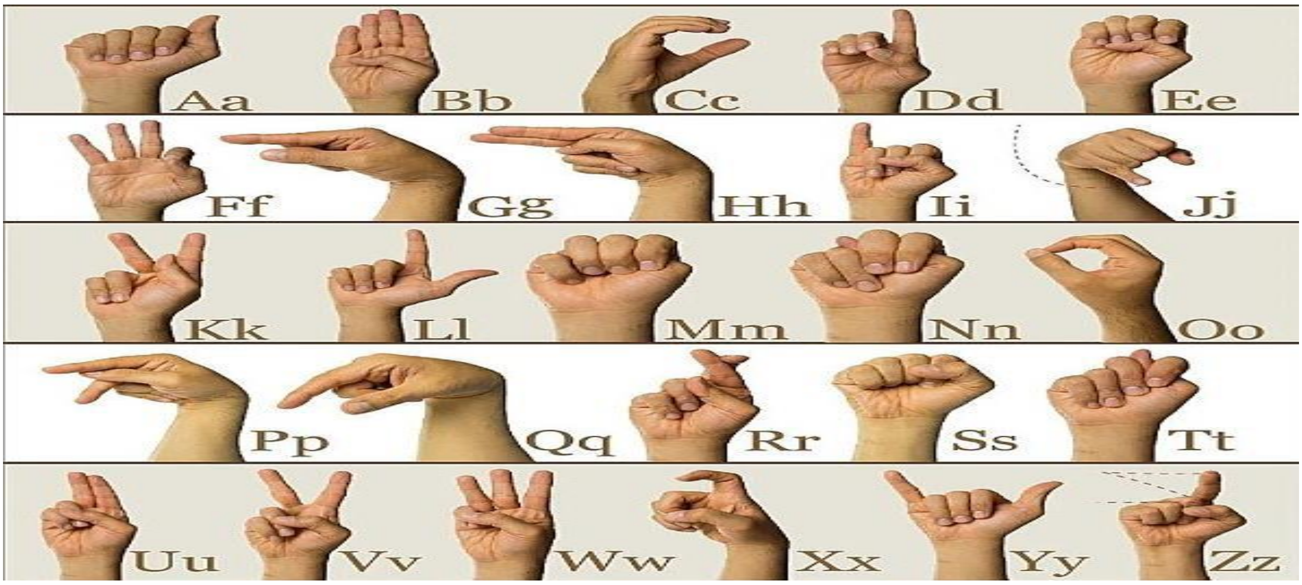
Sprint	Total Story Point	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	18	6 Days	31 Oct 2022	05 Nov 2022	20	31 Oct 2022
Sprint-3	16	6 Days	07 Nov 2022	12 Nov 2022	20	07 Nov 2022
Sprint-4	15	6 Days	14 Nov 2022	19 Nov 2022	20	14 Nov 2022

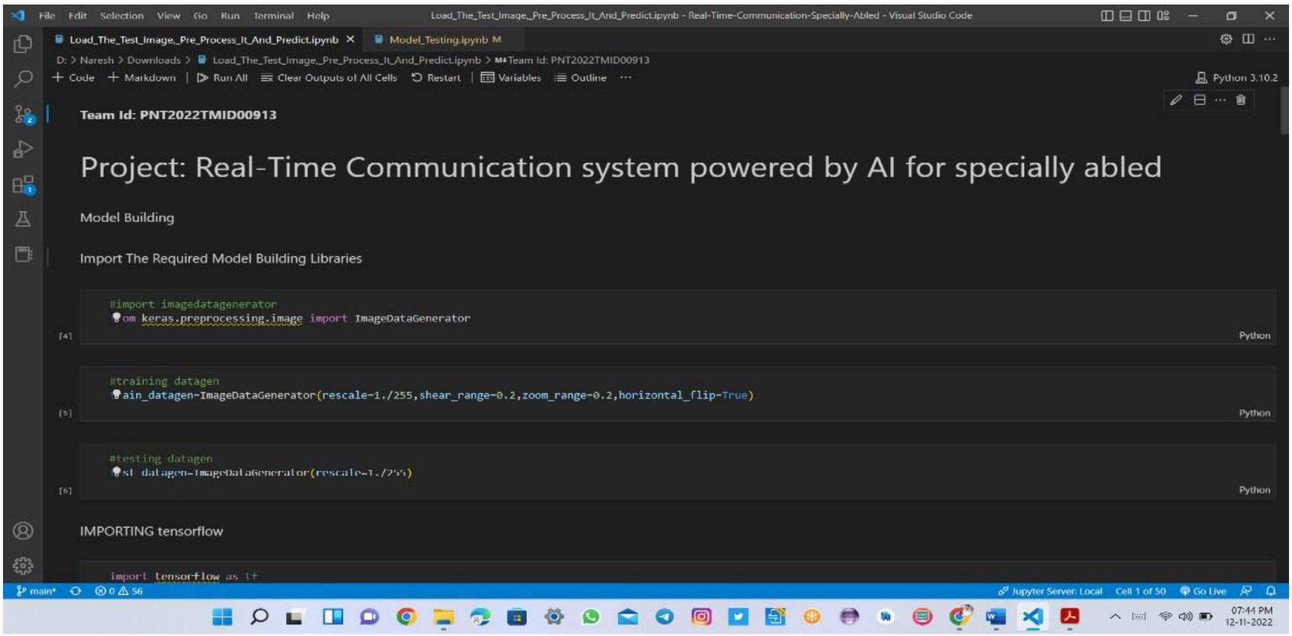
6.3. REPORTS FROM JIRA

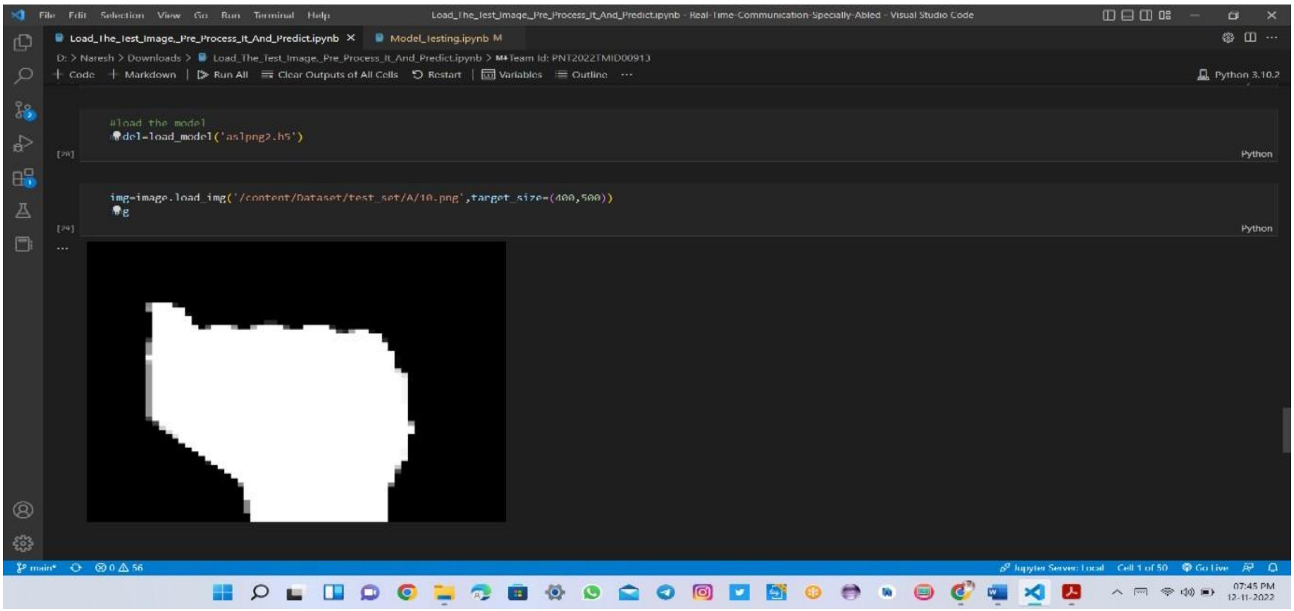
7. CODING & SOLUTIONING

7.1. FEATURE 1

The user can choose which sign language to read based on the different sign language standards that exist.

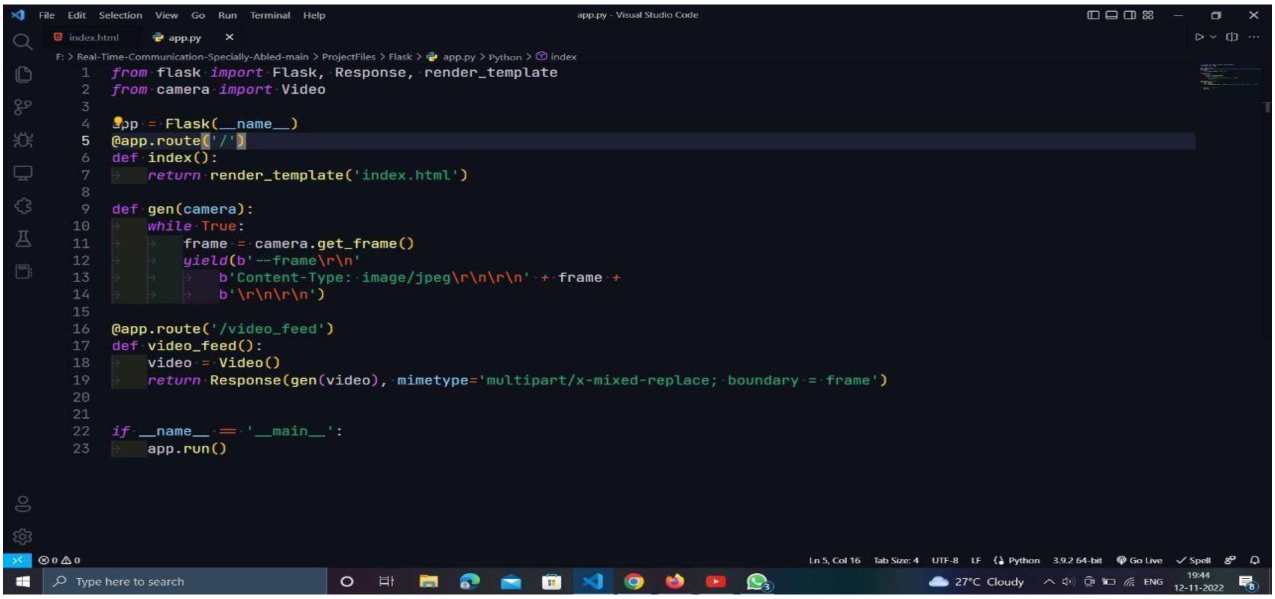






7.2. FEATURE 2

The communication gap between deaf and dumb people and the general public can be bridged with a mobile application.



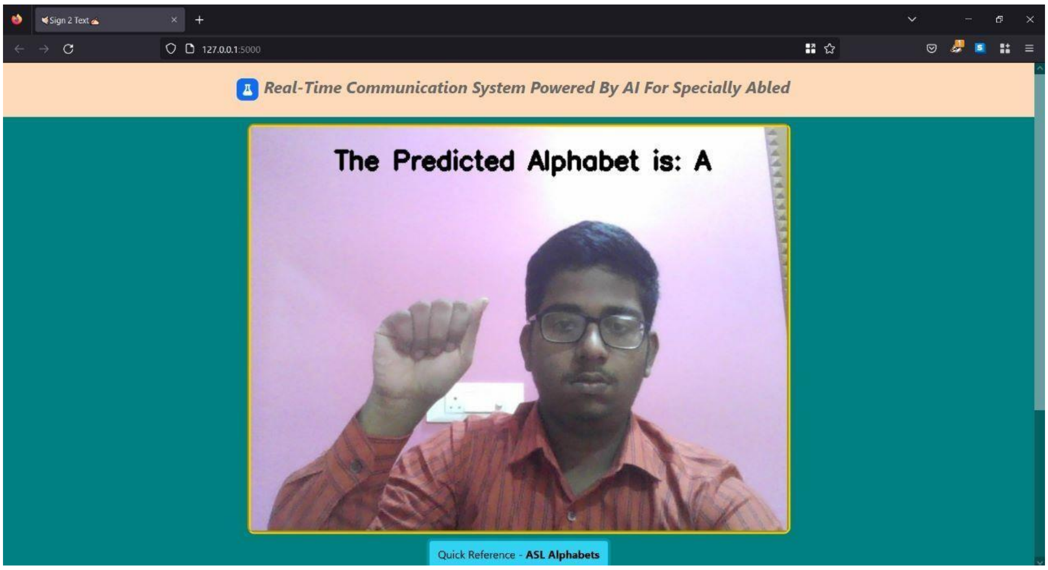
8. TESTING

8.1. TEST CASES

1. Our code was tested on various angle to check whether it gives the correct output.
2. To satisfy the customer's expectations we tested it fully.

8.2. USER ACCEPTANCE TESTING

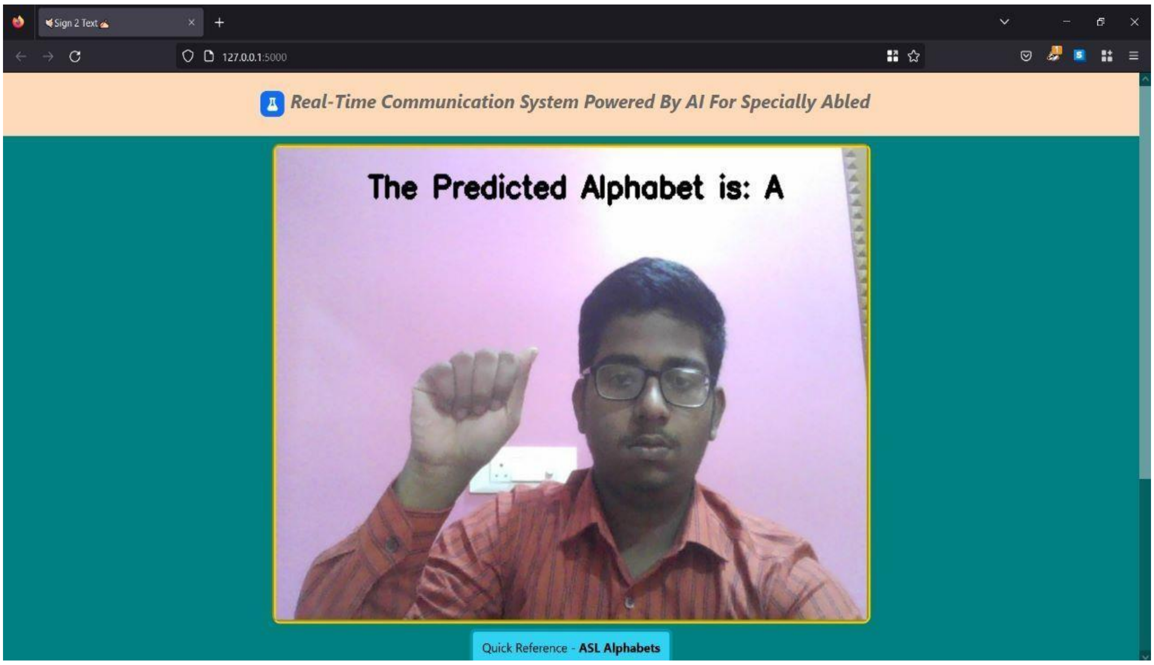
Our project was tested by an end user to verify that it's working correctly.



9. RESULT

9.1. PERFORMANCE METRICS

The proposed procedure was implemented and tested on a set of images. The training database consists of 15750 images of Alphabets from "A" to "I", while the testing database consists of 2250 images of Alphabets from "A" to "I". Once the gesture is recognised the equivalent alphabet is shown on the screen.



10. ADVANTAGES & DISADVANTAGES

ADVANTAGES:

1. The user can choose which sign language to read based on the different sign language standards that exist.
2. The communication gap between deaf and dumb people and the general public can be bridged with a mobile application.

DISADVANTAGES:

1. As of now, the current model is only compatible with alphabets A to I.
2. The dataset has a low number and quality of images so the accuracy isn't high, but a change in the dataset can easily improve the quality of prediction.
3. In the absence of gesture recognition, the alphabets from J cannot be identified as they require some kind of gesture input from the user.

11. CONCLUSION

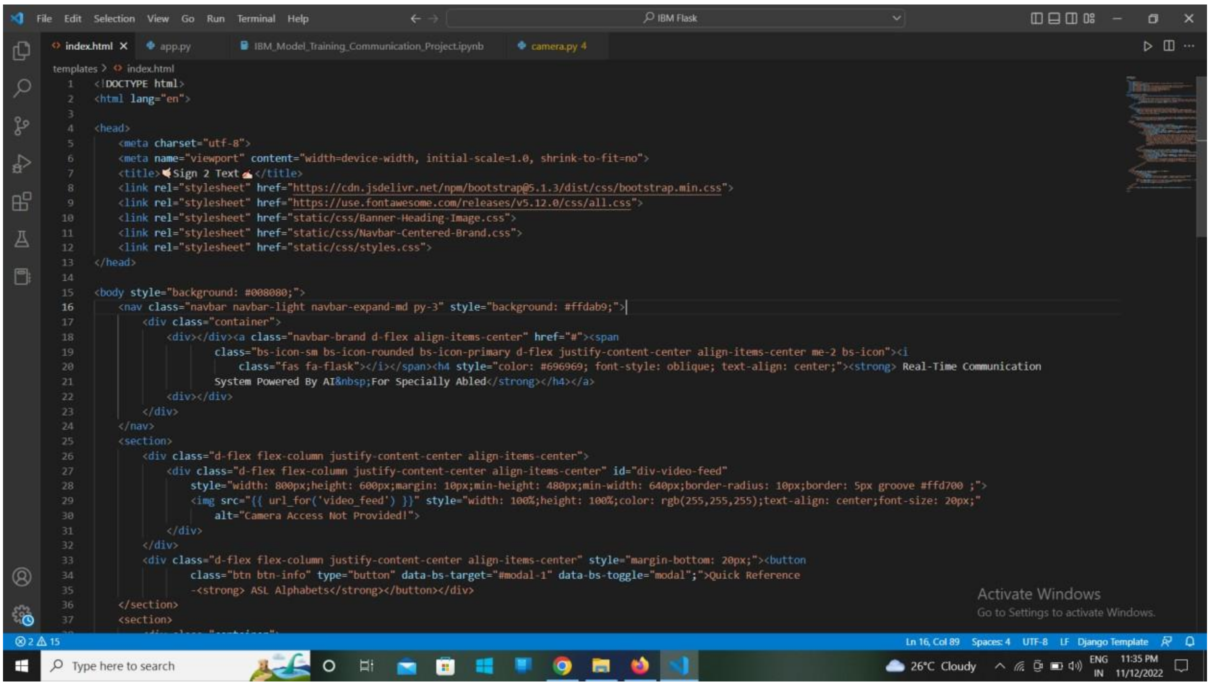
It is beneficial for people who are deaf to use sign language to facilitate communication. Providing two-way communication, the system is intended to help bridge the communication gap between deaf people and society as a whole. Using the proposed methodology, language is translated into English alphabets that are understandable by 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.

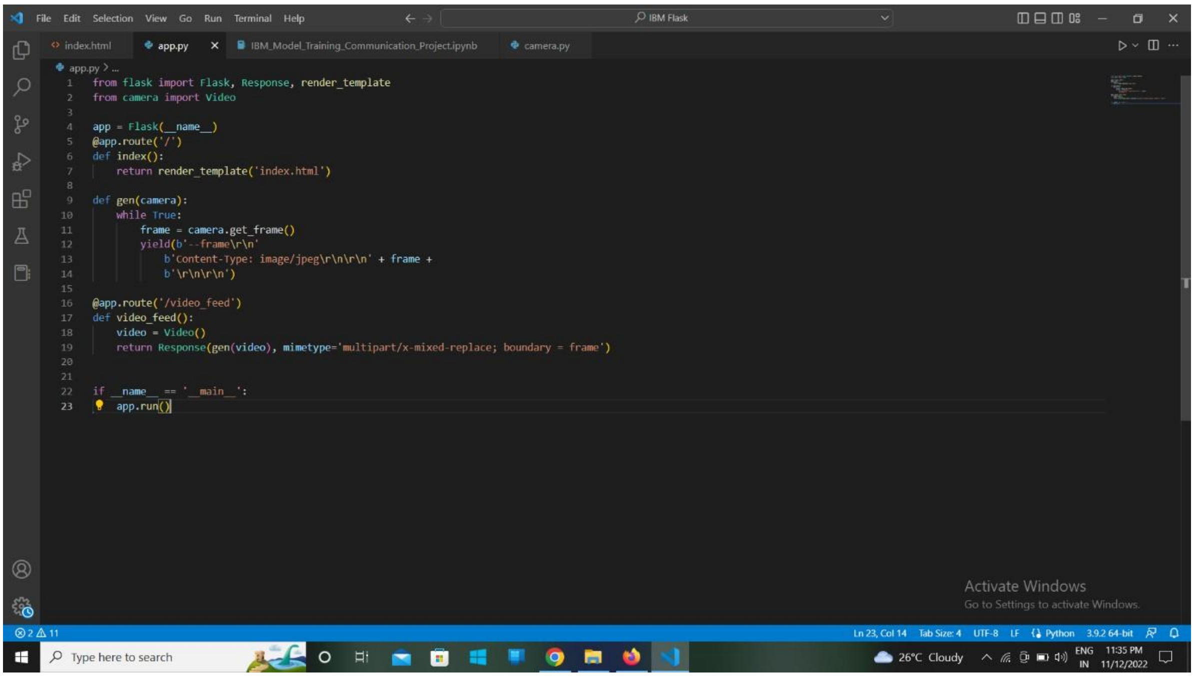
12. FUTURE SCOPE

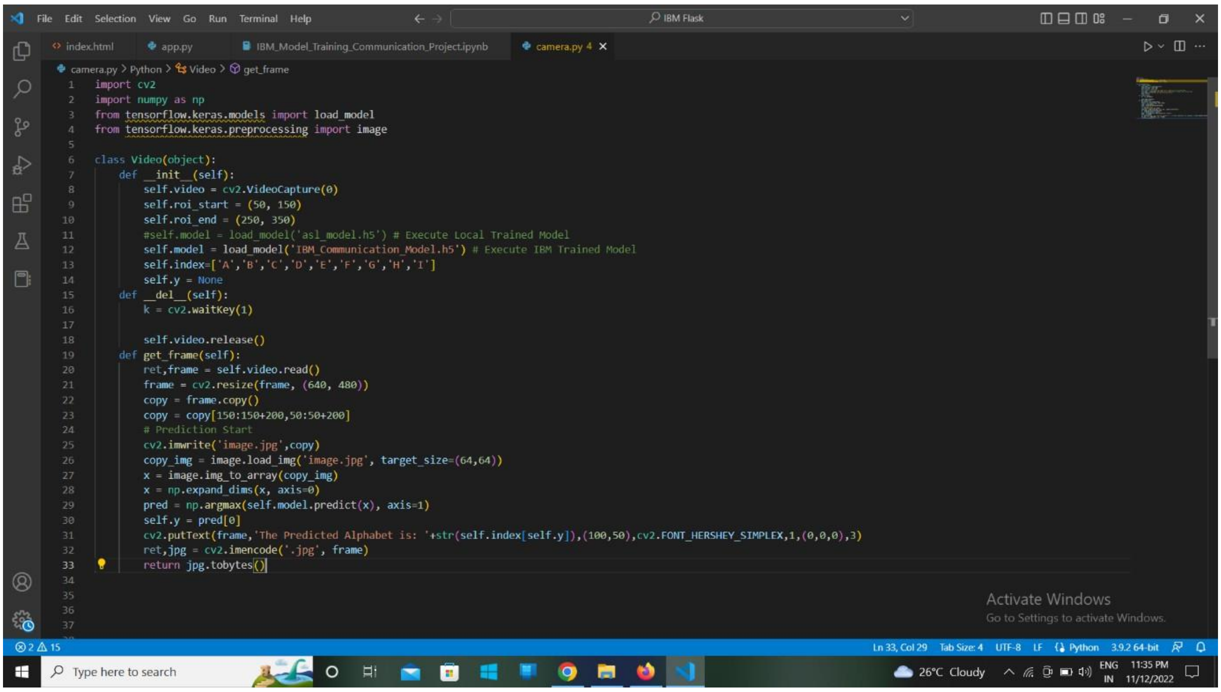
Hand sign language translating technology is a game changer in the field of communication and AI for the handicapped, such as the deaf and dumb. By adding gesture recognition, the app can now recognize letters beyond 'I', digits and other symbols. In addition, gesture recognition can also allow controlling software/hardware interfaces.

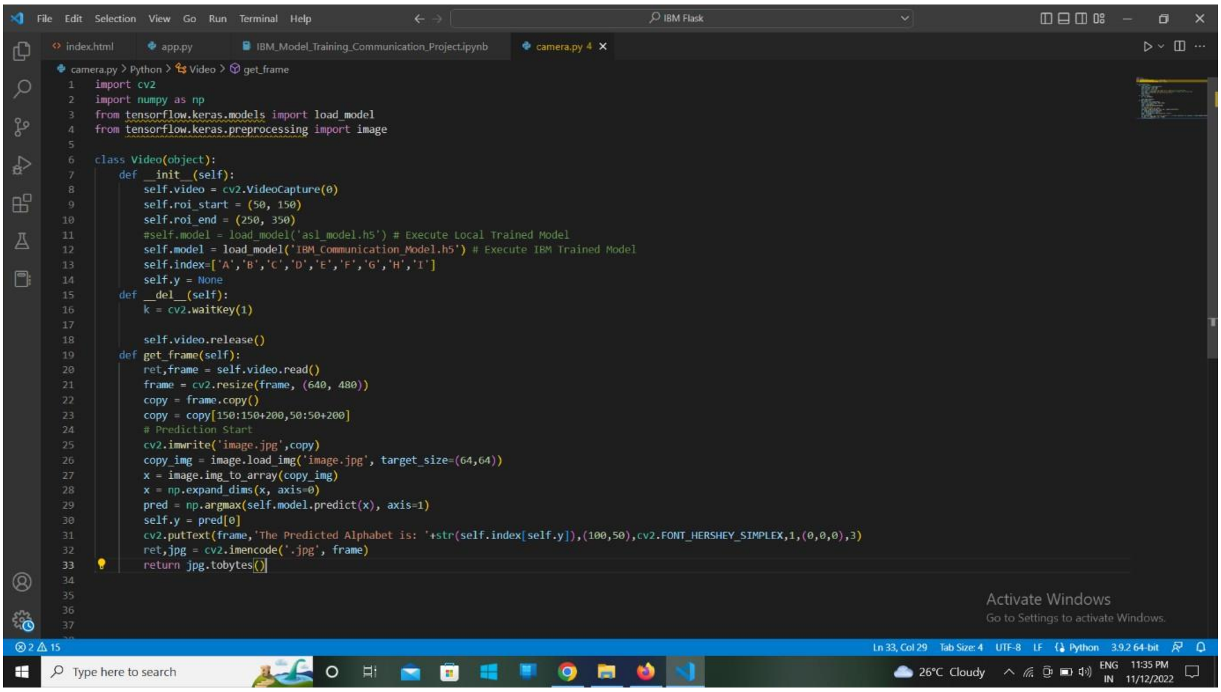
13. APPENDIX

Source Code:









GitHub: https://github.com/IBM-EPBL/IBM-Project-9168-1658984968