

Real-Time Communication System

Powered by AI for Specially Abled

TEAM ID: PNT2022TMID01161

- TEAM LEADER: SHANMUGASRI.S.N
- TEAM MEMBER 1: PRIYENGA.E
- TEAM MEMBER2: SURUDHIKA.J
- TEAM MEMBER3: TIVONA.S

CONTENTS

1. INTRODUCTION

1. Project Overview
2. Purpose

2. LITERATURE SURVEY

1. Existing problem
2. References
3. Problem Statement Definition

3. IDEATION & PROPOSED SOLUTION

1. Empathy Map Canvas
2. Ideation & Brainstorming
3. Proposed Solution
4. Problem Solution fit

4. REQUIREMENT ANALYSIS

1. Functional requirement
2. Non-Functional requirements

5. PROJECT DESIGN

1. Data Flow Diagrams
2. Solution & Technical Architecture
3. User Stories

6. PROJECT PLANNING & SCHEDULING

1. Sprint Planning & Estimation
2. Sprint Delivery Schedule

7. CODING & SOLUTIONING

8. TESTING

1. Test case
2. User Acceptance Testing

9. RESULTS

1. Performance Metrics

10. ADVANTAGES & DISADVANTAGES

11. CONCLUSION

12. FUTURE SCOPE

1.INTRODUCTION

1.1Overview

In our society, we have people with disabilities. The technology is developing day by day but no significant developments are undertaken for the betterment of these people. Communications between deaf-mute and a normal person has always been a challenging task. It is very difficult for mute people to convey their message to normal people. Since normal people are not trained on hand sign language. In emergency times conveying their message is very difficult. The human hand has remained a popular choice to convey information in situations where other forms like speech cannot be used. Voice Conversion System with Hand Gesture Recognition and translation will be very useful to have a proper conversation between a normal person and an impaired person in any language.

1.2.Purpose

The project aims to develop a system that converts the sign language into a human hearing voice in the desired language to convey a message to normal people, as well as convert speech into understandable sign language for the deaf and dumb. We are making use of a convolution neural network to create a model that is trained on different hand gestures. An app is built which uses this model. This app enables deaf and dumb people to convey their information using signs which get converted to human-understandable language and speech is given as output.

1.2LITERATURESURVEY

A literature review is a thorough summary of earlier studies on a subject. The literature review examines scholarly books, journals, and other sources that are pertinent to a particular field of study. This prior research should be listed, described, summed up, impartially evaluated, and clarified in the review.

LITREATURE SURVEY- 1

TITLE: A survey on advanced technology for communication between deaf/dumb people using eye blink sensor & flex sensor.

AUTHOR: MERLIN MARY KOSHY, S.KARTHIKEYAN

YEAR: 2018

DESCRIPTION: The problem that our society faces nowadays is that people with disability are finding hard to grapple with the fast growing technology. The access to communication technologies has become essential for the handicapped people. Normally deaf/dumb people use hand gestures for exchanging information and they find hard to deal with people who can't grasp the idea of sign language. And therefore they can't communicate with normal people.

ADVANTAGES: Some of the most technologically advanced companies engage with users using digital assistants, which eliminates the need for human personnel. Many websites utilize digital assistants to deliver user-requested content.

DISADVANTAGES: The ability to create a machine that can simulate human intelligence is no small feat. It requires plenty of time and resources and can cost a huge deal of money.

LITREATURE SURVEY- 2

TITLE: Accessibility to electronic communication for people with cognitive disabilities

AUTHOR: JOHAN BORG, ANN LANTZ, JAN GULLIKSEN

YEAR: 2014

DESCRIPTION: The purpose of this study was to identify and synthesize measures for accessibility to electronic communication for people with cognitive disabilities by seeking answers to the following research questions: What measures to make electronic communication accessible to people with cognitive disabilities are evaluated and reported in the scientific literature? What documented effects do these measures have? Empirical studies describing and assessing cognitive accessibility measures were identified by searches of 13 databases.

ADVANTAGES: One of the biggest advantages of Artificial Intelligence is that it can significantly reduce errors and increase accuracy and precision

DISADVANTAGES: Humans cannot develop artificial intelligence because it is a technology based on pre-loaded facts and experience. AI is proficient at repeatedly carrying out the same task, but if we want any adjustments or improvements, we must manually alter the codes.

LITREATURE SURVEY- 3

TITLE: Communication skills in the disabled

AUTHOR: LIUBOV BEN-NOUN

YEAR: 2015

DESCRIPTION: Communication is an important human characteristic. In order to maintain relationships effectively humans must communicate with each other. In everyday life, there are a variety of communications including with work colleagues,

DESCRIPTION: The problem that our society faces nowadays is that people with disability are finding hard to grapple with the fast growing technology. The access to communication technologies has become essential for the handicapped people. Normally deaf/dumb people use hand gestures for exchanging information and they find hard to deal with people who can't grasp the idea of sign language. And therefore they can't communicate with normal people.

ADVANTAGES: Some of the most technologically advanced companies engage with users using digital assistants, which eliminates the need for human personnel. Many websites utilize digital assistants to deliver user-requested content.

DISADVANTAGES: The ability to create a machine that can simulate human intelligence is no small feat. It requires plenty of time and resources and can cost a huge deal of money.

LITREATURE SURVEY- 4

TITLE: Perceptions of communication between people with communication disability and general practice staff

AUTHOR: JOAN MURPHY

YEAR: 2016

DESCRIPTION: To explore consultation between people with communication disability and General Practice (GP) staff from the perspectives of both patients and staff. Communication disability causes a particular problem in primary care. This issue has not yet been investigated from the perspective of both patients and GP staff.

ADVANTAGES: In practically every field, AI is the driving force behind numerous innovations that will aid humans in resolving the majority of challenging issues.

DISADVANTAGES: A big disadvantage of AI is that it cannot learn to think outside the box. AI is capable of learning over time with prefer data and past experiences, but cannot be creative in its approach.

LITREATURE SURVEY- 5

TITLE: A survey about deaf and dumb assisting system

YEAR: 2020 **DESCRIPTION:** In this paper we tend to represent sensible forearm band for deaf and dumb patient. concerning 9 billion individuals within the world are deaf and dumb. The communication between a deaf traditional visual individuals. This creates a awfully very little area for them with communication being a basic side of human life.

ADVANTAGES: The primary advantage is that the device can be carried out easily because of its low weight.

2.LITERATURE SURVEY

2.1.Existing problem

Some of the existingsolutions for solvingthis problem are:

Technology

Using a laptop or smart phone as a means of communication is one of the simplest things you can do. A screen reader can be used by someone who is blind or has low eyesight to hear the text being read aloud while a deaf person can type out what they wish to say. A Deaf person can read what a blind person says by using speech recognition software to translate what they are saying into writing.

Interpreter

If a sign language interpreter is available and the deaf person is proficient in sign language, this makes communication much easier. The interpreter enables the blind person and the deaf person to converse. The blind person can communicate with the deaf person using sign language, and the interpreter can translate any words the blind person says into sign language for the deaf person.

Speaking

Depending on how severely deaf they are, a blind person utilising speech may be able to understand a deaf person. For instance, someone who is deaf could have enough residual hearing (with or without the use of an assistive hearing device like a hearing aid) to understand what the person who is blind or has low vision is saying. However, because it greatly depends on the unique circumstances of each person and their environment (for instance, some locations may have excessive background noise), this kind of communication is frequently not the most efficient.

2.2References

1.Upendran, S., and Thamizharasi, A., "American Sign Language interpreter system for deaf and dumb individuals", In the Proceedings of the International Conference on Control, Instrumentation, Communication and Computational Technologies (ICCICCT),

pp. 1477-1481, 2014

2.Rajamohan, A., Hemavathy, R., and Dhanalakshmi, M., "Deaf-Mute Communication Interpreter", International Journal of Scientific Engineering and Technology, Vol.2, No.5, pp.336-341, 2013.

3.Verma, P., Shimi S. L. and Priyadarshani, R., "Design of Communication Interpreter for Deaf and Dumb Person", Vol.4, no.1, 2013.

2.3 Problem Statement Definition

Just uncommonly abled individuals are shown gesture-based communication and the normal individual is ignorant its functioning causing a correspondence hole. Under crisis circumstances, it is significantly more hard for uniquely abled individuals to find support. 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. Non-Crisis typical conditions can likewise be difficult for them to explore requiring unique help. Interchanges between hard of hearing quiet and a typical individual has forever been a difficult errand. It is truly challenging for quiet individuals to pass their message on to typical individuals. Since typical individuals are not prepared close by gesture-based communication.

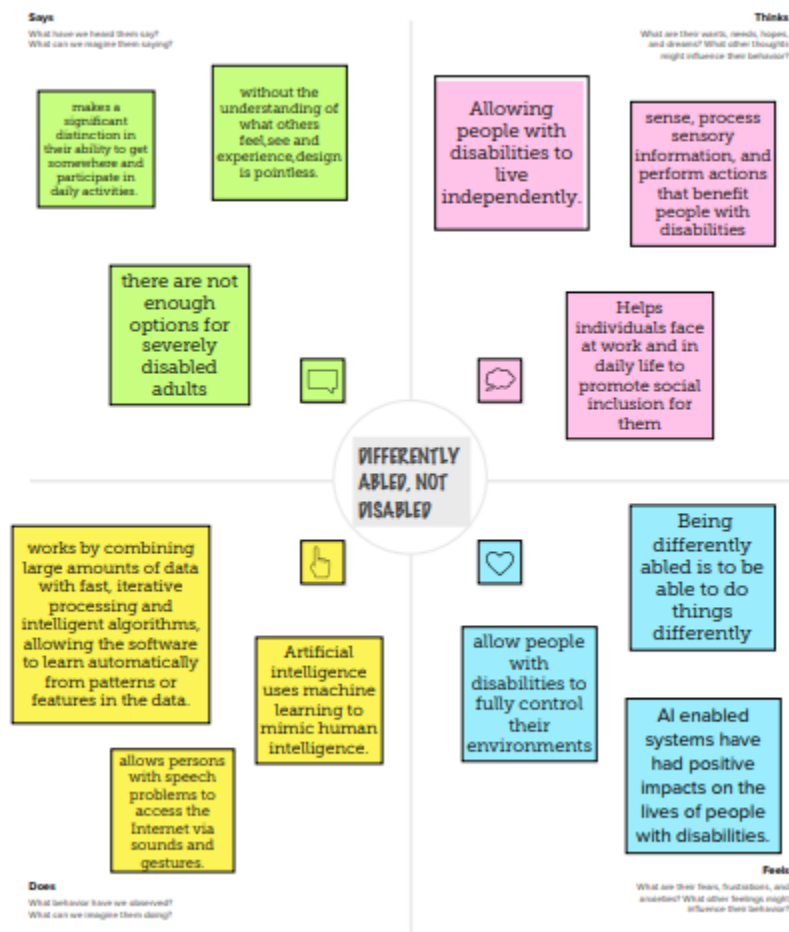
3. IDEATION AND PROPOSED SOLUTION

The ultimate goal of this is to produce a huge number of ideas, which the team can then sort through and narrow down to the best, most useful, or most creative ones in order to be the inspiration for fresh and improved design concepts and products. Ideation is the process through which you come up with concepts and answers using tools like the empathy map canvas, brainstorming, etc. The third stage of the Design Thinking process is ideation process.

The suggested solution is the one in which a convolution neural network is used to build

a model that is trained on various hand movements. This model is used to create a website. This website enables deaf and dumb individuals to communicate using signs that are translated into English alphabets that can be read by humans.

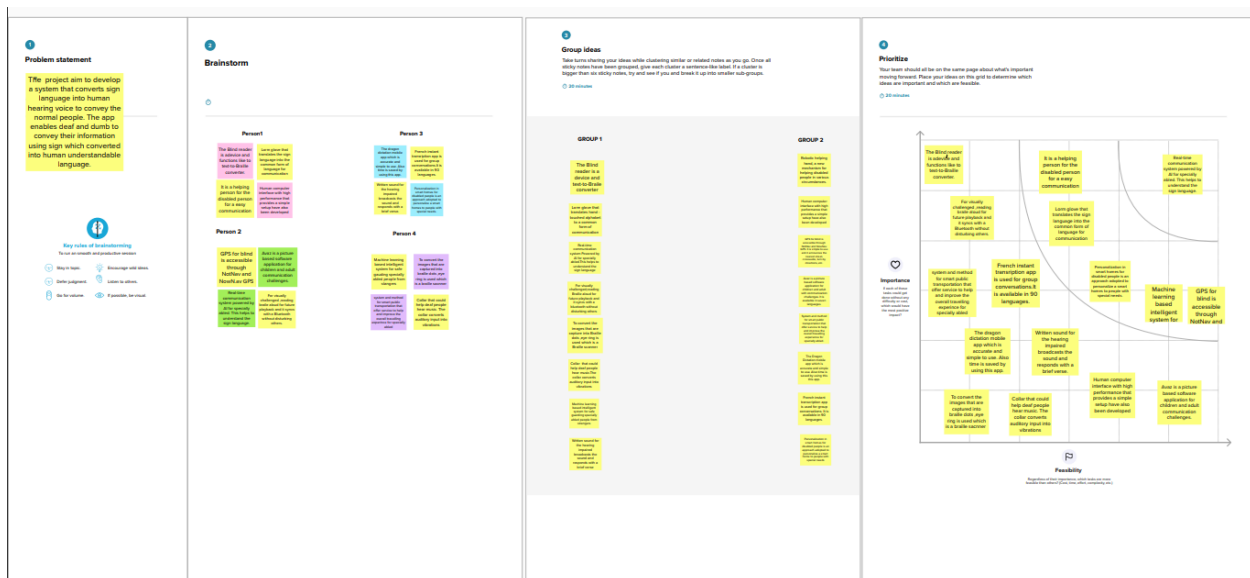
3.1. Empathy map canvas



A collaborative visualisation called an empathy map is used to explain what is known about a specific user type. It externalises user knowledge to facilitate decision-making and foster a shared understanding of user demands. The user or persona is positioned in the centre of a traditional empathy map, which is divided into four quadrants (Says, Thinks, Hears, and Sees). Empathy maps, which are neither chronological nor sequential, offer a

glimpse into a user's character as a whole. The user's actual spoken words during an interview or other usability study are recorded in the Says quadrant. It should ideally include exact quotes from studies. What the user is thinking during the encounter is captured in the Thinks quadrant. The user's emotional state is conveyed in the Hear quadrant by an adjective and a brief statement for context. The user's actions are contained within the See quadrant. Throughout the project, empathy maps should be utilised to find areas of agreement among team members and to comprehend and rank user demands. Any qualitative research technique can serve as the basis for empathy mapping. They can assist team members in determining which aspects of their user they are already familiar with and which areas require additional user data collection. It is best to employ empathy maps right away throughout the design phase. The project gains significant advantages from both the empathy map-making process and the final product.

3.2.Ideation & Brainstorming



Ideation is the process through which you come up with concepts and answers using tools like the empathy map canvas, brainstorming, etc. The third step of the Design Thinking process is also known as ideation. While brainstorming can be used to come up with potential answers to straightforward issues, it is unreasonable to expect it to solve most issues or fulfil most planning requirements. First, brainstorming should prioritise quantity over

quality. The investigation phase of a new project begins with brainstorming, therefore it's critical to be open to all ideas and options. When team members separate the good ideas from the less-than-good ones out of a fear of rejection or condemnation, problems occur. The method is useful when used as a component of a bigger project that also involves the independent development of data and concepts and their collection, assessment, and selection. A plan, procedure, solution, or approach can be created through brainstorming, as well as checklists. The benefit of the procedure is that it generates more quality ideas in a shorter amount of time than a traditional gathering or conference would.

3.3.Proposed Solution

The term "problem-solution fit" simply refers to identifying the issue with the current design and attempting to provide a fix. The ideas of Lean Startup, LUM (Lazy User Model), and User Experience design are the foundation of the Problem-Solution Fit. It enables us to recognise behavioural trends, as well as what would be effective and why. It is used to find solutions that have a better possibility of being adopted, cut down on testing time, and better understand the state of the problem. It aids in the resolution of difficult issues, assists in identifying design flaws, and provides us with a clear-cut solution to any issues that may have arisen.

3.4.Problem solutionfit

Simply said, the Problem-Solution Fit refers to finding the issue in the current design and attempting to provide a fix. The foundation of the Problem-Solution Fit is the User Experience design, Lean Startup, and the "lazy user model." It assists us in recognising behavioural patterns, as well as what would work and why. It is used to find solutions with a better possibility of being adopted, shorten testing times, and get a clearer picture of the current situation. It aids in the solution of complicated problems, aids in the discovery of design flaws, and provides us with a clear-cut solution to the design flaws that have been plaguing the project.

Define CS, fit into CC	1.CUSTOMER SEGMENT(S) Specially abled persons	6.CUSTOMER CONSTRAINTS A cochlear implant is an implanted electronic medical device that can produce useful hearing sensation by electrically stimulating nerves inside the inner ear.	5.AVAILABLE SOLUTIONS AI-voice-assisted technologies, like Echo, Google Home, Alexa, have created new means of accessibility for disabled people. As Artificial Intelligence takes an important role in communication and interaction, the use of this technology enables individuals with disabilities to access information much easier, all just by speaking to their devices.	Explore AS, differentiate
Focus on I&P, target to BE, understand HC	2.JOBS-TO-BE-DONE / PROBLEMS Any denial of opportunity is not simply a result of bodily limitations. It is also down to the attitudinal, social, and environmental barriers facing disabled people.	9.PROBLEM ROOT CAUSE Disabilities affect the entire family. Meeting the complex needs of a person with a disability can put families under a great deal of stress — emotional, financial, and sometimes even physical. However, finding resources, knowing what to expect, and planning for the future can greatly improve overall quality of life.	7.BEHAVIOUR Directly related : D-Talk, sign language, message conversion, hand gesture, mental damage, difficulty to communicate. Indirectly associated : Empowered technology, completely paralyzed, noble cause, using sensors in day to day life, environmental threats affect their life difficulty in society.	Focus on I&P, 'ajipitak', understand HC
Identify strong TRIGGERS	3.TRIGGERS Persons using sensors, vibrators, neural networks are the things used for developing their communication, for the accessible language and to avoid long words that might be hard to understand. 4.EMOTIONS: BEFORE /AFTER They loss their confidence and they feel unlike whose have the inferiority complex to own	10. YOUR SOLUTION AI powered solution stand to make a real difference for people with disabilities, supporting them in activities of daily living and enabling them to gain new skills. AI technology helping disabled people opens up new opportunities for accessibility, inclusion in society, and independent living that would otherwise be difficult or impossible to achieve.	8. CHANNELS OF BEHAVIOURS ONLINE Providing special Equipment to augment Educational services for them to improve their mind and mental health. They affected by social medias by using their part of things mostly. OFFLINE They mostly affected by going into our direct society i.e schools, colleges and workplace such things affect their life directly.	Extract online & offline CHoB&E

4. REQUIREMENT ANALYSIS

4.1.Functional requirement

Functional requirements are the features that the system must provide that are specifically requested by the end user. All of these features must unavoidably be built into the system as part of the design. These are shown or described as the input to be provided to the system, the operation carried out, and the intended outcome. In contrast to non-functional needs, they are essentially the user-stated criteria that are visible in the final design.

4.2.Non- Functional requirement

Non-functional requirements are essentially the quality restrictions that the system must meet in order to follow the design plan. Depending on the project, these criteria may be prioritised differently or applied to a different degree. Additionally known as non-behavioral requirements. Basically, they deal with

- I. Security
- II. Reliability
- III. Performance
- IV. Availability
- V. Scalability
- VI. Usability

Non-functional Requirements:

Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The app is effective and easy for the users to learn and use the application.
NFR-2	Security	All data inside the system or its part is protected against malware attacks or unauthorized access
NFR-3	Reliability	The application performs without any failure and does not produce any glitch.
NFR-4	Performance	The system's response time under different load conditions is good.
NFR-5	Availability	The system is accessible for a user at any given point of time.
NFR-6	Scalability	It assesses the highest workloads under which the system will still meet the performance requirements.

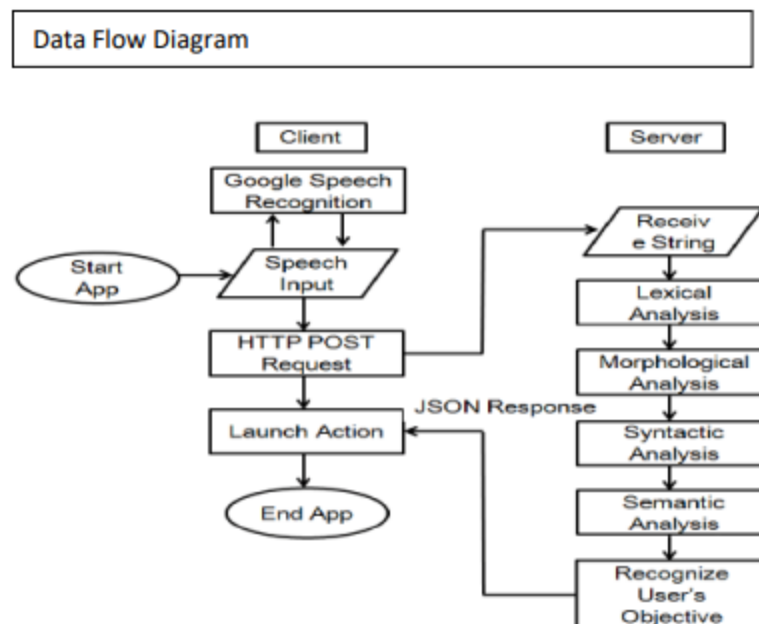
5.PROJECT DESIGN

The project lifecycle's initial stage, project design is where concepts, procedures, resources, and deliverables are organised. A project design comes before a project plan because it provides a broad picture while the latter contains more specific details. Our project's ultimate goal is to convert sign language into English alphabets that are clear to humans. To do this, we should create a website that allows for the conversion of sign

language into English alphabets. Data flow diagrams, solution architectures, and technological architectures are all included. Let's look at the following in depth:

5.1.Data Flow Diagrams

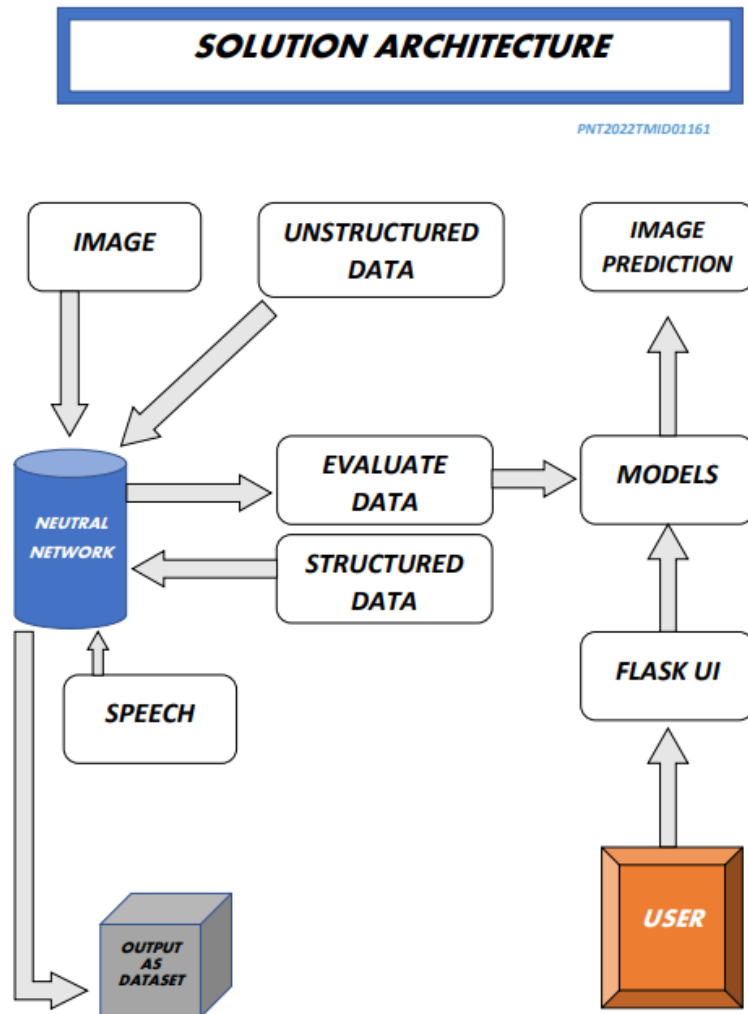
The information flow within a system is typically represented visually using a data flow diagram. A tidy and understandable data flow diagram can graphically represent the appropriate quantity of system requirements. It displays the system's data flow from input to output. Additionally, it demonstrates the materials used in the design. It makes it much simpler to comprehend how the to-be-developed design will flow. It displays data inputs, outputs, storage locations, and routes between each destination using predefined symbols such rectangles, circles, and arrows as well as brief text labels. The design team can quickly comprehend the flow thanks to those symbols. According to the specifications, we created these data flow diagrams.



5.2.Solution Architecture

Solution architecture is the process of creating solutions using established

procedures, rules, and best practises with the goal of ensuring that the created solution is compatible with the enterprise architecture in terms of information architecture, system portfolios, integration needs, and other factors. The combination of roles, procedures, and documentation can thus be seen as being used to solve certain business requirements, needs, or issues designing and creating information systems and applications.

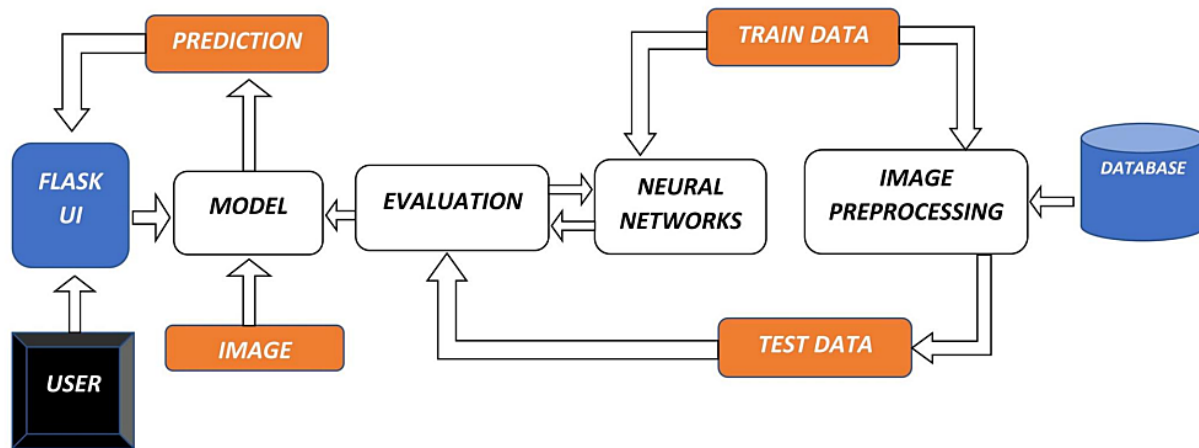


Technical Architecture:

Technical Architecture:

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2

Example: Real time communication system powered by AI for specially disable



Systems are designed using technical architecture, a type of information technology (IT) architecture. It entails creating a technical blueprint for how all components should be arranged, work together, and depend on one another in order to satisfy system-related criteria. The usage of a technological architecture diagram is widespread because it offers precise information about how the system was designed and the components that were employed.

The table of technologies and components provides a detailed description of the sources and components utilised in the design. Additionally, the detailed explanation provided in the table makes it simpler to comprehend how the components work. Every component employs a different technology and has a unique application. The following elements were utilised in this design:

- User interface
- Flash UI
- Models
- Image prediction
- Image
- Speech
- Evaluate data
- Unstructured data
- Structured data

- Data set
- Neural network

Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User	Communication barriers of deaf or hearing- impaired people with other communities, contributing significantly to their social inclusion	AI technology
2.	Flash UI	Flash's user interface components let you interact with the users that use your site and gather information.	Using the cloud it can be executed
3.	Models	Support Vector Machine (SVM) is subsequently applied to classify our gesture image dataset.	Machine Learning
4.	Image Prediction	Gesture can be completely observable and viewing a gesture from another perspective makes the prediction.	ANN,CNN
5.	Image	Image processing is used to made the image into signs by the neural network	ANN, CNN, Open CV
6.	Speech	Speech translates the voice into image and sensitive neural play.	AI and machine learning methods like deep learning and neural networks
7.	Evaluate data	Aims to estimate the generalization accuracy of a model on future (unseen/out-of-sample) data.	
8.	Unstructured data	P unstructured data is a conglomeration of many varied types of data that are stored in their native formats	Natural Language Processing (NLP)
9.	Structured data	Typically categorized as quantitative data — is highly organized and easily decipherable by machine learning algorithms	Machine language and artificial intelligence tools
10.	Neural network	The same convolutional neural network architecture was used for both, the top view and the bottom view models, the only difference is the number of output units	AI technology
11.	Dataset	First prototype of this system is was used a dataset of 24 static signs from the Panamanian Manual Alphabet.	AI technology

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Robots and other tools provide home-based care and other assistance, allowing people with disabilities to live independently	Artificial Intelligence like robots and software systems
2.	Security Implementations	Set the inclusion and exclusion criteria , Report the results in the survey	Artificial Intelligence
3.	Scalable Architecture	The improvement in the specially abled persons interaction with the environments	Artificial Intelligence
4.	Availability	Technology solutions that mimic humans and use logic from playing chess to solving equations and Machine learning is one of the technologies	Artificial Intelligence
5.	Performance	Enables people with disabilities to step into a world where their difficulties are understood and taken into account	Artificial Intelligence

It is crucial to look at the design's qualities while creating a system. The

following characteristics should always be included in every design.

1. Open-source framework
2. Security Implementation
3. Scalable Architecture
4. Availability
5. Performance

5.3 User Stories

A user narrative is a casual, all-inclusive description of a design element written from the viewpoint of the end user. Its objective is to explain how a design will benefit the end user. Putting people first is a

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	Through a third party Google link.	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password	Can enter manually or auto fill depends.	High	Sprint-1
	Dashboard	USN-6	As a user, I want to know about my data what i have given so to see them visually appealing	Can see them.	Medium	Sprint-1
Customer (Web user)	Registration	USN-7	As a user I can login through phone number with OTP instead of Gmail	I can register & access dashboard with mobile	High	Sprint-1
Customer Care Executive		USN-8	Can get the service by dialling support or the call	after registering as a member can avail this.	Medium	Sprint -1
Administrator		USN-9	Admin side in the company should take care	all the requirements are there.	High	Sprint 1
Sign up		USN-10	Need to sign up to use it.	Need valid credentials.	High	Sprint-1
Wish list		USN-11	Before availing the service can be kept aside.	As a user can review and use the service.	Low	Sprint-2
Enrolled		USN-12	Can use the service after enrolling, so that user can know and use.	As a user it is quite appealing.	Low	Sprint-2

crucial aspect of agile software development, and a user narrative places end users at the forefront of the discussion. These narratives give context for the development team's work in non-technical terms. The development team understands their goals, the nature of their work, and the value it adds after reading a user narrative. One of the

essential elements of an agile program is the user story. They aid in creating a framework for everyday work that is user-focused, which encourages cooperation, innovation, and better design in general.

6.PROJECT PLANNING AND SCHEDULING

6.1Sprint planning and Estimation

Planning and scheduling are separate but connected components needed for effective project management. The major focus of the planning phase is choosing the appropriate policies and procedures to achieve the project's objectives. During scheduling, an operational schedule is created from the project action plans for the scope.

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data Collection	USN-1	Collect Dataset .	10	High	Shanmugasri, Tivona
Sprint-1		USN-2	Image preprocessing	7	Medium	Priyenga,Shanmugasri
Sprint-2	Model Building	USN-3 Body text	Import the required libraries, add the necessary layers and compile the model	10	High	Surudhika
Sprint-2		USN-4	Training the image classification model using CNN	7	Medium	Surudhika, Shanmugasri
Sprint-3	Training and Testing	USN-5	Training the model and testing the model's performance	10	High	Priyenga, Tivona
Sprint-4	Implementation of the application	USN-6	Converting the input sign language images into english alphabets	7	Medium	Priyenga,Surudhika

6.1.Sprint Planning& Estimation:

The process for estimating the time needed to perform a priority item from the product backlog is called sprint planning and estimation. This effort is often assessed in relation to the amount of time needed to finish the work, which enables precise sprint planning. It is necessary for,

Making teams accountable for deliverables

- i. Inducing discipline across the team members
- ii. Predicting the approximate time it will take to finish the project
- iii. Enabling better sprint management
- iv. Improving team productivity

6.2.Sprint Delivery Schedule

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	25 Oct 2022	31 Oct 2022	10	30 Oct 2022
Sprint-2	20	6 Days	1 Nov 2022	05 Nov 2022	8	06 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	9	12 Nov 2022
Sprint-4	20	6 Days	13 Nov 2022	19 Nov 2022	6	18 Nov 2022

7.CODING & SOLUTIONING

7.1.FEATURE1

1182 lines (1182 sloc) | 47 KB

<>  Raw Blame   

Image Preprocessing

```
In [29]: from tensorflow.keras.preprocessing.image import ImageDataGenerator
```

```
In [30]: train_datagen=ImageDataGenerator(rescale=1./255, horizontal_flip=True, vertical_flip=True, zoom_range=0.2)
```

```
In [31]: test_datagen=ImageDataGenerator(rescale=1./255)
```

```
In [32]: x_train = train_datagen.flow_from_directory(r"/content/drive/MyDrive/ibm/Dataset/training_set", target_size=(64,64), class_mode="categorical", batch_size=32)

Found 5630 images belonging to 9 classes.
```

```
In [34]: x_test = test_datagen.flow_from_directory(r"/content/drive/MyDrive/ibm/Dataset/test_set", target_size=(64,64), class_mode="categorical", batch_size=32)

Found 2243 images belonging to 9 classes.
```

Model Building

```
In [35]: 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
```

7.1.FEATURE2

Testing the model

```
In [18]: from keras.models import load_model
import numpy as np
import cv2
```

```
In [19]: from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
import numpy as np
```

```
In [21]: model=load_model("as1png.h5")
img = image.load_img(r"/content/drive/MyDrive/ibm/Dataset/test_set/D/10.png",target_size=(64,64))
img
```

Out[21]: 

```
In [22]: x = image.img_to_array(img)
x
```

Out[22]: array([[0., 0., 0.],
[0., 0., 0.],
[0., 0., 0.],
...,
[0., 0., 0.],
[0., 0., 0.],
[0., 0., 0.]])

[[0., 0., 0.],
[0., 0., 0.],
[0., 0., 0.]])

[[0., 0., 0.],
[0., 0., 0.],
[0., 0., 0.],
...,
[0., 0., 0.],
[0., 0., 0.],
[0., 0., 0.]])

[[0., 0., 0.],
[0., 0., 0.],
[0., 0., 0.],
...,
[0., 0., 0.],
[0., 0., 0.],
[0., 0., 0.]]], dtype=float32)

```
In [23]: x.shape
```

Out[23]: (64, 64, 3)

```
In [24]: x = np.expand_dims(x,axis=0)
x.shape
```

Out[24]: (1, 64, 64, 3)

```
In [25]: pred = model.predict(x)
```

1/1 [=====] - 0s 172ms/step

```
In [26]: pred
```

Out[26]: array([[0., 0., 0., 1., 0., 0., 0., 0.]], dtype=float32)

```
In [27]: class_name=["A","B","C","D","E","F","G","H","I"]
pred_id = pred.argmax(axis=1)[0]
pred_id
```

```

Out[23]: (64, 64, 3)

In [24]: x = np.expand_dims(x,axis=0)
          x.shape

Out[24]: (1, 64, 64, 3)

In [25]: pred = model.predict(x)

1/1 [=====] - 0s 172ms/step

In [26]: pred

Out[26]: array([[0., 0., 0., 1., 0., 0., 0., 0.]], dtype=float32)

In [27]: class_name=["A","B","C","D","E","F","G","H","I"]
          pred_id = pred.argmax(axis=1)[0]
          pred_id

Out[27]: 3

In [28]: print("the alphabet is ",str(class_name[pred_id]))

the alphabet is D

```

8.TESTING

After designing the website we need to test it whether it working finely. And it is mandatory to create a test report based on the testing. A test report is an organized summary of testing objectives, activities, and results. Test Report is a document which contains a summary of all test activities and final test results of a design. Test report is an assessment of how well the Testing is performed. Based on the test report, we can better understand the design quality and its performance.

8.1 Test cases

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the [ProductName] project at the time of the release to User Acceptance Testing (UAT).

2. Defect Analysis

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

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	11	2	3	2	18
Duplicate	1	3	4	0	8
External	3	5	0	0	8
Fixed	12	2	5	22	41
Not Reproduced	0	1	0	0	1
Skipped	0	0	1	2	3
Won't Fix	0	4	1	1	7
Totals	27	17	14	27	86

3. Test Case Analysis

This report shows the number of test cases that have passed, failed, and untested

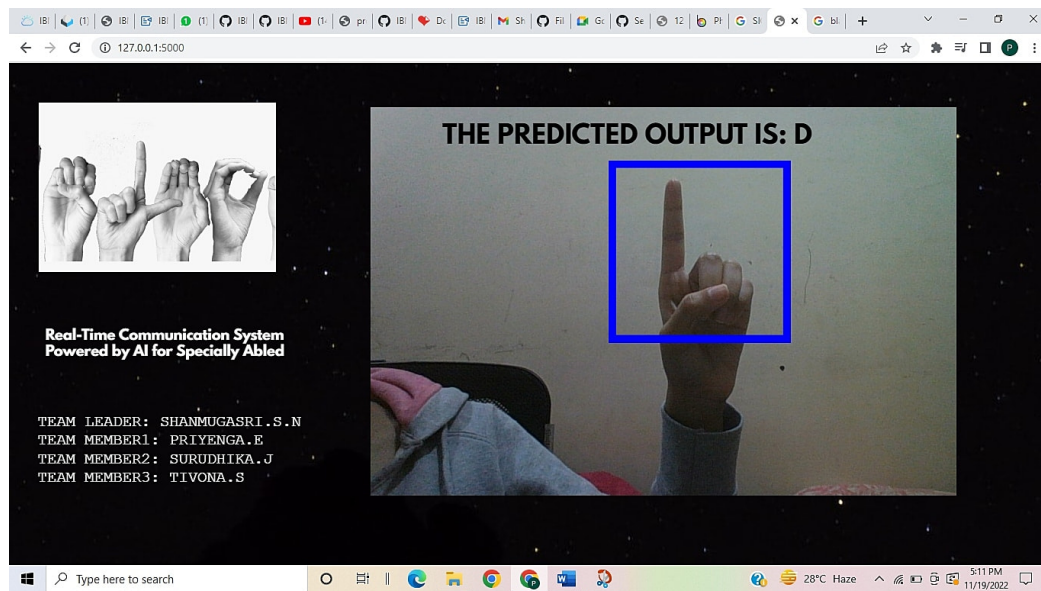
Section	Total Cases	Not Tested	Fail	Pass
Print Engine	8	0	0	8
Client Application	49	0	0	49
Security	4	0	0	4
Outsource Shipping	4	0	0	4
Exception Reporting	11	0	0	11
Final Report Output	2	0	0	2
Version Control	1	0	0	1

9.RESULT

Finally we got the output for the desired input. Our ultimate aim is to covert sign language into English alphabets .We have created the user interface for implementing it.Thus the websitewas created successfully. As a result both the deaf and dump along with normal people can able to understand the desired languagethat is required for them.

9.1.Performance Metrics

The proposed procedure was implemented and tested with set of images. The set of 15750 images of Alphabets from "A" to "I" are used for training database and a set of 2250 images of Alphabets from "A" to "I" are used for testing database. Once the gesture is recognised the equivalent Alphabet is shown on the screen. Some sample images of the output are provided below:



10.ADVANTAGES & DISADVANTAGES

Advantages:

1. It is feasible to develop a mobile application to close the communication gap between the general population and those who are deaf or dumb.
2. The user may select which sign language to read by adding the dataset when new sign language standards are created.

Disadvantages:

1. The present model is limited to the letters A through I.
2. Alphabets from J cannot be recognised in the absence of gesture recognition because they need user input in the form of a gesture.
3. The accuracy isn't excellent because there aren't many or high-quality photographs in the dataset, but that can be fixed by changing the dataset.

11.CONCLUSION

The use of sign language can help hearing and deaf individuals communicate more effectively. The technology strives to reduce the communication gap between the deaf community and the rest of society since it supports two-way conversation. The suggested approach converts spoken languages into human-understandable English alphabets. The model receives hand signals from this system, who identifies them and shows the corresponding Alphabet on the screen. This initiative allows deaf-mute persons to perform sign language with their hands, which will later be translated into alphabets.

12.FUTURE SCOPE

For persons with particular needs, such as the deaf and dumb, having technology that can convert hand sign language to its appropriate alphabet is a game changer. The web program may easily be developed to detect letters other than "I," numbers, and other symbols with the addition of gesture recognition. Gesture recognition can also be used to control software and hardware interfaces. For ISL word and sentence level recognition, we can create a model. A system that can recognise changes in the temporal space will be needed for this. Additionally, by creating a comprehensive solution, we can bridge the communication gap for those who are deaf or hard of hearing.

13.APPENDIX

Source Code for Model Training and Saving:

```

<!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>SmartBridge_WebApp_VideoTemplate</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>
    <nav class="navbar navbar-light navbar-expand-md py-3"
style="background: #121212;">
        <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"
style="color:#ffffff;"></i></span><span style="color:
rgb(255,255,255);">Real-Time Communication
                System Powered By AI&nbsp;For Specially
Abled</span></a>
            <div></div>
        </div>
    </nav>
    <section style="background-image:
url('https://img.freepik.com/free-vector/hand-sign-background-doodle-

```

```
pattern-black-white-vector_53876-
157748.jpg?w=740&t=st=1668366858~exp=1668367458~hmac=5e3fc702d27b9c822
35eebd9c4e4ae26c8718196c48854abbf8dff28fc0c11b9');background-size:
cover;
```

```
">
```

```
<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(255,255,255) ;">
```

```

```

```
</div>
```

```
</div>
```

```
<div class="d-flex flex-column justify-content-center align-
items-center" style="margin-bottom: 10px;"><button style="background:
rgb(33,37,41);">
```

```
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(18,18,18);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 class="accordion-item" style="background:
rgb(33, 37, 41);">
            <h2 class="accordion-header" role="tab"><button
class="accordion-button collapsed"
                data-bs-toggle="collapse" data-bs-
target="#accordion-1 .item-2" aria-expanded="false"
                aria-controls="accordion-1 .item-2"
                style="background: rgb(18, 18, 18); color:
rgb(231, 241, 255);">Developed By</button></h2>
            <div class="accordion-collapse collapse item-2"

role="tabpanel" data-bs-parent="#accordion-1">
                <div class="accordion-body">
                    <p class="mb-0">TEAM ID:PNT2022TMID01161

```


1. Shanmugasri.S.N 211419104252
2.

Priyenga.E 211419104207
3.

Tivona.S 211419104280
3.

Surudhika.J 211419104270

</p>

</div>

</div>

</div>

</div>

</div>

</section>

</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">

<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"></div>

<div class="modal-footer"><button class="btn btn-
secondary" type="button"
data-bs-dismiss="modal">Close</button></div>

</div>

</div>

</div>

<script

src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/js/bootstrap.bu
ndle.min.js"></script>

</body>

</html>

FINAL CODE

File Edit View Navigate Code Refactor Run Tools Git Window Help main_app.py - index.html

project_1 FINAL DELIVERABLES FINAL CODE templates index.html

Project

External Libraries

Scratches and Consoles

```
1 <!DOCTYPE html>
2 <html lang="en">
3
4 <head>
5   <meta charset="utf-8">
6   <meta name="viewport" content="width=device-width, initial-scale=1.0, shrink-to-fit=no">
7   <title>SmartBridge_WebApp_VideoTemplate</title>
8   <link rel="stylesheet" href="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/css/bootstrap.min.css">
9   <link rel="stylesheet" href="https://use.fontawesome.com/releases/v5.12.0/css/all.css">
10  <link rel="stylesheet" href="assets/css/Banner-Heading-Image.css">
11  <link rel="stylesheet" href="assets/css/Navbar-Centered-Brand.css">
12  <link rel="stylesheet" href="assets/css/styles.css">
13 </head>
14
15 <body>
16   <nav class="navbar navbar-light navbar-expand-md py-3" style="background-color: #f8d7da;">
17     <div class="container">
18       <div class="navbar-brand d-flex align-items-center" href="#"><span
19         class="bs-icon-sm bs-icon-rounded bs-icon-primary d-flex justify-content-center align-items-center" style="font-size: 2em; margin-right: 10px;"><i class="fas fa-flask" style="font-size: 2em; margin-right: 10px;"></i></span><span style="font-size: 1.2em; font-weight: bold;">Real-Time Commun
20       </div>
21     </div>
22     System Powered By AI For Specially Abled</span></a>
```

10 items 1 item selected 720 bytes Available on this device

Downloads

File Edit View Navigate Code Refactor Run Tools Git Window Help main_app.py - index.html

project_1 FINAL DELIVERABLES FINAL CODE templates index.html

Project

External Libraries

Scratches and Consoles

```
22   System Powered By AI For Specially Abled</span></a>
23   </div></div>
24 </div>
25 </nav>
26 <section style="background-color: #f8d7da;">
27   <section>
28     <div class="d-flex flex-column justify-content-center align-items-center">
29       <div class="d-flex flex-column justify-content-center align-items-center" id="div-video-feed" style="background-color: #f8d7da; padding: 10px; border: 1px solid #dee2e6;">
30         
31       </div>
32     </div>
33     <div class="d-flex flex-column justify-content-center align-items-center" style="background-color: #f8d7da; padding: 10px; border: 1px solid #dee2e6;">
34       <button class="btn btn-info" type="button" data-bs-target="#modal-1" data-bs-toggle="modal">Quit
35     </div>
36   </section>
37   <section>
38     <div class="container">
39       <div class="accordion text-white" role="tablist" id="accordion-1">
40         <div class="accordion-item" style="background-color: #f8d7da; border: 1px solid #dee2e6;">
41           <h2 class="accordion-header" role="tab"><button class="accordion-button" data-bs-target="#modal-1" data-bs-toggle="modal">Quit
42         </div>
43       </div>
44     </div>
```

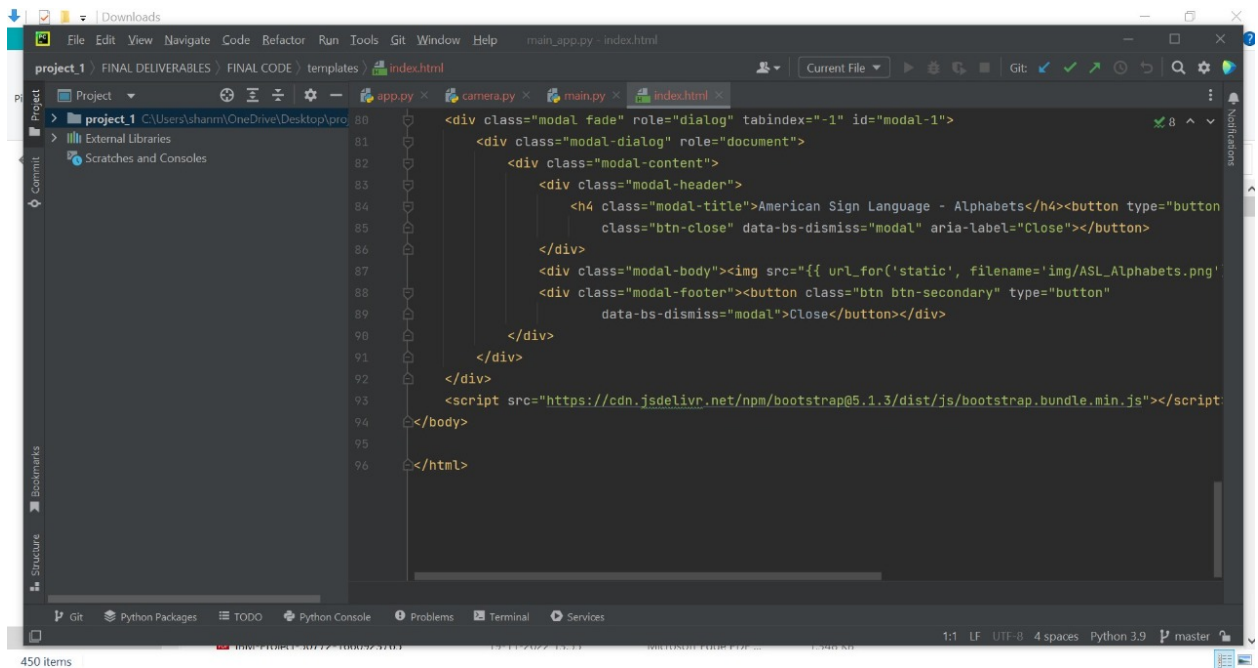
447 items

The screenshot shows a VS Code editor window with the file `index.html` open. The code defines an accordion structure with a container, a tablist, and an accordion-item. The first item has a header with a button labeled "About The Project" and a body containing a paragraph about Artificial Intelligence.

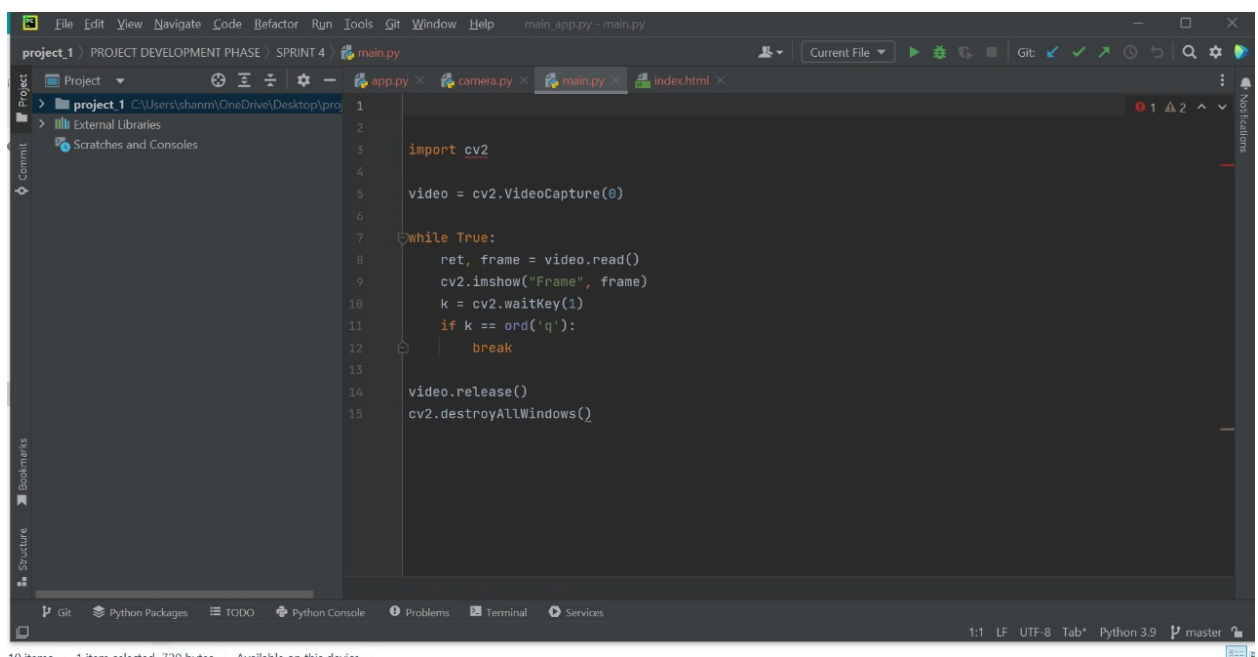
```
41 <div class="container">
42   <div class="accordion text-white" role="tablist" id="accordion-1">
43     <div class="accordion-item" style="...">
44       <h2 class="accordion-header" role="tab"><button class="accordion-button" data-bs-target="#accordion-1 .item-1" aria-expanded="true"
45         data-bs-target="#accordion-1 .item-1" aria-controls="accordion-1 .item-1"
46         style="...">About The Project</button></h2>
47       <div class="accordion-collapse collapse show item-1" role="tabpanel" data-bs-parent="#accordion-1">
48         <div class="accordion-body">
49           <p class="mb-0">Artificial Intelligence has made it possible to handle our
50             in new and simpler ways. With the ability to automate tasks that normal
51             intelligence, such as speech and voice recognition, visual perception,
52             functionality, decision-making, and a variety of other tasks, AI can as
53             disabilities by significantly improving their ability to get around and
54             daily activities.<br><br>Currently, Sign Recognition is available <strong>
55             alphabets A-I</strong> and not for J-Z, since J-Z alphabets also re
56             Recognition for them to be able to be predicted correctly to a certain
57             accuracy.</p>
58         </div>
59       </div>
60     </div>
61   </div>
62   <div class="accordion-item" style="...">
```

The screenshot shows the continuation of the `index.html` file. It includes the second accordion item with a header button labeled "Developed By" and a body containing team information. Below the accordion, there is a section tag and a modal fade element.

```
59   </div>
60   </div>
61   </div>
62   <div class="accordion-item" style="...">
63     <h2 class="accordion-header" role="tab"><button class="accordion-button collapsed"
64       data-bs-toggle="collapse" data-bs-target="#accordion-1 .item-2" aria-expanded="false"
65       data-bs-target="#accordion-1 .item-2" aria-controls="accordion-1 .item-2"
66       style="...">Developed By</button></h2>
67     <div class="accordion-collapse collapse item-2" role="tabpanel" data-bs-parent="#accordion-1">
68       <div class="accordion-body">
69         <p class="mb-0">TEAM ID: PNT2022TMI00668
70           <br><br>1. <strong>Shakthi Sri.S</strong> 211419104243<br>2.
71           <strong>Sarah Jaci</strong> 211419104237<br>3. <strong>Shafreen Fathima</strong>
72         </p>
73       </div>
74     </div>
75   </div>
76 </div>
77 </section>
78 </section>
79 <div class="modal fade" role="dialog" tabindex="-1" id="modal-1">
```



```
80 <div class="modal fade" role="dialog" tabindex="-1" id="modal-1">
81   <div class="modal-dialog" role="document">
82     <div class="modal-content">
83       <div class="modal-header">
84         <h4 class="modal-title">American Sign Language - Alphabets</h4><button type="button"
85           class="btn-close" data-bs-dismiss="modal" aria-label="Close"></button>
86       </div>
87       <div class="modal-body"><button class="btn btn-secondary" type="button"
89         data-bs-dismiss="modal">Close</button></div>
90     </div>
91   </div>
92 </div>
93 <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/js/bootstrap.bundle.min.js"></script>
94 </body>
95
96 </html>
```



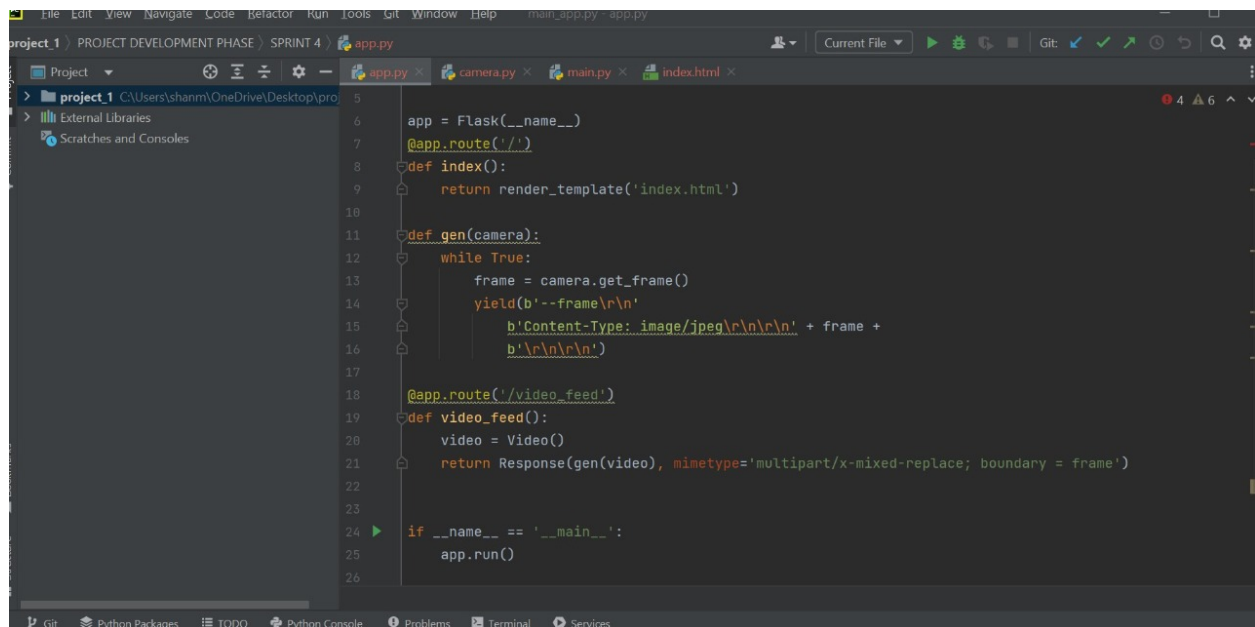
```
1
2
3 import cv2
4
5 video = cv2.VideoCapture(0)
6
7 while True:
8     ret, frame = video.read()
9     cv2.imshow("Frame", frame)
10    k = cv2.waitKey(1)
11    if k == ord('q'):
12        break
13
14 video.release()
15 cv2.destroyAllWindows()
```

```
class Video(object):
    def __init__(self):
        self.video = cv2.VideoCapture(0)
        self.roi_start = (50, 150)
        self.roi_end = (250, 350)
        self.model = load_model('aslpng_ibm.h5')
        self.index = ['A', 'B', 'C', 'D', 'E', 'F', 'G', 'H', 'I']
        self.y = None

    def del(self):
        self.video.release()

    def get_frame(self):
        ret, frame = self.video.read()
        frame = cv2.resize(frame, (640, 480))
        copy = frame.copy()
        copy = copy[150:150+200, 50:50+200]
        # Prediction Start
        cv2.imwrite('image.jpg', copy)
        copy_img = image.load_img('image.jpg', target_size=(64, 64))
        x = image.img_to_array(copy_img)
        x = np.expand_dims(x, axis=0)
        pred = np.argmax(self.model.predict(x), axis=1)
```

```
        ret, frame = self.video.read()
        frame = cv2.resize(frame, (640, 480))
        copy = frame.copy()
        copy = copy[150:150+200, 50:50+200]
        # Prediction Start
        cv2.imwrite('image.jpg', copy)
        copy_img = image.load_img('image.jpg', target_size=(64, 64))
        x = image.img_to_array(copy_img)
        x = np.expand_dims(x, axis=0)
        pred = np.argmax(self.model.predict(x), axis=1)
        self.y = pred[0]
        cv2.putText(frame, 'The Predicted Alphabet is: ' + str(self.index[self.y]), (100, 50), cv2.FONT_HERSHEY_SIMPLEX, 1, (0, 255, 0), 2)
        ret, jpeg = cv2.imencode('.jpg', frame)
        return jpeg.tobytes()
```



The screenshot shows a PyCharm IDE window with a project named 'project_1'. The file explorer on the left shows the project structure. The main editor displays the code for 'app.py'. The code is a Flask application that serves a video feed. It includes a route for the root path ('/') that renders 'index.html'. It also has a generator function 'gen(camera)' that yields video frames from a camera object. A route for '/video_feed/' is defined, which returns a Response object containing the video feed. The application is run using 'app.run()'.

```
5
6 app = Flask(__name__)
7 @app.route('/')
8 def index():
9     return render_template('index.html')
10
11 def gen(camera):
12     while True:
13         frame = camera.get_frame()
14         yield(b'--frame\r\n'
15              b'Content-Type: image/jpeg\r\n\r\n' + frame +
16              b'\r\n\r\n')
17
18 @app.route('/video_feed/')
19 def video_feed():
20     video = Video()
21     return Response(gen(video), mimetype='multipart/x-mixed-replace; boundary = frame')
22
23
24 if __name__ == '__main__':
25     app.run()
26
```

GITHUB LINK -<https://github.com/IBM-EPBL/IBM-Project-7492-1658859339>

DEMO LINK - <https://drive.google.com/drive/folders/1i4-oe1W4kD5rdTzxVG5fE9ulcr2Mf51H?usp=sharing>