REAL TIME COMMUNICATION

SYSTEM POWERED BY AI

FOR SPECIALLY ABLED

NALAIYA THIRAN PROJECT BASED LEARNING
On
PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP

A PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that project report "**REAL TIME COMMUNICATION SYSTEM POWERED BY AI FOR SPECIALLY ABLED**" is the bona fide work of "**MOURISH MANO RANJAN B, MARI NEELA PARVATHY S, MONISHA R, NICKSON ABRAHAM D**" who carried out the project work under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other

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1. INTRODUCTION

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.

Depending on the type of disability and profile, communicating with others can be a challenge. The same holds true for staying connected to others in a world that's more and more digitized with the growing importance of social media and our dependence to the Internet. But technology and AI leave no one behind and can be at the service of people with disabilities. A lot of apps use artificial intelligence to favor accessibility.

Sign Language is the well-structured code, which uses hand gestures instead of sound to convey meaning, simultaneously combining hand shapes, orientations and movement of the hands. Communicative hand glove is an electronic device that can translate sign language into speech and text in order to make the communication possible between the deaf and/or mute with the general public. This technology has been used in a variety of application areas, which demands accurate interpretation of sign language. In this project, the words/letters conveyed by the disabled person are displayed on a screen and also spoken on a speaker.

1.1 PROJECT OVERVIEW

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

To develop an application trained with Artificial Intelligence algorithm that can capture the hand sign gestures made by the impaired people to communicate with other people through the application. 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

[1] Researchers are actively investigating methods to develop sign language recognition systems, but they face many challenges during the implementation of such systems which include recognition of hand poses and gestures. This paper focuses on the sign language alphabet recognition system because the letters are the core of any language.

There are two types of sign language recognition methods, namely sensor-based and image-based. The first method is dependent on localized sensors or wearing specific gloves. The second method uses different types of cameras. It is based on image processing which does not require equipment such as sensors. Various datasets are

created because of many factors such as regional differences, type of images (RGB or Depth) and so on. In this study, an American Sign Language Alphabet (ASLA) dataset is created and developed a deep learning- based method for its recognition.

The creation of the dataset was dependent on many factors such as illumination and the distance between the camera and hand, which is adjusted to improve the performance of the convolutional neural network model. While in other datasets, the distance of the hand from the camera was reported to be fixed such as 0.5 m, 0.75 m or 1 m. This dataset contains images varying 0.5 m, 0.75 m and 1 m hand distance.

In the field of deep learning, when a new dataset is created, it may be considered a new contribution to the field mainly because each dataset has its specific features to improve existing models. However, the availability of several datasets often creates more challenges that require solutions. Therefore, the creation of a custom dataset with special conditions may be considered as a new contribution in the field of sign language interpretation.

Convolutional neural network involves less pre-processing compared to other image classification algorithms. The use of a CNN reduces the images into a format that is easier to process while preserving features that are essential for making accurate predictions. There are four types of operations in a CNN: convolution, pooling, flattening, and fully connected layers

According to the results of the experiments, the training was executed for the first dataset [23] and the obtained accuracy was 99.41% with a 0.0204 loss. Secondly, the training was implemented to the second dataset [24], for which the obtained accuracy was 99.48% and the loss was 0.0210. This study can be improved by adding more images for more letters and words into the dataset. Also, more images can be added to improve accuracy and reduce loss. By the addition of new words and terms, the proposed system may be improved to predict a complete word.

[2] Currently treating sign language issues and producing high quality solutions has attracted researchers and practitioner’s attention due to considerable prevalence of hearing disabilities around the world.

The literature shows that Arabic sign language (ARSL) is one of the most popular sign languages due to its rate of use.

ARSL is categorized into two groups:

1. The first group is ARSL alphabetic (ARSLA), where each Arabic letter is represented by a sign.
2. The second group is ARSL, where words are represented by signs i.e., picture.

This paper introduces a real time ARSLA recognition model using deep learning architecture. As a methodology, the proceeding steps were followed.

[3] Due to the lack of assistive resources, hard-of-hearing people cannot live independently. Sign language or gesture language is the natural language and it is the primary mode of communication for hard-of-hearing people. Researchers and IT companies are continuously trying to find the best solutions to minimize the communication barriers for Hearing-impaired people. Existing translation techniques for speech to sign language on the web platform are consuming higher resources.

2.2 REFERENCES

Stephen Cox, Michael Lincoln and Judy Tryggvason,Mark Wells, Marcus Tutt and Sanja Abbott,Melanie Nakisa TESSA, a system to aid communication with deaf people 2017

Nidhi Kawale, Divya Hiranwar, Mayuri Bomewar An Android Messenger Applicationfor Deaf and dump 2017

Manisha U. Kakde,Mahender G. Nakrani,Amit M. Rawate A Review Paper on Sign Language Recognition System For Deaf And Dumb People using Image Processing

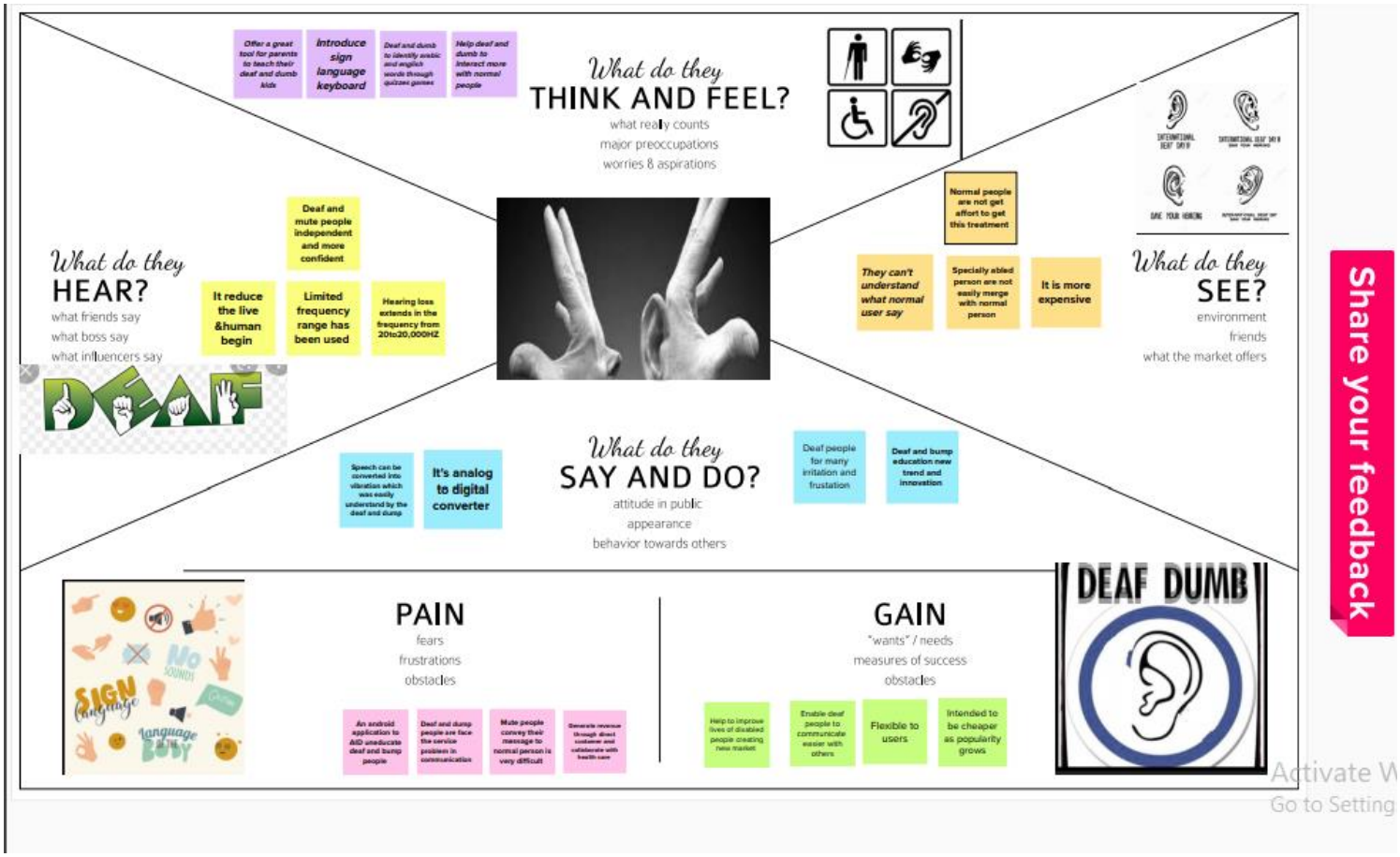
Dalia Nashat , Abeer Shoker , Fowzyah Al-Swat and Reem Al- Ebailan AN ANDROID APPLICATION TO AID UNEDUCATED DEAF-DUMB PEOPLE

2.3 PROBLEM STATEMENT DEFINITION

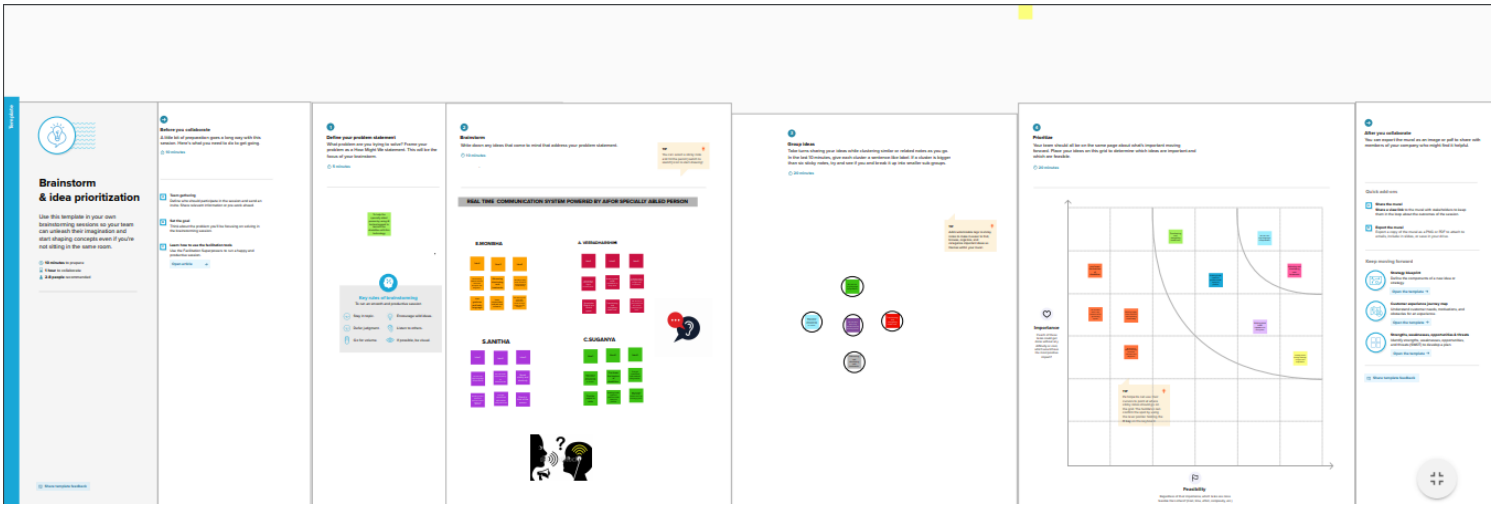
Problem Statement (PS):	People with disabilities are not able to communicate with the people and society. Though technologies are evolving but there is no significant growth for these people. So, an AI system is developed to communicate with people in real time.
I am (Specially abled person)	A Specially abled person, who finds difficulties in communicating with the people and couldn't able to convey what they feel. And so, the talented ones not able to express what they feel.
I'm trying to	Communicate with normal persons to convey the information which I intend to.
But	I can't able to communicate easily with the people and they find it difficult to understand.
Because	Only few knows the hand sign language not most of the people knows. So, it is a problem that every impaired person has.
Which makes me feel	Frustrated, Lose confidence, Anxiety.

3. IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



3.2 IDEATION AND BRAINSTORMING



3.3 PROPOSED SOLUTION

S.NO	PARAMETERS	DESCRIPTION
1.	Problem Statements (Problem tobesaved)	Coiningtheterm"specially-abled'toreplace"disabled'wasperhapsthemostsignificantpositivesteptowardscreatinganinclusiveworkplace. Not only did it help in breaking theshackles of incapacity and low self-esteem, but italsoreinforcedafeelingofempathyintheecosystem that has proved to be invaluable indownplaying the stigma attached to a disabledperson. You will now find people welcoming thespecially-abled to the workplace, helping themadjusttotheirworkenvironmentandtreating themat parwith othermembersoftheteam.
2.	Idea/Solutiondescription	Wearemakinguseofaconvolutionneuralnetworktocreateamodelthatistrainedondifferent hand gestures. An app is built whichuses this model. This app enables deaf and dumbpeople to convey their information using signswhichgetconvertedtohuman-understandable languageandspeech isgiven asoutput.

3.	Novelty/Uniqueness	Creatingnewtoolscouldhelpintegrateasegmentofourpopulationthathasoftenbeenleftoutofroutinedailylifeactivitiesandjobopportunities.Theunemploymentrateistwiceashighfor Americanswithdisabilities,accordingtothe Bureau of Labor Statistics. Worldwide, onlyonein10peoplewhocoulduseassistiveproductshaveaccesstothem.Disabilities,whetherrelated
		tovision,hearing,mentalhealth,learning,cognition,ormobility,canbepermanent,temporary, or even situational. Designing newproductswithdifferentlevelsofabilitiesinmind—aconceptcalledinclusivedesign—has gonealongwayinensuringthattechnologyworksfor everyone.
4.	Social impact/ CustomerSatisfaction	Communicatingwithothersandbeingconnected.Dependingonthe type of disabilityand profile, communicating with others can be achallenge.Thesameholdstrueforstayingconnected to others in a world that's more andmore digitized with the growing importance ofsocial media and our dependence to the Internet.But technology and AI leave no one behind andcanbeattheserviceofpeoplewithdisabilities.Alotofappsuseartificialintelligencetofavoraccessibility.
5.	Business model(Revenuemodel)	• ableto getaccurateresults • easyto useforspeciallyabled • speciallyabledpersoncanusethisfeatureby theirown • lowcost
6.	Scalabilityofthesolution	• Thismodelensuresthesafetyandaccuracyofspecially abled • speciallyabledpersonsandtheirfamilyneednotto worry about theirfuture

3.4 PROBLEM SOLUTION FIT

Define CS, fit into CC

1.CUSTOMERSEGMENT(S) CS

The normal people who are trying to communicatewith Specially abled persons such as deaf and dumbpeoplearethecustomer

6.CUSTOMERCONSTRAINTS CC

Thesignlanguageisnotunderstandabletoall.Thedifficultyinunderstandingthesignlanguagebynormalpeople

5.AVAILABLESOLUTIONS AS

i.e. pen and paper is an alternative to digital notetaking

Provide personalized learning experiences. It makesuseoftexteditorsandsocialmediateEasytolearnandvisualizeaccess withallkeywords.

Usingtexttypewritersand AIBaseddevicesie.Voicerecognition

Explore AS, differentiate

Focus on J&P, tap into BE, understand RC

2.JOBS-TO-BE-DONE/PROBLEMS J&P

Which jobs-to-be-done (or problems) do you address for yourcustomers?Therecouldbemorethanone;exploredifferentsides.

Createacommunicationlinkbetweendeaf-dumbandnormalpeopleUnderstandinginputsfromtheusermaytake alotofefforts.

AIinstantlytranscribestheconversationofagroup of people. Its algorithm adds punctuation,the name of the person who is talking, and thenecessary vocabulary from the user's dictionary.Voice Accesswas specially created for peoplewith reduceddexterity.

9.PROBLEMROOTCAUSE RC

Thecommunicationbarrieristherootcause.

Duringemergencythespeciallyabledpeoplecannotcontact or express their feelings to others (normalpeople).

The feeling cannot be shared with other they feelstressed.

7.BEHAVIOUR BE

AI has a huge impact on people with disabilities everydaylives.

Today,facialrecognitionsoftwareisbeingusedforblindchildren to read books aloud and as an accessible way fordeafpeopletocommunicatewithothersviavideochat.

Focus on J&P, tap into BE, understand RC

Identify strong TR & EM

3.TRIGGERS TR

An ability of the customers to communicateefficientlyatseriousandnecessarysituations.

AIistoenableyoutoachievepersonalfulfillment and stay adaptable in this fast-changingtechindustry.

4.EMOTIONS: BEFORE/ AFTER EM

Visuallyimpairedusers can set it up to work with VoiceOver.Allowspeoplewithdisabilitiestofullycontroltheirenvironments

10.YOURSOLUTION SL

This device helps in emergency situations to contact .Thecustomercan sharetheirfeelingsandalsohelpsinexpressingemotions and theirmotives.

8. CHANNELSofBEHAVIOUR CH

8.1 ONLINE

AItechnologiescanplayanimportantroleinbreakingdownthecommunicationthroughonlinetranslation.

8.2 OFFLINE

Theybuydevicesthathelpsintranslatingsignlanguagetotext and vice versa.

Identify strong TR & EM

4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

FunctionalRequirements:

Followingarethefunctional requirementsoftheproposedsolution.

FR No.	FunctionalRequirement (Epic)	SubRequirement (Story/ Sub-Task)
FR-1	UserRegistration	• RegistrationthroughForm • RegistrationthroughGmail
FR-2	UserConfirmation	• ConfirmationviaEmail • ConfirmationviaOTP
FR-3	System	• Desktopwithhighresolutioncamera. • ProvidesAccesstocaptureImagethroug h the Camera. • Provides Access to Upload theCapturedimagethroughGallery.
FR-4	Textconversion	ConvertstheSignlanguageintoatextusing Convolutional Neural Network (CNN)Model.
FR-5	SentenceTranslation	RecognizestheseparateSignsofOne-By-OneanditCouldprovideaTranslationinthe situationwhereSignedExtractSystem(SEE)isp rovided.
FR-6	Review	UsersCanGivetheirFeedbackontheReview pageabout theApplication.

4.2 NON-FUNCTIONAL REQUIREMENT

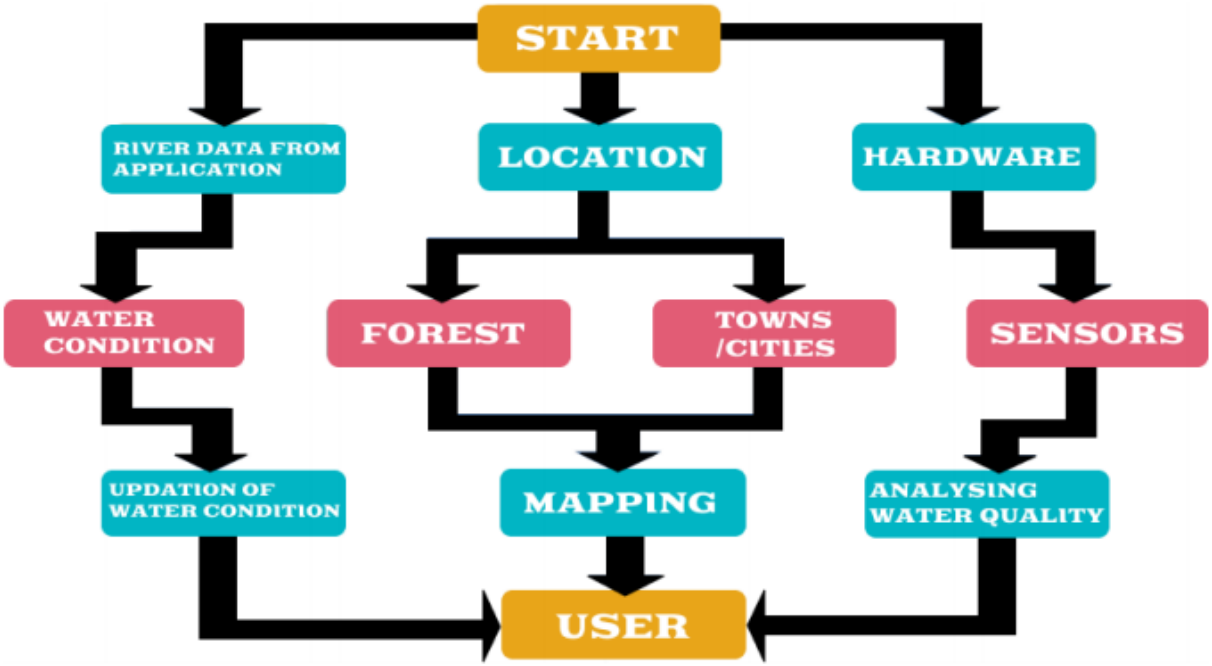
Non-functionalRequirements:

Followingarethenon-functionalrequirementsoftheproposedsolution.

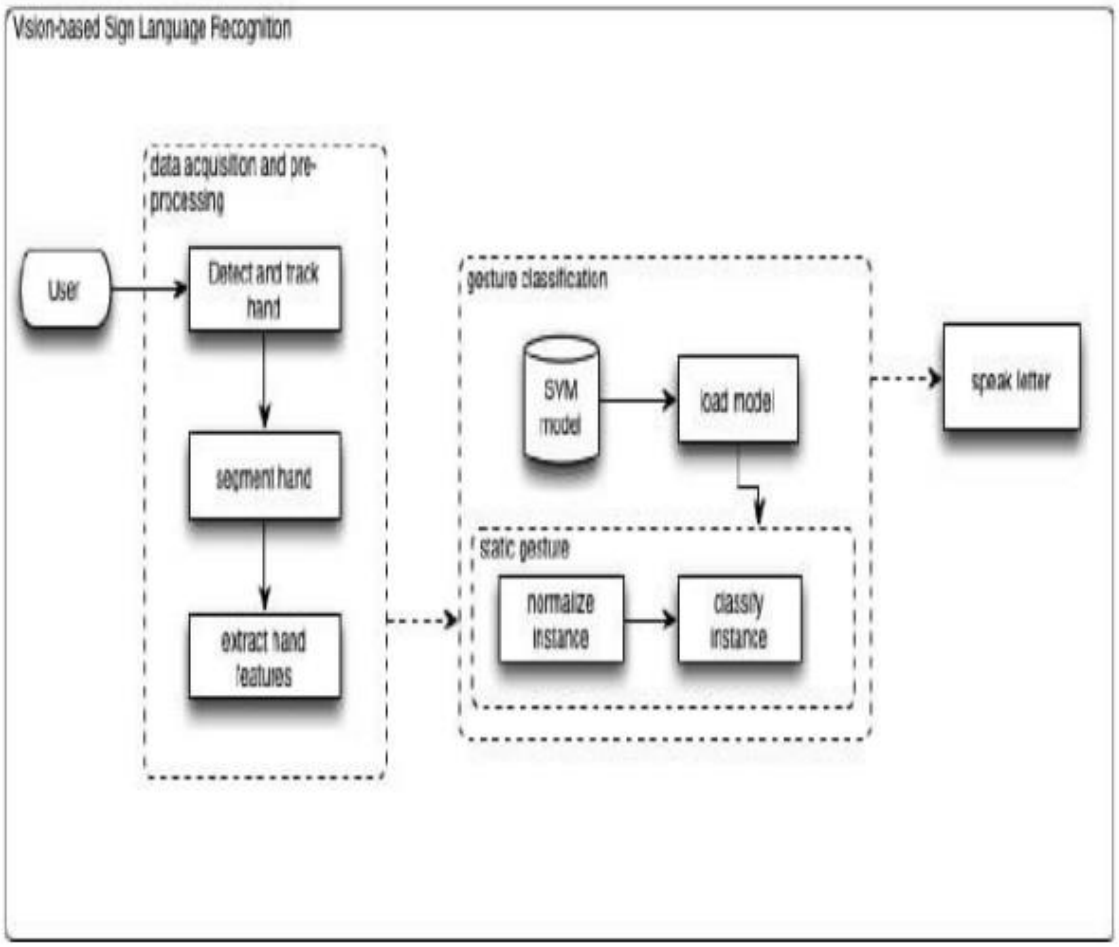
FRNo.	Non-FunctionalRequirement	Description
NFR-1	**Usability**	To convey a message to normal people,aswellasconvertspeechintoundersta ndablesignlanguageforthedeaf anddumbpeople.
NFR-2	**Security**	Convertedinformationusingsignsintospee ch isaccessedonlybythe user.
NFR-3	**Reliability**	SignMethodisRelevanttouseforDifferentl y abledpersons.
NFR-4	**Performance**	Thetimeforconvertingsignsintospeechsh ouldbefasterfortherealtimecommunication.
NFR-5	**Availability**	Providesautomaticrecoveryasmuchas possible.
NFR-6	**Scalability**	This app enables deaf and dumb peopletoconveytheirinformationusingsigns whichgetconvertedtohuman-understandablelanguageandspeechis givenasoutput.

5. PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS

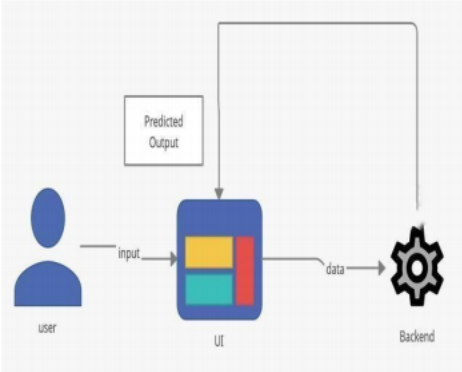


5.2 SOLUTION AND TECHNICAL ARCHITECTURE

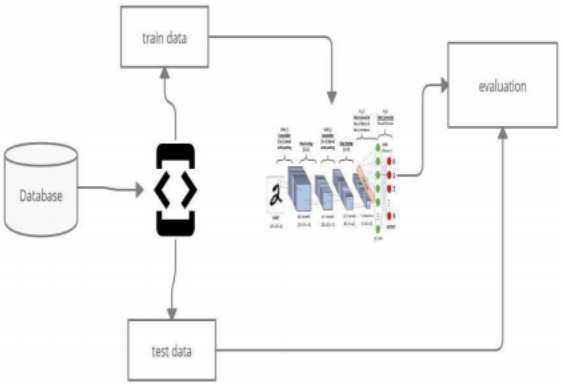

Vsion-based Sign Language Recognition
data acquisition and pre-processing
User
Detect and track hand
segment hand
extract hand features
gesture classification
SVM model
load model
static gesture
normalize instance
classify instance
speak letter

TechnicalArchitecture:

TheDeliverableasbelowandtheinformationasperthetable1.



DEPLOYMENT



TRAININGANDEVALUATION

5.3 USER STORIES

UserType	FunctionalRequirement (Epic)	User StoryNumber	User Story/Task	Acceptancecriteria	Priority	Release
Customer(Mobileuser)	Registration	USN-1	As a user, I can register for the application byentering email , password, and confirming mypassword.	Ican accessmyaccount/ dashboard	High	Sprint-1
		USN-2	As a user, I will receive a confirmationemail once I have registered for theapplication	Ican receiva econfirmation email &clickconfirm	High	Sprint-2
		USN-3	As a user, I can register for the applicationthroughgoogle	Icanregister& access the dashboard withgoogle	High	Sprint-1
		USN-4	As a user, I can register for the applicationthroughGmail	I can register througthe hmail.	Medium	Sprint-2
	Login	USN-5	As a user, I can log into the application byenteringemail,password& captcha	I can receive logincredentials.	High	Sprint-1
	Interface	USN-6	Asauser,theinterfaceshouldbeuser-friendlymanner	Icanabletoaccesseasily.	Medium	Sprint-1
Customer (Webuser)	dashboard	USN-7	Asa user,Icanaccessthespecificinfo(phvalue,temp,humidity,quality).	I can able to know thequalityofthewater.	High	Sprint-1
Customer (input)	Viewmanner	USN-8	Asauser,Icanviewdatainvisualrepresentationmanner(graph)	Icaneasilyunderstandbyvisuals.	High	Sprint-1
	Taste	USN-9	Asauser,Icanabletoviewthequality(salty)ofthewater	I can easily know whether itissaltyornot	High	Sprint-1
	Colourvisiblity	USN-10	Asauser ,Icanablepredictthewater colour	I can easily know theconditionby colour	High	Sprint-1
Administrator	Risk tollerent	USN-11	An administrator who Is handling the systemshouldupdateandtakecareoftheapplication.	Admin should monitor therecordsproperly.	Medium	Sprint-2

6. PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1 USN-4	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	E.MONISHA&A.VEERADHARSHINI
Sprint-2			As a user, I will receive confirmation email oncel have registered for the application	1		
Sprint-1	Login	USN-2 USN-3	As a user, I can log into the application by entering email & password	1	Medium	C.SUGANYA&S.ANITHA
Sprint-2	Dashboard		As a user, I can log into my account in a given Dashboard	1		
Sprint-1	User interface	USN-4	Professional responsible for user requirements & needs	1	High	E.MONISHA
Sprint-3	Objective	USN-3	The goal is to describe all the inputs and outputs	1	High	E.MONISHA
Sprint-4	Privacy	USN-1	The developed application should be secure for the users	1	High	A.VEERADHARSHINI

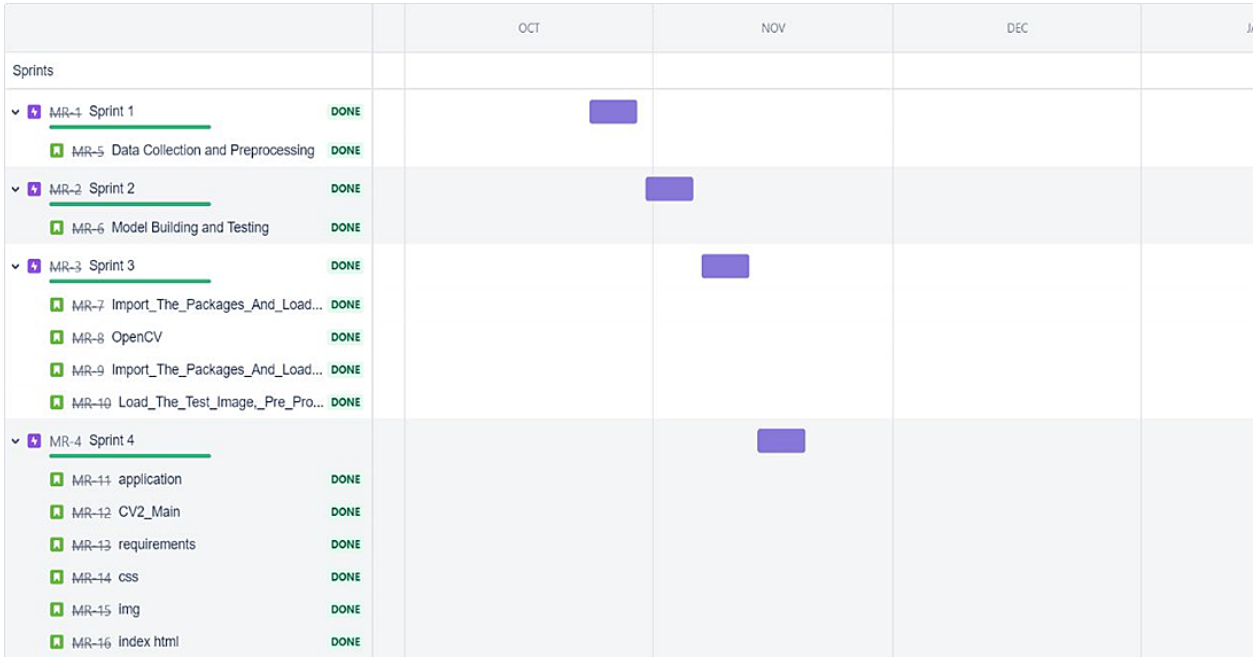
6.2 SPRINT DELIVERY SCHEDULE

4

Project Tracker, Velocity & Burndown Chart: (4 Marks)

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	26 Oct 2022	29 Oct 2022	20	30 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

6.3 REPORTS FROM JIRA



7. CODING AND SOLUTIONING

7.1 FEATURE 1

Import The Required Model Building Libraries

In [9]:
```
from keras.models import Sequential
from keras.layers import Dense
from keras.layers import Convolution2D
from keras.layers import MaxPooling2D
from keras.layers import Dropout
from keras.layers import Flatten
```

Initialize The Model

In [11]:
```
model=Sequential()
```

Add The Convolution Layer

In [12]:
```
model.add(Convolution2D(32, (3,3), input_shape=(64,64,1), activation= 'relu'))
#no. of feature detectors, size of featuredetector, image size, activation function
```

Add The Pooling Layer

In [14]:
```
model.add(MaxPooling2D(pool_size=(2,2)))
```

Add The Flatten Layer

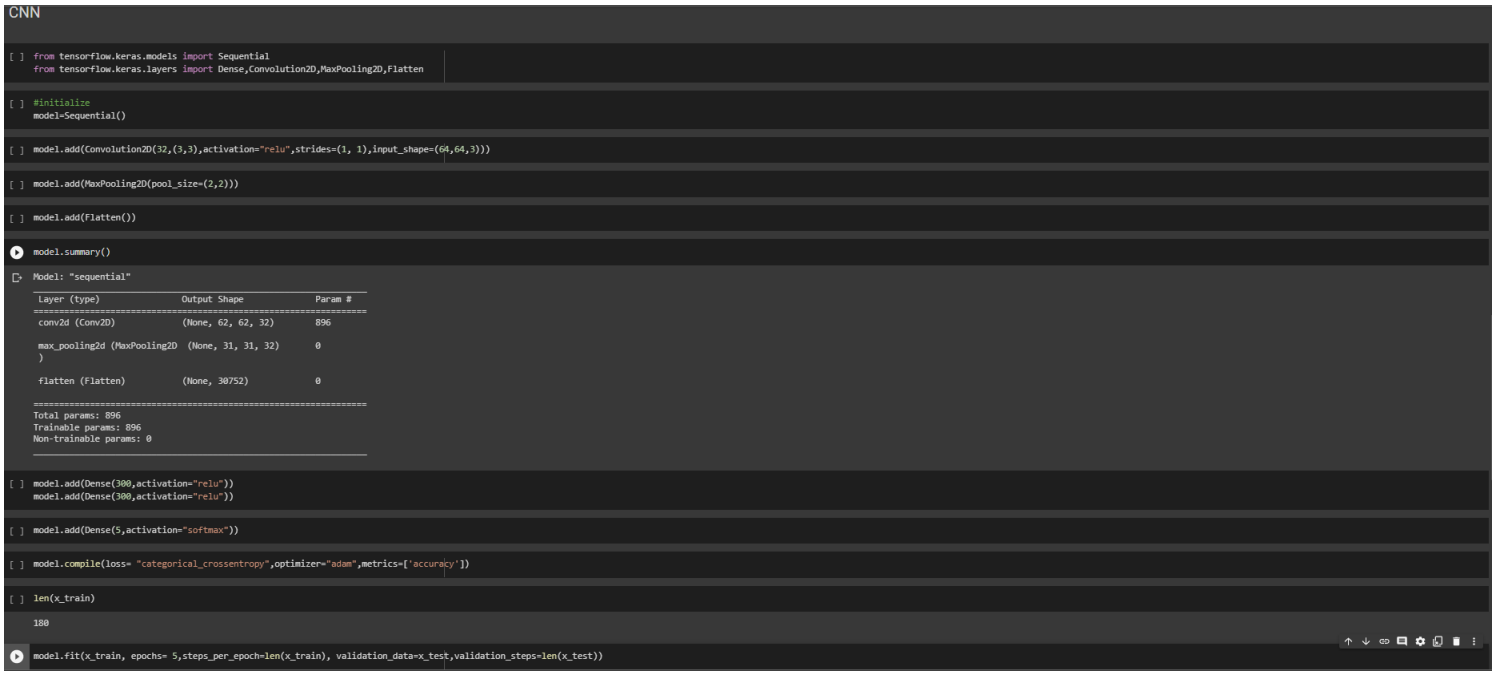
In [15]:
```
model.add(Flatten())
```

Adding The Dense Layers

In [16]:
```
model.add(Dense(units=512, activation='relu'))
model.add(Dense(units=9, activation='softmax'))
```

This project deals with certain layers which is added in the program, libraries and frameworks are also added like Tensorflow, Keras, openCV and Flask. These parameters are essential for the program to execute efficiently and effectively. This determines the flow of the code and its operation.

7.2 Feature 2



We use CNN (Convolutional Neural Network) because it is a subtype of neural networks that is mainly used for applications in image and speech recognition. It's built-in convolutional layers reduce the high dimensional of images without losing its information. That is why we use the CNN algorithm in this case. It is designed to map image data (two-dimensional data) to an output variable (one-dimensional data). It is easy to understand and fast implement. It has the highest accuracy among all algorithms that predicts images.

8. TESTING

8.1 Test Cases & User Acceptance Testing

Test Case	Feature Type	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Coments
Home page_TC_1	Camera Access	Provided Access	An URL to test	There will be a dropdown box to allow or block for camera access	Random https:// Urls	Camera Access Enabled	Works Properly	Pass	
Home page_TC_2	Camera Access	Not Provided Access	An URL to test	There will be a dropdown box to allow or block for camera access	Random https:// Urls	Camera Access Disabled	Not Works Properly	Fail	
Home page_TC_3	Camera Access	Provided Access	An URL to test	There will be a dropdown box to allow or block for camera access	Random https:// Urls	Camera Access Enabled	Works Properly	Pass	
Prediction_TC_1	Predicting using the AI Model	Predicting the hand sign gesture	Trained AI model	Live video feed to capture	Random https:// Urls	Gives the correct Prediction Output	Works Properly	Pass	
Prediction_TC_2	Predicting using the AI Model	Predicting the hand sign gesture	Trained AI model	Live video feed to capture	Random https:// Urls	Gives the correct Prediction Output	Works Properly	Pass	
Prediction_TC_3	Predicting using the AI Model	Predicting the hand sign gesture	Trained AI model	Live video feed to capture	Random https:// Urls	Not within the region of interest	Not Works Properly	Fail	
Prediction_TC_4	Predicting using the AI Model	Predicting the hand sign gesture	Trained AI model	Live video feed to capture	Random https:// Urls	Gives the correct Prediction Output	Works Properly	Pass	

Prediction_TC_5	Predicting using the AI Model	Predicting the hand sign gesture	Trained AI model	Live video feed to capture	Random https:// Urls	Gives the correct Prediction Output	Works Properly	Pass	
Redirect_TC_1	Redirect to about and contact us	Move from one page to another page		Click the page on the navigation you wish to go to	Click on the navigation menu	Moves to the selected page	Works Properly	Pass	
Redirect_TC_2	Redirect to about and contact us	Move from one page to another page		Click the page on the navigation you wish to go to	Click on the navigation menu	Moves to the selected page	Works Properly	Pass	
Redirect_TC_3	Redirect to about and contact us	Move from one page to another page		Click the page on the navigation you wish to go to	Click on the navigation menu	Moves to the selected page	Works Properly	Fail	Due to Multiple request and system issues
Redirect_TC_4	Redirect to about and contact us	Move from one page to another page		Click the page on the navigation you wish to go to	Click on the navigation menu	Moves to the selected page	Works Properly	Pass	
Contact_Us_TC_1	Contact the developers	Contact the developers regaurding bugs and Feedback		Click Contact us and once page open enter the required details		Send the Message and redirect to home page	Works Properly	Pass	
Contact_Us_TC_2	Contact the developers	Contact the developers regaurding bugs and Feedback		Click Contact us and once page open enter the required details		Send the Message and redirect to home page	Works Properly	Fail	Due to network Connectivity
Contact_Us_TC_3	Contact the developers	Contact the developers regaurding bugs and Feedback		Click Contact us and once page open enter the required details		Send the Message and redirect to home page	Works Properly	Pass	
Contact_Us_TC_4	Contact the developers	Contact the developers regaurding bugs and Feedback		Click Contact us and once page open enter the required details		Send the Message and redirect to home page	Works Properly	Fail	Presence of Incomplete Field
Contact_Us_TC_5	Contact the developers	Contact the developers regaurding bugs and Feedback		Click Contact us and once page open enter the required details		Send the Message and redirect to home page	Works Properly	Pass	

9.RESULTS

9.1 PERFORMANCE METRICS

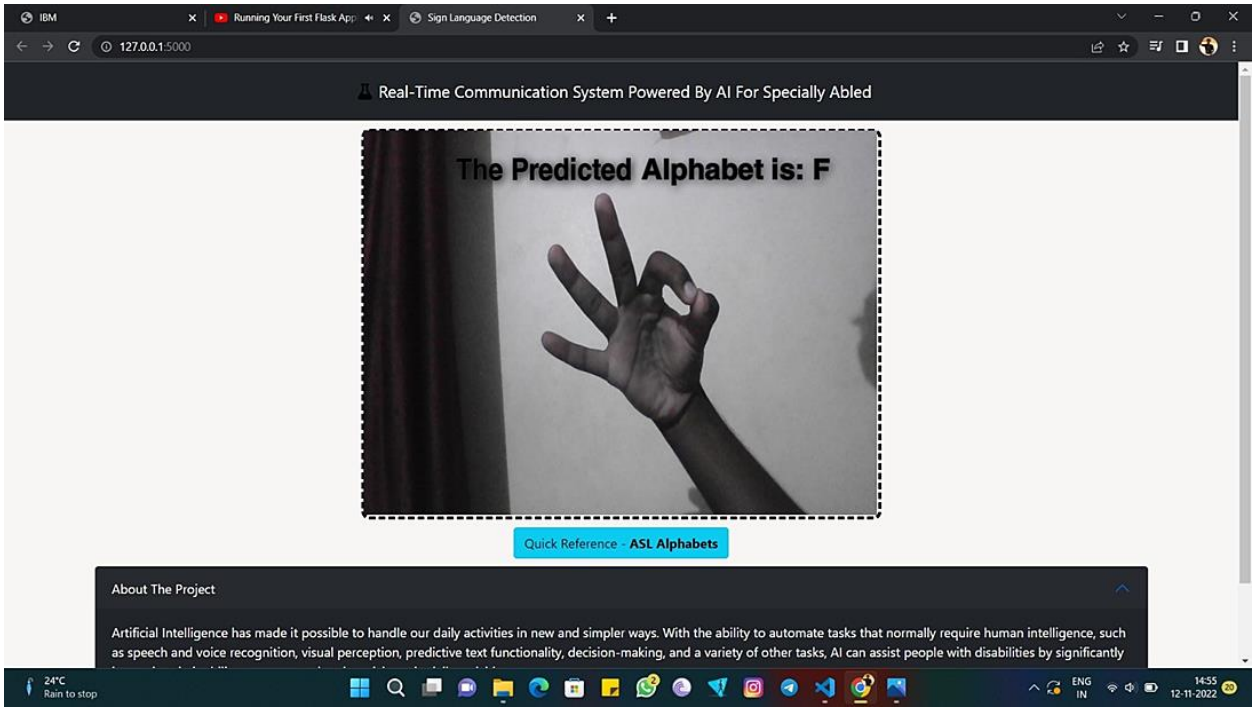
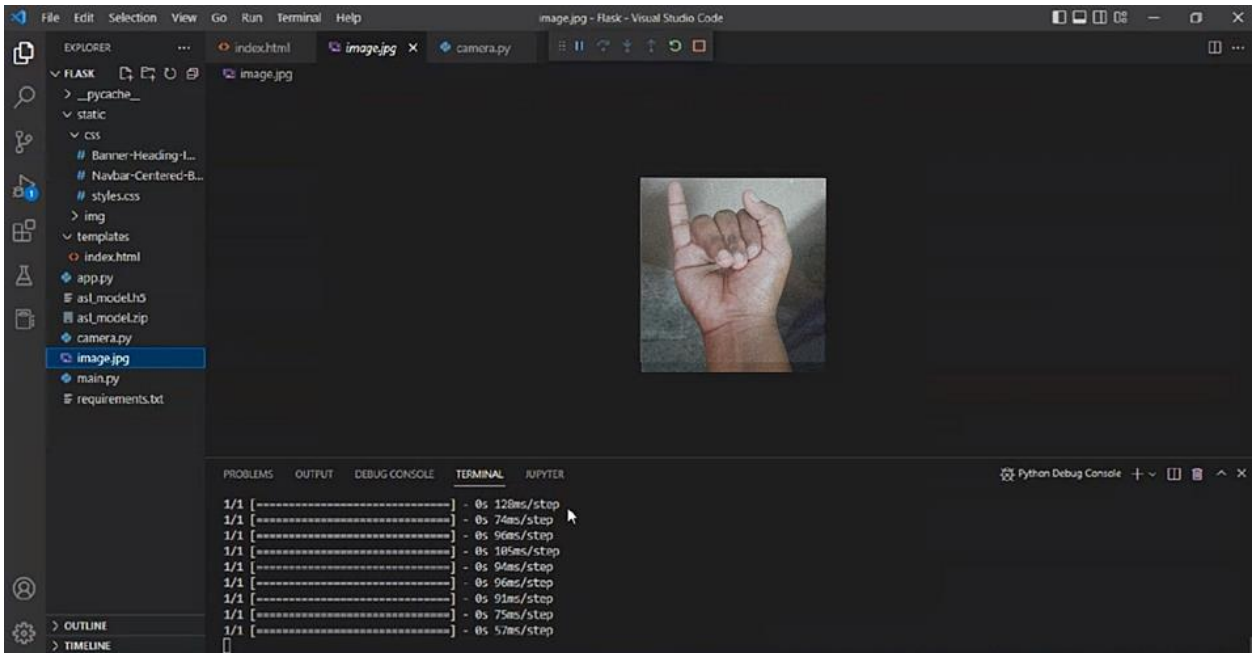


IMAGE PREDICTION



10. ADVANTAGES & DISADVANTAGES

Advantages

1. This project aims to develop an application that converts the sign language into a text in the desired language to convey a message to normal people, as well as convert text into understandable sign language for the deaf and dumb.
2. We are making use of a convolution neutral network to create model that is trained on different hand gestures.
3. This application enables deaf and dumb people to convey their information using signs which get converted to human understandable language and text is given as output.

Disadvantages

1. This requires a good internet connection to establish proper outputs.
2. Some people may not be as educated to use these kind of facilities which requires a proper guidance to use effectively.
3. People are supposed to have smart devices to use this mode of communication.

11.CONCLUSION

From this literature survey done on the communication system for specially-abled people, it is proposed to implement this project **Real time communication System powered by AI for specially-abled** using mobile application. The methodology is based on Hidden Markov Models movement of H-frame, Image processing and Object detection combined together.

12.FUTURE SCOPE

1. The application forms the base infrastructure for a complete communication-aid system for the deaf and mute.
2. To expand its capabilities, more languages can be easily added by adjusting sensor values.
3. Further, reliance on a dedicated computer system to enable the TTS functionality can be eliminated by adding a portable computer like the Raspberry Pi, which can handle the TTS while retaining portability of such a system.

13.APPENDIX

13.1 SOURCE CODE

APP.PY:

```python
from flask import Flask, Response, render_template
from camera import Video

app = Flask(__name__)
@app.route('/')
def index():
    return render_template('index.html')

def gen(camera):
    while True:
        frame = camera.get_frame()
        yield(b'--frame\r\n'
            b'Content-Type: image/jpeg\r\n\r\n' + frame +
            b'\r\n\r\n')

@app.route('/video_feed')
def video_feed():
    video = Video()
    return Response(gen(video), mimetype='multipart/x-mixed-replace; boundary = frame')


if __name__ == '__main__':
    app.run()
```

BANNER HEADING:

```css
.fit-cover {
  object-fit: cover;
}
```

HTML.PY:

```
<!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>Sign Language Detection</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(247, 246, 244);">
    <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(0, 0,
                <img src="{{ url_for('video_feed') }}" style="width: 100%;height: 100%;color: rgb(0, 0, 0);text-align: center;font-size: 20px;"
                    alt="Camera Access Not Provided!">
            </div>
        </div>
        <div class="d-flex flex-column justify-content-center align-items-center" style="margin-bottom: 10px;"><button
```


HTML.PY:

```
                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>
            </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">
```

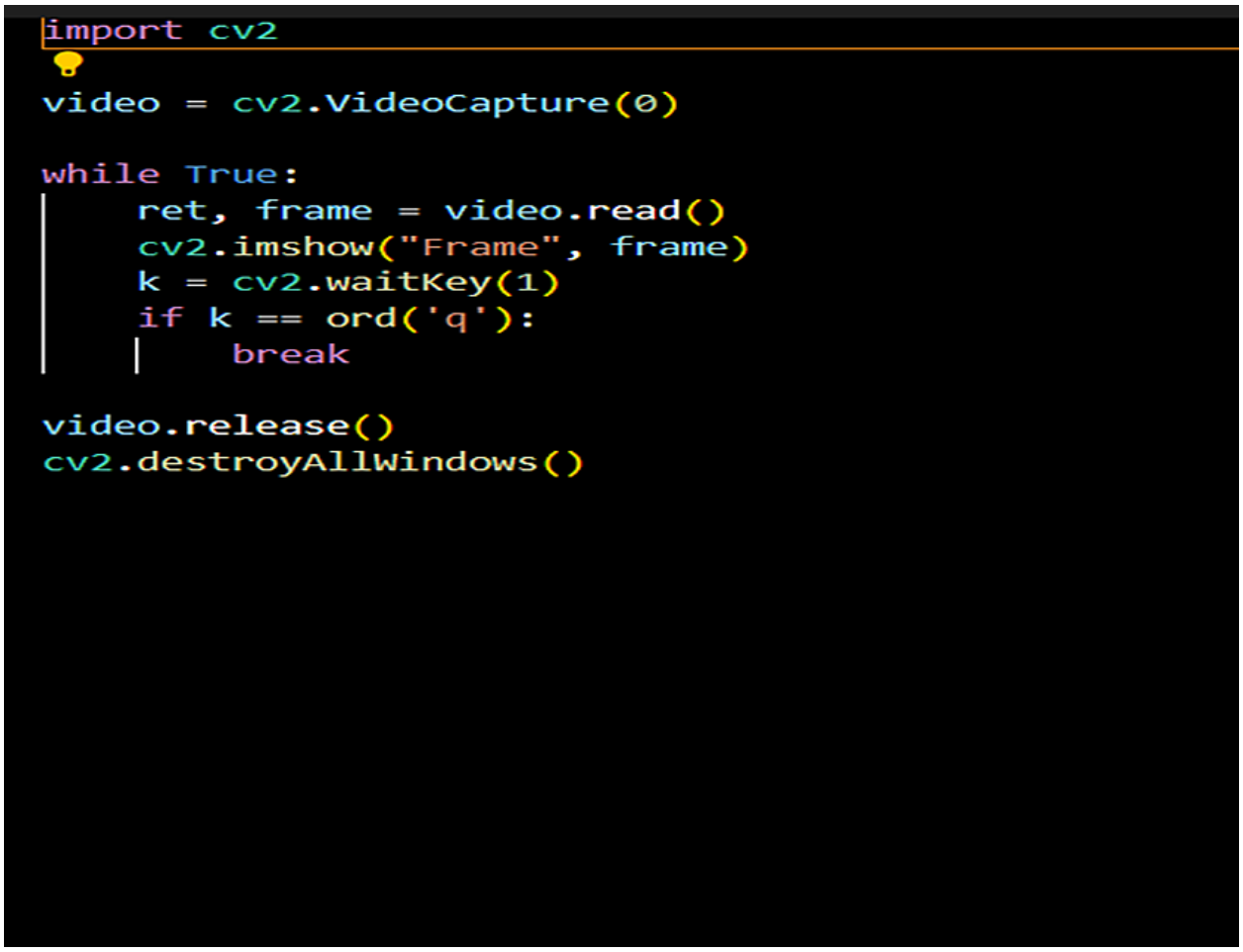
Activate W

HTML.PY:

```
                        <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>
        </div>
        <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/js/bootstrap.bundle.min.js"></script>
    </body>

    </html>
```

MAIN.PY:



```python
import cv2

video = cv2.VideoCapture(0)

while True:
    ret, frame = video.read()
    cv2.imshow("Frame", frame)
    k = cv2.waitKey(1)
    if k == ord('q'):
        break

video.release()
cv2.destroyAllWindows()
```

NAVBAR CENTERED:

```css
.bs-icon {
  --bs-icon-size: .75rem;
  display: flex;
  flex-shrink: 0;
  justify-content: center;
  align-items: center;
  font-size: var(--bs-icon-size);
  width: calc(var(--bs-icon-size) * 2);
  height: calc(var(--bs-icon-size) * 2);
  color: var(--bs-primary);
}

.bs-icon-xs {
  --bs-icon-size: 1rem;
  width: calc(var(--bs-icon-size) * 1.5);
  height: calc(var(--bs-icon-size) * 1.5);
}

.bs-icon-sm {
  --bs-icon-size: 1rem;
}

.bs-icon-md {
  --bs-icon-size: 1.5rem;
}

.bs-icon-lg {
  --bs-icon-size: 2rem;
}

.bs-icon-xl {
  --bs-icon-size: 2.5rem;
}
```

```css
.bs-icon.bs-icon-primary {
  color: var(--bs-white);
  background: var(--bs-primary);
}

.bs-icon.bs-icon-primary-light {
  color: var(--bs-primary);
  background: rgba(var(--bs-primary-rgb), .2);
}

.bs-icon.bs-icon-semi-white {
  color: var(--bs-primary);
  background: rgba(255, 255, 255, .5);
}

.bs-icon.bs-icon-rounded {
  border-radius: .5rem;
}

.bs-icon.bs-icon-circle {
  border-radius: 50%;
}
```

WEBSTREAMING:

```python
from flask import Flask, Response, render_template
from camera import Video

app = Flask(__name__)
@app.route('/')
def index():
    return render_template('index.html')

def gen(camera):
    while True:
        frame = camera.get_frame()
        yield(b'--frame\r\n'
            b'Content-Type: image/jpeg\r\n\r\n' + frame +
            b'\r\n\r\n')

@app.route('/video_feed')
def video_feed():
    video = Video()
    return Response(gen(video), mimetype='multipart/x-mixed-replace; boundary = frame')


if __name__ == '__main__':
    app.run()
```

13.2 GitHub & Project Demo link

https://github.com/IBM-EPBL/IBM-Project-6721-1658835052

https://drive.google.com/file/d/1QbvBS8AOirbv13ryQ7zqR-3ZmldozaDP/view?usp=drivesdk