Project Based Experiential Learning Program (Nalaiya Thiran)

Real-Time Communication System Powered by AI for Specially Abled

An IBM PROJECT REPORT

SUBMITTED BY

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In partial fulfillment of award of the degree

of

BACHELOR OF ENGINEERING

in

COMPUTER SCIENCE AND ENGINEERING

Er. PERUMAL MANIMEKALAI COLLEGE OF ENGINEERING

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ABSTRACT

Intelligence is being added to the products and services we use every day. We routinely speak to voice assistants, use vision processing to identify friends and family in photos, and quietly benefit from behind the scenes algorithms that improve quality and reliability. Advances in consumer oriented AI technologies are now finding new applications and use cases as these capabilities become democratized. The communications industry, which was once at the forefront of many of these technologies, is now presented with a plethora of new options for improving existing applications, finding new cost advantages, and redefining existing communications modalities. In the recent years, there has been rapid increase in the number of deaf and dumb victims due to birth defects, accidents and oral diseases. Since deaf and dumb people cannot communicate with normal person so they have to depend on some sort of visual communication. This study examines the role of Artificial Intelligence (AI) and Deep Learning in Real Time Communications. It is designed to help product, strategy, and business development decision makers communications service providers, technology vendors, communications-centric app providers, and enterprise information technology organizations.

CHAPTER 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 text cannot be used. Text 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. Artificial Intelligence has been opening up new and simpler ways to manage our daily activities. With the big potential to automate tasks that typically require human intelligence, such as speech and voice recognition, visual perception, predictive text functionality, decision-making and performance of a variety of other tasks, AI can help individuals with disabilities by making a major difference in their ability to get around and take part in the activities of daily living. The project aims to develop a system that converts the sign language into a human hearing 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. 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 text is given as output.

1.1 Project Overview

The objective of the program proposes a python and efficient convolution neural network on classifying the Designing and implementing of a system using artificial intelligence, Deep Learning algorithms and image processing concepts to take input as hand gestures (or) sign language and It generates recognizable outputs in the form of text . We can convert the sign languages into text. So that the specially abled people will convey the message to normal people. The system uses neural networks and Computer vision to recognizes the image of sign language then smart deep learning algorithms translate it into text. As the specially abled people feel very difficult to convey their message to normal people in emergency times as well as in normal times. The main purpose of this application is to make deaf-mute people feel independent and more confident. They can participate in daily activities rather than being inactive and can get good job opportunities. Adaptive learning platforms also provide personalised learning experiences tailored to the specific needs of students with disabilities. This application aims to help deaf and dumb by providing them with an attractive communication.

1.2 Purpose

As the specially abled people feel very difficult to convey their message to normal people in emergency times as well as in normal times. The main purpose of this application is to make deaf-mute people feel independent and more confident. They can participate in daily activities rather than being inactive and can get good job opportunities. Adaptive learning platforms also provide personalised learning
experiences tailored to the specific needs of students with disabilities. This application aims to help deaf and dumb by providing them with an attractive communication. The system can generate revenue through direct customers and collaborate with health care sector and generate revenue from their customers. 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 text is given as output.

CHAPTER 2
LITERATURE SURVEY

2.1 Existing problem

Artificial Intelligence enabled virtual sixth sense application for the disabled. The sixth sense is a multiplatform app for aiding the people in need that is people who are handicapped in the form of lack of speech (dumb), lack of hearing (deaf), lack of sight (blind). Tools used are ML OCR kit , Firebase ML toolkit , Google Web toolkit TTS. Technologies used are Android smartphones ,object Detection ,Text Recognition ,API. Pros and cons are Help dumb people to easily and quickly communicate with normal people. The application still does depend on the camera picture quality for object detection. Design of a Communication System using Sign Language aid for Differently Abled Peoples. Our goal is to design a human computer interface system that can accurately identify the language of the deaf and dumb. Feature Extraction ,Sign to text and Speech conversion. Image preprocessing and segmentation. Blob Detection , Skin color recognition , Template Matching. Hand gestures of deaf peoples by normal peoples this system is proposed and it gives output in the form of sound. A mediator is required to know the sign language. D-Talk: Sign Language Recognition System for People with Disability using Machine Learning and Image Processing. D-talk is a system that allows people who are unable to talk and hear and for them to learn their language easier and also for the people that would interact with them. Image Recognition process Object Detection Gesture Recognition HSV Algorithm. Machine learning ,Deep learning , Decision tree. Speech interpretation is helpful for sign language nonspeakers who want the hand sign to understood. The type of inaccuracy can emerge from user's, such as poor web camera. Real-time Communication System for the Deaf and Dumb.Aims to aid the deafmute by creation of a new system that helps convert sign language to text for easier communication with audience. Flex sensor,Arduino Uno, Arduino IDE.Python Programming Language, Gesture Recognition. The system forms the base infrastructure for a complete communicational aid system for the deaf and mute/it requires logical mechanism for classification of letters based on sensor values.

2.2 References

Aditya Sharma , Aditya Vats, Shiva Shankar Dash and Surinder Kaur.
Shrikant Temburwar, Payal Jaiswal, Shital Mande, Souparnika Patil.

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[4] Setiawardhana, Rizky Yuniar Hakkun, Achmad Baharuddin, "Sign Language Learning based on Android For Deaf and Speech Impaired People", 978-1-4673-9345-4/15/31.00 c 2015 IEEE

[5] M. Ebrahim Al-Ahdal & Nooritawati Md Tahir,’’ Review in Sign Language Recognition Systems’’ Symposium on Computer & Informatics(ISCI),pp:52-57, IEEE,2012

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[7] Iwan Njoto Sandjaja, Nelson Marcos,’’ Sign Language Number Recognition’’ Fifth International Joint Conference on INC, IMS and IDC, IEEE 2009

2.3 Problem Statement Definition

Statement – In the recent years, there has been rapid increase in the number of deaf and dumb victims due to birth defects, accidents and oral diseases. Since deaf and dumb people cannot communicate with normal person so they have to depend on some sort of visual communication.A World Health Organization report says around 63 million people in India suffer from either complete or partial deafness, and of these, at least 50 lakh are children. Communication between deaf-mute and a normal person has always been a challenging task.
Description - The Deaf/Dump people needs a way to communicate easily and quickly with the normal people, so that the Deaf/Dump people feel confident enough to express there thought, ideas, and can make conversation with the normal people.

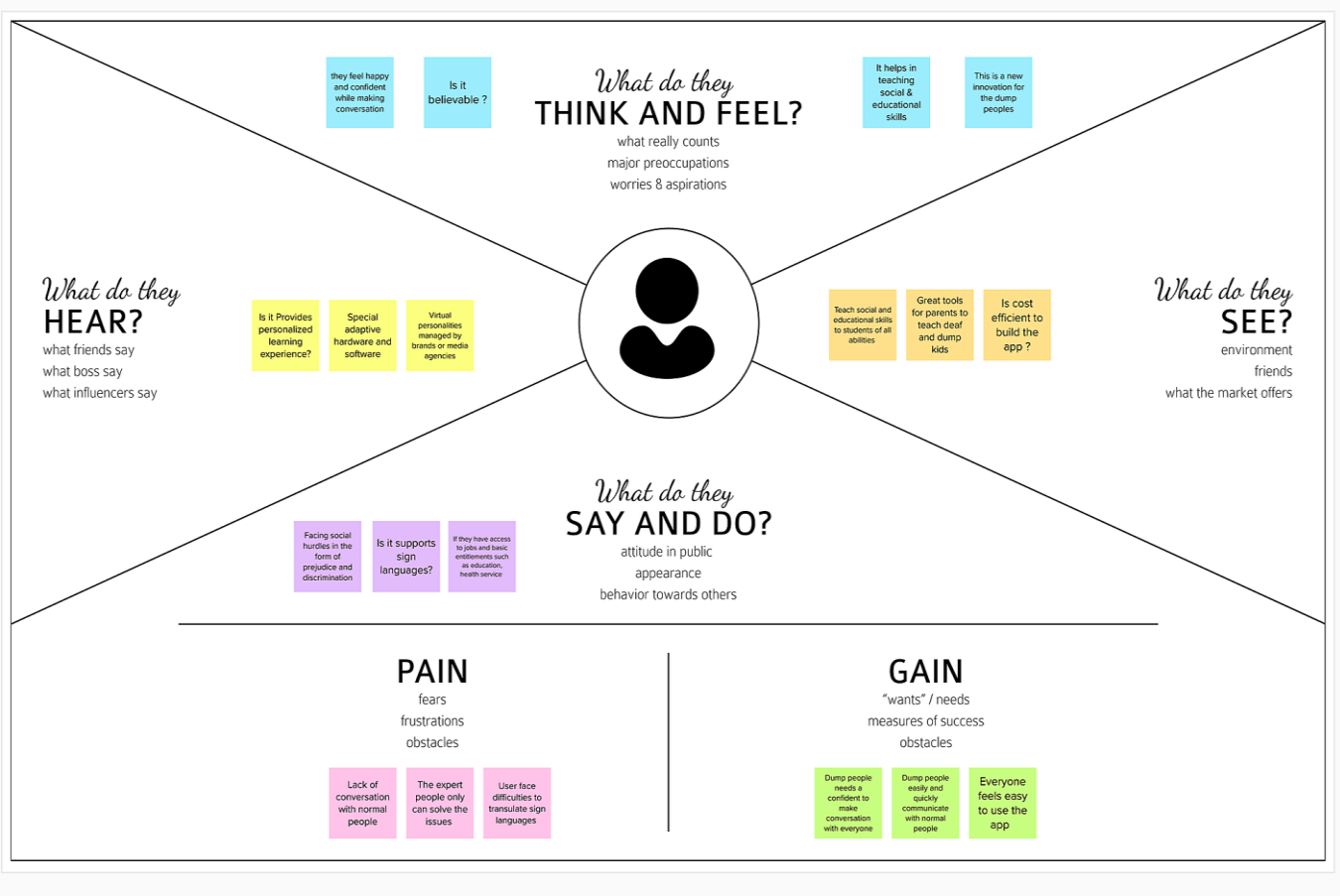
Who does the problem affect?	1) Communication plays a significant role in making the world a better place. Most people communicate efficiently without any issues, but many cannot due to disability. 2) They cannot hear or speak, which makes Earth a problematic place to live for them. Even simple basic tasks become difficult for them. 3) Disability is an emotive human condition, Being deaf and dumb pushes the subject to oblivion, highly introverted.
What are the boundaries of the problem?	1) People sometimes stereotype those with disabilities, assuming their quality of life is poor or that they are unhealthy because of their impairments. 2) People may see disability as a personal tragedy, as something that needs to be cured or prevented, as a punishment for wrongdoing, or as an indication of the lack of ability to behave as expected in society.
What are the resources?	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.

What are the objectives?	1) Designing and implementing a system using artificial intelligence, Deep Learning algorithms and image processing concepts to take input as hand gestures (or) sign language and It generates recognizable outputs in the form of text and voice. 2) We can convert the sign languages into voice or text. So that the specially abled people will convey the message to normal people.
What are the purposes?	The project aims to develop a system that converts the sign language into a human hearing voice or text in the desired language to convey a message to normal people, as well as convert speech or text into understandable sign language for the deaf and dumb.
Why is it important that we fix the problem?	1) They can participate in daily activities rather than being inactive and can get good job opportunities. 2) Adaptive learning platforms also provide personalised learning experiences tailored to the specific needs of students with disabilities. 3) This application aims to help deaf and dumb by providing them with an attractive communication.

CHAPTER 3
IDEATION & PROPOSED SOLUTION

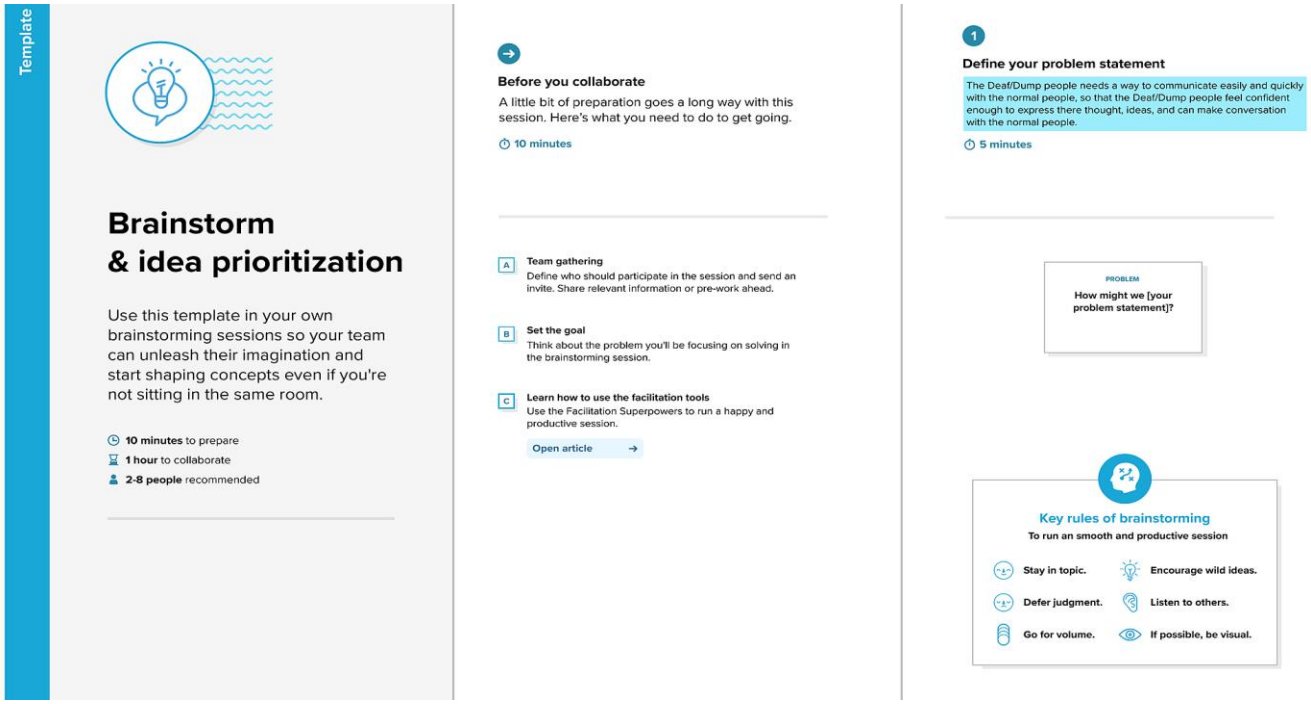
3.1 Empathy Map Canvas

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviors and attitudes .It is a useful tool to teams better understand their users Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges



3.2 Ideation & Brainstorming

Ideation is often closely related to the practice of brainstorming, a specific technique that is utilized to generate new ideas. A principal difference between ideation and brainstorming is that ideation is commonly more thought of as being an individual pursuit, while brainstorming is almost always a group activity.Your goal This is where you engage in unfiltered, Unrestrained brainstorming. *Rules of Brainstorming*- Defer judgement, Encourage wild Ideas, Build on the Ideas of Others, Stay Focused on The Topic, One conversation at a Time, Be Visual,Go for Quantity.



2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

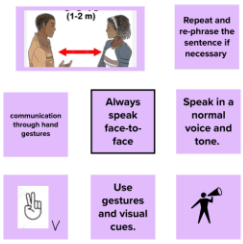
10 minutes

TIP

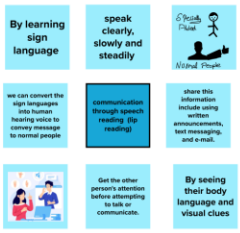
You can select a sticky note and hit the pencil [switch to sketch] icon to start drawing!

N NIVETHA

N SEMBARUTHI



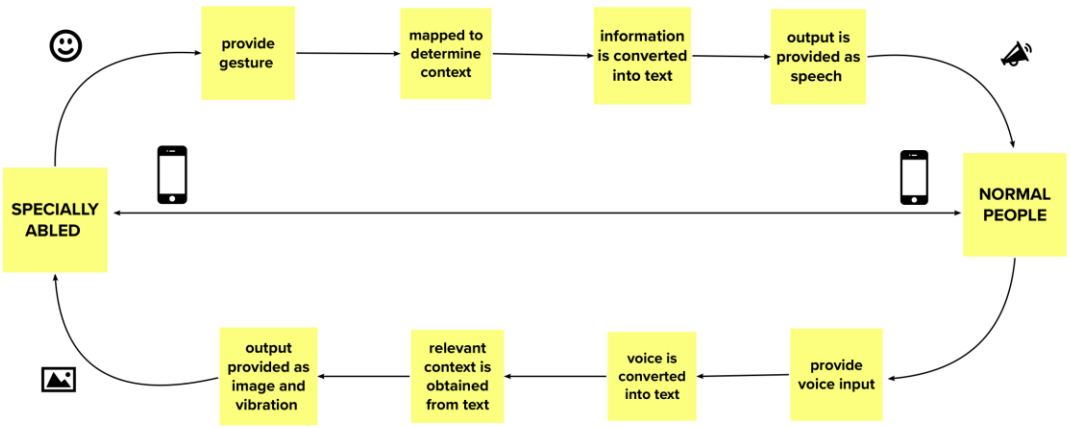
G KRITHIKSHA



M SUBHASRI

Y MONIKA

GENERAL IDEA



3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. In the last 10 minutes, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

20 minutes

CATEGORY - 1 : COMMUNICATION

communication through written messages

communication through hand gestures

Keep conversation ordered and coherent

video and tele conferencing is used to communicate with others

keep your distance while speaking with specially abled people

communication through speech reading (lip reading)

TIP

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

CATEGORY - 2 : GESTURES AND VISUAL CLUES

By seeing their body language and visual clues

Use facial expression and gesture to add meaning.

learn some figure spelling or sign language

By learning sign language

Uneducated deaf -dumps are educated by sign languages

Use gestures and body language

they also educated by sign languages

Uneducated deaf -dumps are educated by sign languages

Use gestures and visual cues.

CATEGORY - 3 : NECCESSARY THINGS TO BE FOLLOWED

speak clearly, slowly and steadily

deaf -dump people will only communicate with sign language

Do not cover your mouth or look around while speaking.

Repeat and re-phrase the sentence if necessary

Speak in a normal voice and tone.

In group meetings establish turn-taking rules

CATEGORY - 4 : SCOPES

people first language is a techniques that emphasis person first not the disability.

they can participate in daily activities rather than being inactive

share this information include using written announcements, text messaging, and e-mail.

sign language is also used in the education system

we can convert the sign languages into human hearing voice to convey message to normal people

Learn a few simple words in sign language such as please, thank you, and how to say your name.

provide personalized learning experiences and good job opportunities

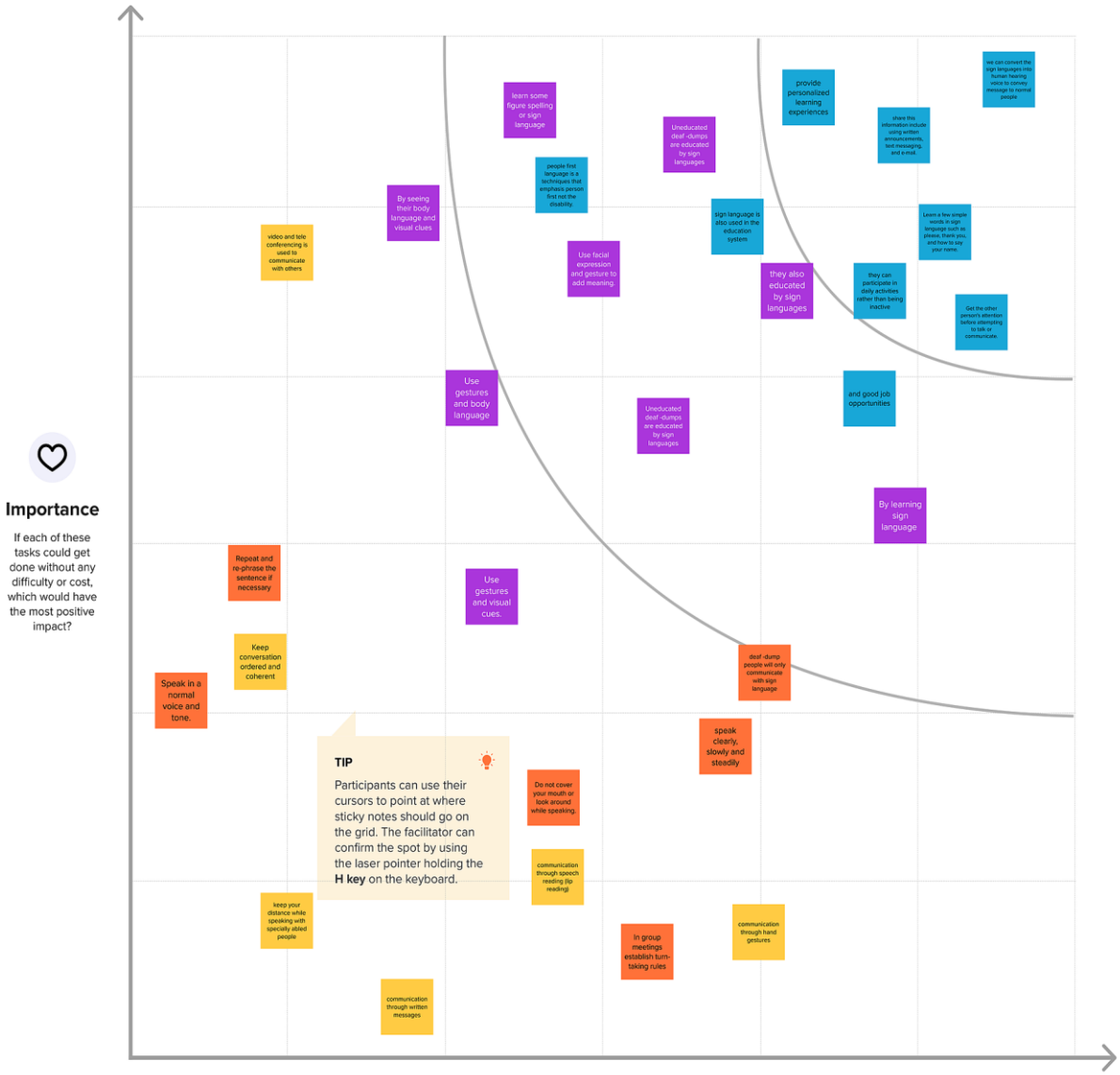
Get the other person's attention before attempting to talk or communicate.

4

Prioritize

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

20 minutes



3.3 Proposed Solution

The main goal of presenting a business proposal is to provide solution to a problem faced by a potential buyer. This section should be as comprehensive as possible, and able to address all the needs that you have pointed in the first section. proposed solution should relate the current situation to a desired result and describe the benefits that will accrue when the desired result is achieved.

S.No.	Parameter	Description
1.	**Problem Statement (Problem to be solved)**	**Statement -** Communication between deaf-mute and a normal person has always been a challenging task. **Description -** The Deaf/Dump people needs a way to communicate easily and quickly with the normal people, so that the Deaf/Dump people feel confident enough to express there thought, ideas, and can make conversation with the normal people.
2.	**Idea / Solution description**	**The Solution description of our project –** 1) Designing and implementing a system using artificial intelligence, Deep Learning algorithms and image processing concepts to take input as hand gestures (or) sign language and It generates recognizable outputs in the form of text and voice. 2) We can convert the sign languages into voice or text. So that the specially abled people will convey the message to normal people.
3.	**Novelty / Uniqueness**	**Uniqueness of Our Project -** 1) The system uses neural networks and Computer vision to recognizes the video or image of sign language then smart deep learning algorithms translate it into speech or text.

4.	**Social Impact / Customer Satisfaction**	**Social Impact -** 1) As the specially abled people feel very
5.	**Business Model (Revenue Model)**	**Business Model -** The system can generate revenue through direct customers and collaborate with health care sector and generate revenue from their customers.
6.	**Scalability of the Solution**	**Scalability -** 1) They can participate in daily activities rather than being inactive and can get good job opportunities. 2) Adaptive learning platforms also provide personalised learning experiences tailored to the specific needs of students with disabilities. 3) This application aims to help deaf and dumb by providing them with an attractive communication.

3.4 Problem Solution fit

Problem-Solution canvas is a tool for entrepreneurs, marketers and corporate innovators, which helps them identify solutions with higher chances for solution adoption, reduce time spent on solution testing and get a better overview of current situation. The Problem-Solution Fit simply means that you have found a problem with your customer and that the solution you have realized for it actually solves the customer's problem.

CHAPTER 4

REQUIREMENT ANALYSIS

4.1 Functional requirement

Functional requirements may involve calculations, technical details, data manipulation and processing, and other specific functionality that define what a system is supposed to accomplish. Behavioral requirements describe all the cases where the system uses the functional requirements, these are captured in use cases. Functional requirement define what a product must do, what its feature and functions are. They are product features or functions that developers must implement to enable users to accomplish their tasks. Generally, functional requirements describe system behaviour under specific conditions.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Image Capturing Processing	Provides Access to Capture Image Through Camera Provides Access to Upload Image Through Gallery
FR-4	Text Conversion System	System converts the sign language into a Text using the CNN model (deep learning algorithm)
FR-5	Sentence level Translation	A System that recognizes separate signs one-byone could only provide a translation in a situation where SEE (Signed Extract English) is provided
FR-6	Review	Users can give their the feedback or review on the Review page about the Application

4.2 Non-Functional requirements

Nonfunctional Requirements (NFRs) define system attributes such as security, reliability, performance, maintainability, scalability, and usability. They serve as constraints or restrictions on the design of the system across the different backlogs. In systems engineering and requirements engineering, a non-functional requirement is a requirement that specifies criteria that can be used to judge the operation of a system, rather than specific behaviours. Non-Functional requirements, not related to the system functionality, rather define how the system should perform. Here, we will just briefly describe the most typical non functional requirements.

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The Most Usability dimensions appears learnability ,accessibility ,Sign languages and satisfication the usefulness of Mobile Application meant to specially abled
NFR-2	**Security**	ADT-Best Security System for the specially abled Overall Simplisafe- Best Security System for the specially abled With an App
NFR-3	**Reliability**	The Sign method is the most accepted method as a means of communication to specially abled people
NFR-4	**Performance**	Languages,behaviour norms significant role in each of the pepole
NFR-5	**Availability**	Loop system ,accessible it helps to people who are specially abled
NFR-6	**Scalability**	Sign language which will deal with development of an automatic sign language recognition/verification and sign product

CHAPTER 5
PROJECT DESIGN

5.1 Data Flow Diagrams

It is a way of representing a flow of data through a process or a system (usually an information system). The DFD also provides information about the outputs and inputs of each entity and the process itself. A data-flow diagram has no control flow — there are no decision rules and no loops. Specific operations based on the data can be represented by a flowchart. There are several notations for displaying data-flow diagrams. For each data flow, at least one of the endpoints (source and / or destination) must exist in a process. The refined representation of a process can be done in another data-flow diagram, which subdivides this process into sub-processes.

The data-flow diagram is a tool that is part of structured analysis and data modelling. When using UML, the activity diagram typically takes over the role of the data-flow diagram. A special form of data-flow plan is a site-oriented data-flow plan. Data flow (flow, dataflow) shows the transfer of information (sometimes also material) from one part of the system to another. The symbol of the flow is the arrow. The flow should have a name that determines what information (or what material) is being moved.

Exceptions are flows where it is clear what information is transferred through the entities that are linked to these flows. Material shifts are modeled in systems that are not merely informative. Flow should only transmit one type of information (material). The arrow shows the flow direction (it can also be bi-directional if the information to/from the entity is logically dependent - eg. question and answer). Flows link processes, warehouses and terminators.

Three levels of data flow diagram:

0-level DFD, 1-level DFD, and 2-level DFD

1. 0-level DFD:

It is also known as a context diagram. It's designed to be an abstraction view, showing the system as a single process with its relationship to external entities. It represents the entire system as a single bubble with input and output data indicated by incoming/outgoing arrows.

2. 1-level DFD:

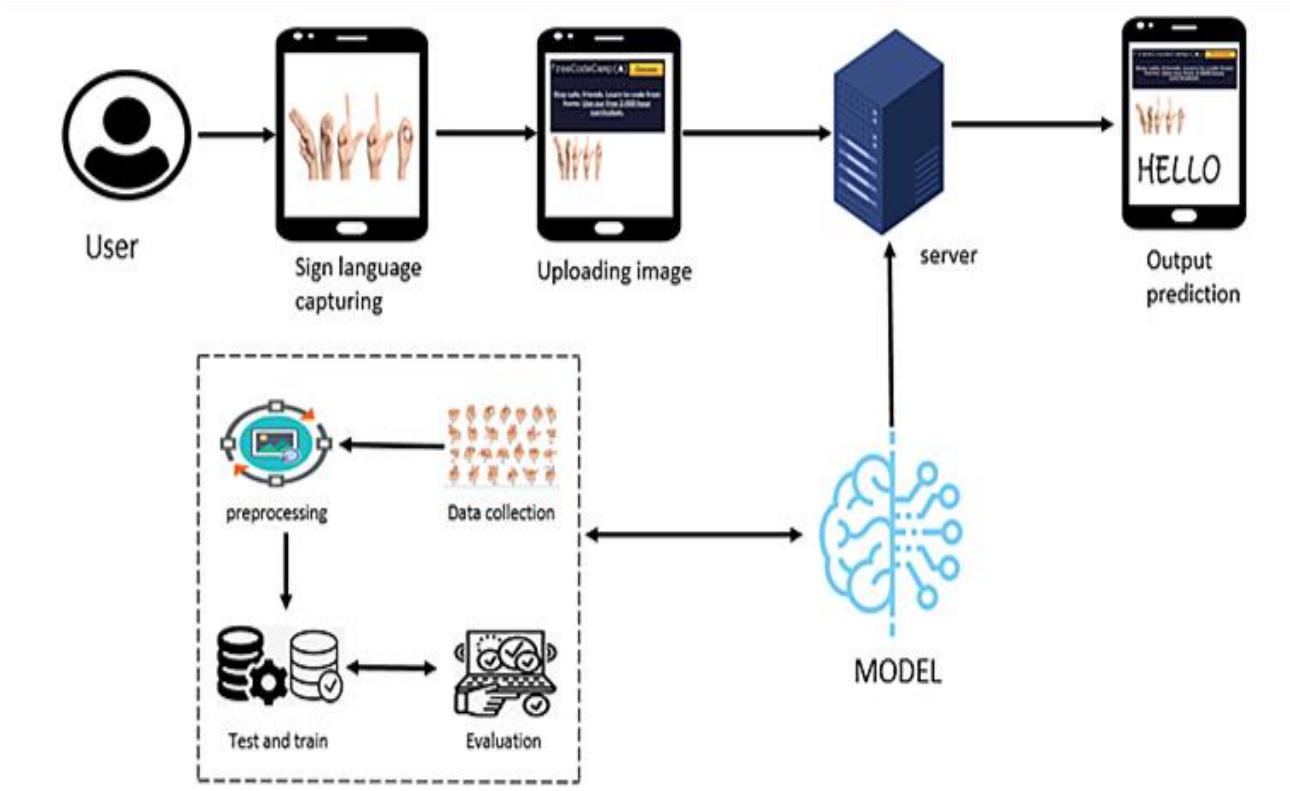
In 1-level DFD, the context diagram is decomposed into multiple bubbles/processes. In this level, we highlight the main functions of the system and breakdown the high-level process of 0-level DFD into subprocesses.

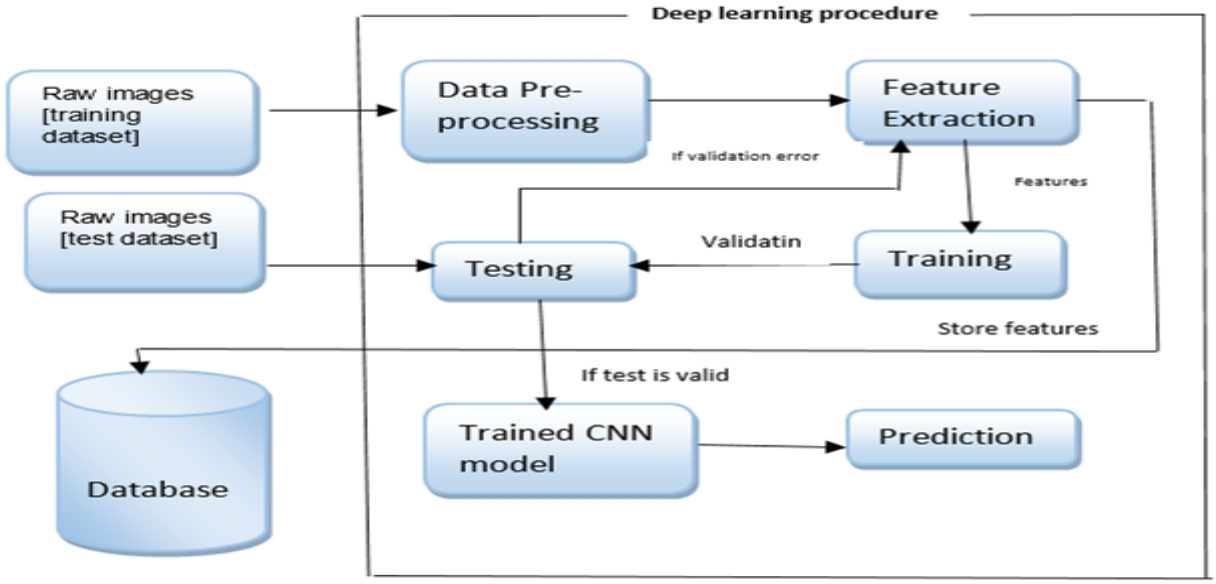
3. 2-level DFD:

2-level DFD goes one step deeper into parts of 1-level DFD. It can be used to plan or record the specific/necessary detail about the system's functioning.

Data Flow Diagrams:

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.





5.2 Solution & Technical Architecture

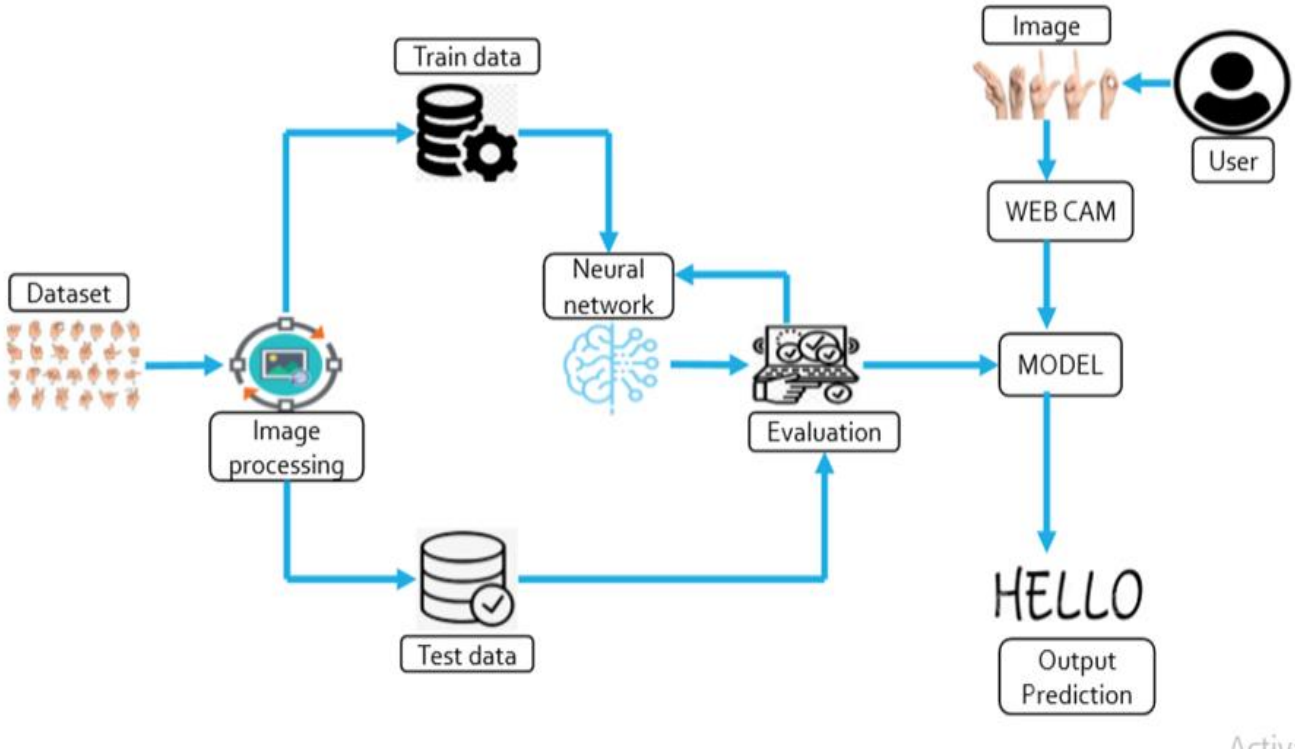
1. SOLUTION ARCHITECTURE

PROBLEM STATEMENT:

Statement– In the recent years, there has been rapid increase in the number of deaf and dumb victims due to birth defects, accidents and oral diseases. Since deaf and dumb people cannot communicate with normal person so they have to depend on some sort of visual communication. A World Health Organization report says around 63 million people in India suffer from either complete or partial deafness, and of these, at least 50 lakh are children. Communication between deaf-mute and a normal person has always been a challenging task.

Description - The Deaf/Dump people needs a way to communicate easily and quickly with the normal people, so that the Deaf/Dump people feel confident enough to express there thought, ideas, and can make conversation with the normal people.

Solution- The project aims to develop a system that converts the sign language into a human hearing voice or text in the desired language to convey a message to normal people, as well as convert speech or text into understandable sign language for the deaf and dumb.

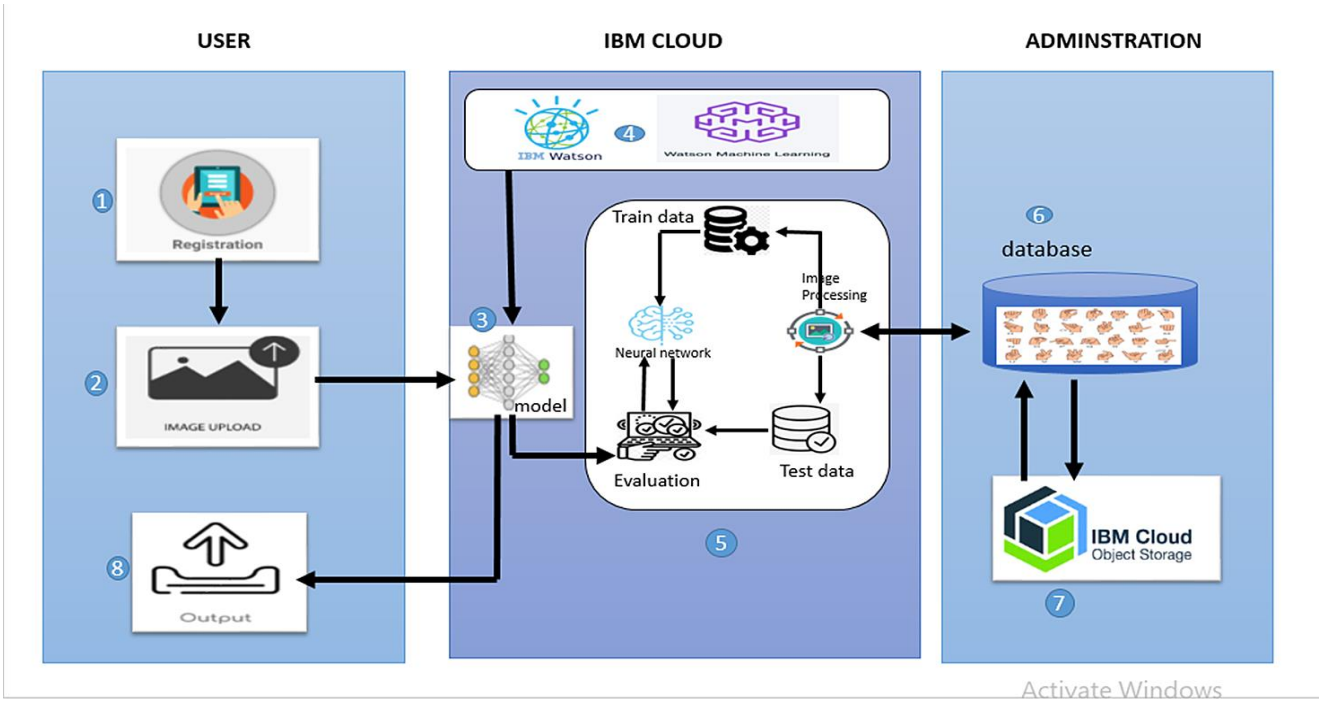


2. TECHNICAL ARCHITECTURE

Technical Architecture (TA) is a form of IT architecture that is used to design computer systems. It involves the development of a technical blueprint with regard to the arrangement, interaction, and interdependence of all elements so that system-relevant requirements are met. Technology Architecture describes the logical software and hardware capabilities that are required to support the deployment of business, data, and application services. This includes IT infrastructure, middleware, networks, communications, processing, standards, etc. Technology architecture deals with the deployment of application components on technology components. A standard set of predefined technology components is provided in order to represent servers, network, workstations, and so on

3 - TIER ARCHITECHTURE

Three-tier architecture is a well-established software application architecture that organizes applications into three logical and physical computing tiers: the presentation tier, or user interface; the application tier, where data is processed; and the data tier, where the data associated with the application is stored and managed. The chief benefit of three-tier architecture is that because each tier runs on its own infrastructure, each tier can be developed simultaneously by a separate development team, and can be updated or scaled as needed without impacting the other tiers. Three-tier architecture, which separates applications into three logical and physical computing tiers, is the predominant software architecture for traditional client-server applications.

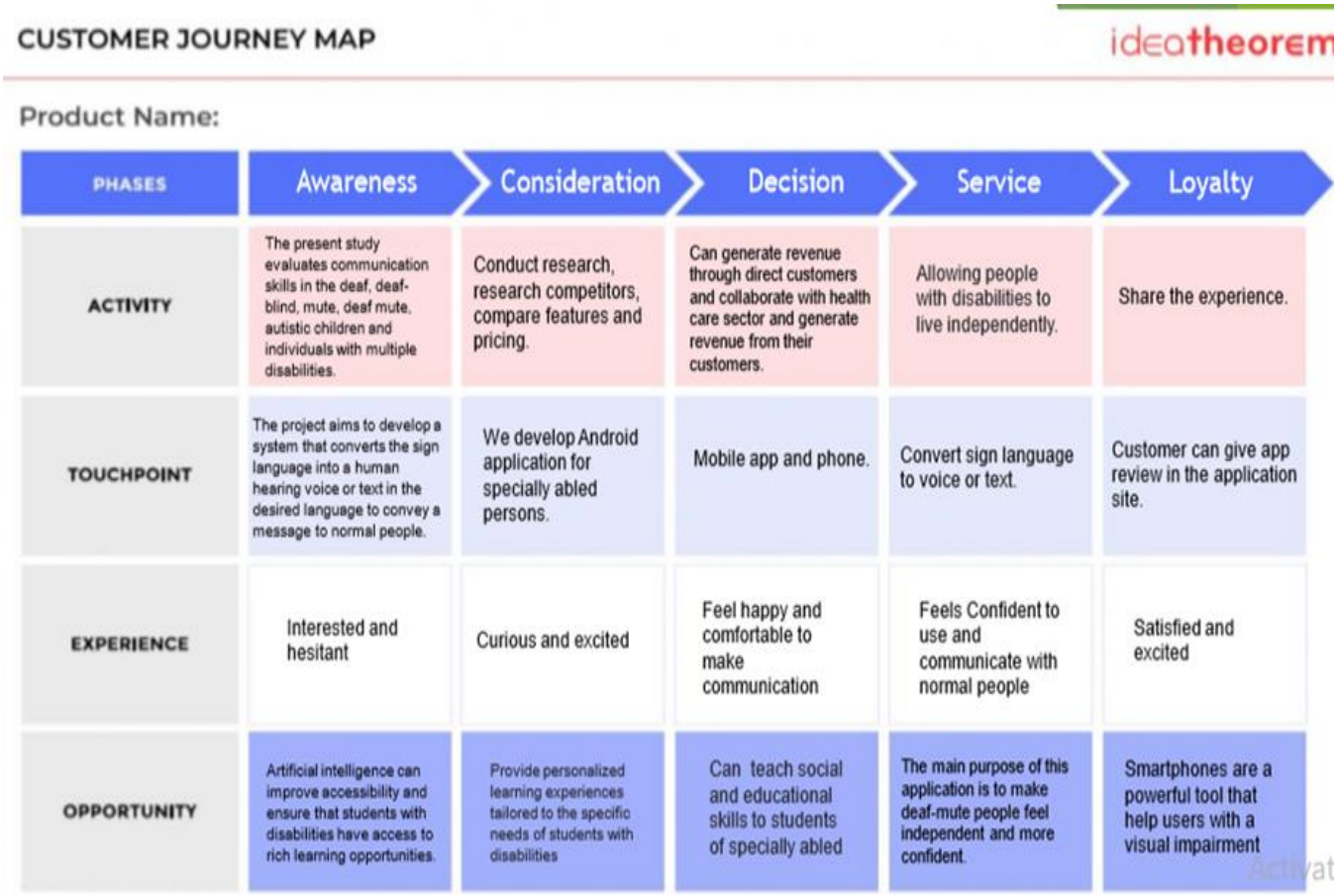


5.3 User Stories

CUSTOMER JOURNEY MAP

A user journey is the experiences a person has when interacting with something, typically software. This idea is generally used by those involved with user experience design, web design, user-centered design, or anyone else focusing on how users interact with software experiences. It is often used as a shorthand for the overall user experience and set of actions that one can take in software or other virtual experiences.

User journeys describe at a high level of detail exactly what steps different users take to complete a specific task within a system, application, or website. This technique shows the current (as-is) user workflow, and reveals areas of improvement for the to-be workflow. When documented, this is often referred to as a User Journey Map.



CHAPTER 6

PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Project Milestone and Tasks/Activities:

Milestone is a point on the calendar with one clearly defined deliverable; tasks are activities required to accomplish that milestone. Tasks or activities have start and finish dates. A milestone is a single date on which delivery is accomplished. Milestones in project management are used as signal posts for a project's start or end date, external reviews or input, budget checks, submission of a major deliverable, etc.

A milestone is a reference point that marks a significant event or a branching decision point within a project. Milestones are checkpoints that highlight the successful completion of major events, tasks, or groups of tasks along your project timeline. Milestones are used to track progress toward a specific goal or event. There are three types of SAFe milestones: Program Increment (PI), fixed-date, and learning milestones.

Milestone	Task	Starting Date	Ending Date	Project Completion Status	Team Members
Data Collection	Create Train and Test Folders	31 Oct 2022	01 Nov 2022	10%	Nivetha Sembarythi Subha sri
Image Preprocessing	Import ImageDataGenerator Library and Configure It	01 Nov 2022	01 Nov 2022	15%	Monika Krithiksha
	Apply ImageDataGenerator Functionality to Train and Test Set	02 Nov 2022	02 Nov 2022	25%	Nivetha Sembarythi Subha sri
Model Building	Import the Required Model Building Libraries	03 Nov 2022	03Nov 2022	27%	Nivetha Subha sri Krithiksha

	Initialize the Model Add the Convolution Layer	03 Nov 2022	03 Nov 2022	30%	Krithiksha Nivetha Sembarythi Subha sri Monika
	Add the Pooling Layer Add the Flatten Layer Adding the Dense Layers	04 Nov 2022	04 Nov 2022	36%	Krithiksha Nivetha Sembarythi Subha sri Monika
	Compile the Model Fit and Save the Model	05 Nov 2022	05 Nov 2022	45%	Krithiksha Nivetha Sembarythi Subha sri Monika
Test the Model	Import the Packages and Load the Saved Model Load the Test Image, Pre-Process It and Predict	06 Nov 2022	06 Nov 2022	50%	Krithiksha Nivetha Sembarythi Subha sri Monika
Application Building	Build a Flask Application part -1	07 Nov 2022	07 Nov 2022	60%	Krithiksha Subha sri Monika
	Build a Flask Application part -2	08 Nov 2022	08 Nov 2022	70%	Krithiksha Nivetha Subha sri
	Building Flask Application -Part 3	09 Nov 2022	09 Nov 2022	80%	Krithiksha Sembarythi Subha sri

	Build the HTML Page Output	10 Nov 2022	12 Nov 2022	90%	Krithiksha Nivetha Sembarythi Subha sri Monika
Train CNN Model on IBM	Train image Classification Model	13 Nov 2022	16 Nov 2022	100%	Krithiksha Nivetha Sembarythi Subha sri Monika

6.2 Sprint Delivery Schedule

Product Backlog, Sprint Schedule, and Estimation

Sprint Schedule

In case you're unfamiliar, a sprint schedule is a document that outlines sprint planning from end to end. It's one of the first steps in the agile sprint planning process—and something that requires adequate research, planning, and communication.

Product Backlog

A product backlog is a prioritized list of work for the development team that is derived from the roadmap and its requirements. The most important items are shown at the top of the product backlog so the team knows what to deliver first.

Estimation

In Scrum Projects, Estimation is done by the entire team during Sprint Planning Meeting. The objective of the Estimation would be to consider the User Stories for the Sprint by Priority and by the Ability of the team to deliver during the Time Box of the Sprint.

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members

Sprint-1	User Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	10	High	Nivetha Sembarythi Subha sri
Sprint-1	User Confirmation	USN-2	As a user, I can log into the application by entering email & password and Confirmation via Email, Confirmation via OTP	10	Moderate	Monika Krithiksha
Sprint-2	Dashboard	USN-3	As a user, I can access my dashboard	5	Moderate	Nivetha Sembarythi Subha sri
Sprint-2	Image Capturing Processing	USN-4	Provides Access to Capture Image Through Camera Provides Access to Upload Image Through Gallery, As a user, I can upload the sign language image for translating into text format	5	High	Nivetha Subha sri Krithiksha
Sprint-2	Text Conversion System	USN-5	System converts the sign language into a Text using the CNN model (deep learning algorithm)	5	High	Krithiksha Nivetha Sembarythi Subha sri Monika
Sprint-2	Sentence level Translation	USN-6	A System that recognizes separate signs one-by one could only provide a translation in a situation where SEE (Signed Extract English) is provided	5	High	Krithiksha Nivetha Sembarythi Subhasri Monika

Sprint-3	Review	USN-7	Users can give their the feedback or review on the Review page about the Application	10	High	Krithiksha Nivetha Sembarythi Subhasri Monika
Sprint-3	Solution	USN-8	As a user, If user get any queries, then they get suggestions through Help desk.	10	Moderate	Krithiksha Nivetha Sembarythi Subhasri Monika
Sprint-4	Testing & Deployment Phase-I	USN-9	Testing the Real time communication system performance with the trained conversations/As a user, I can know the Real time communication system performance level	5	High	Krithiksha Subhasri Monika
		USN-10	Integration of Flask webpage with the Real time communication system to provide a framework/As a user, I can see a webpage to access the Real time communication system	5	High	Krithiksha Nivetha Subha sri
Sprint-4	Deployment Phase-II & Model Improvement	USN-11	Deployment of AI based Real time communication system for specially abled people or Running the Real time communication system service/As a user, I can see and use a 24*7 Real time communication system	5	High	Krithiksha Nivetha Sembarythi Subhasri Monika

		USN-12	Improving the model efficiency whenever needed/As a user, I can see new updated Real time communication system in Future days.	5	High	Krithiksha Nivetha Sembarythi Subhasri Monika

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	4 Days	31 Oct 2022	03 Nov 2022	20	03 Nov 2022
Sprint-2	20	5 Days	03 Nov 2022	07 Nov 2022	20	07 Nov 2022
Sprint-3	20	5 Days	08 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

Project Tracker, Velocity & Burndown Chart:

Velocity:

The team's average velocity (AV) per iteration unit (story points per day)

AV = 20/6 = 3.34

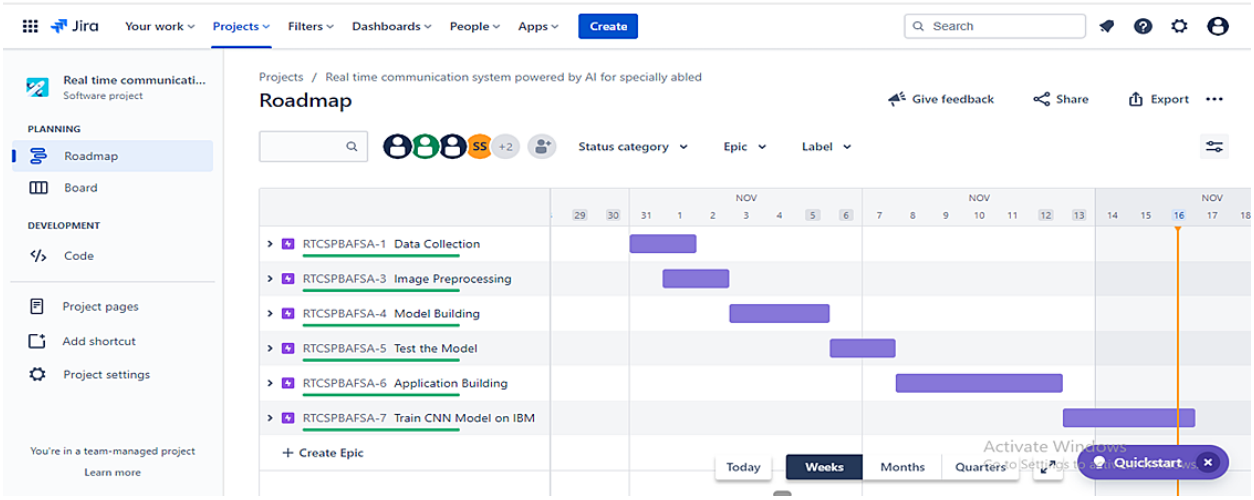
6.3 Reports from JIRA

JIRA:

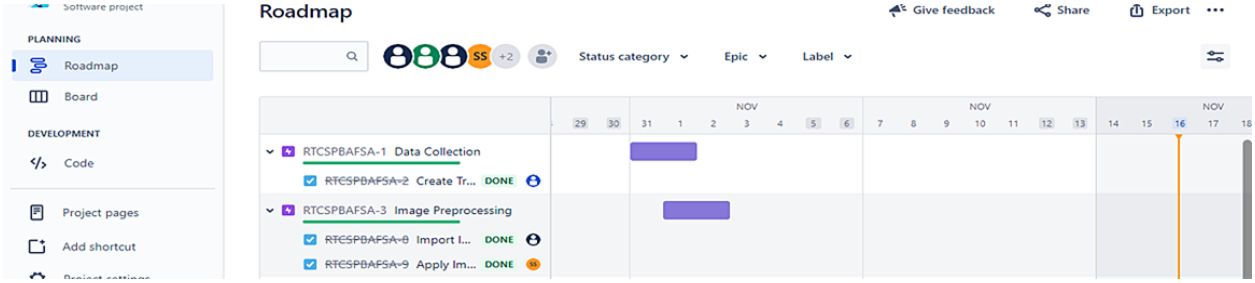
Jira is a proprietary issue tracking product developed by Atlassian that allows bug tracking and agile project management. Jira helps teams plan, assign, track, report, and manage work and brings teams together for everything from agile software development and customer support to start-ups and enterprises. Software teams build better with Jira Software, the #1 tool for agile teams.

Jira is a commercial software product that can be licensed for running on-premises or available as a hosted application. Atlassian provides Jira for free to open source projects meeting certain criteria, and to organizations that are non-academic, non-commercial, non-governmental, non-political, non-profit, and secular. For academic and commercial customers, the full source code is available under a developer source license.

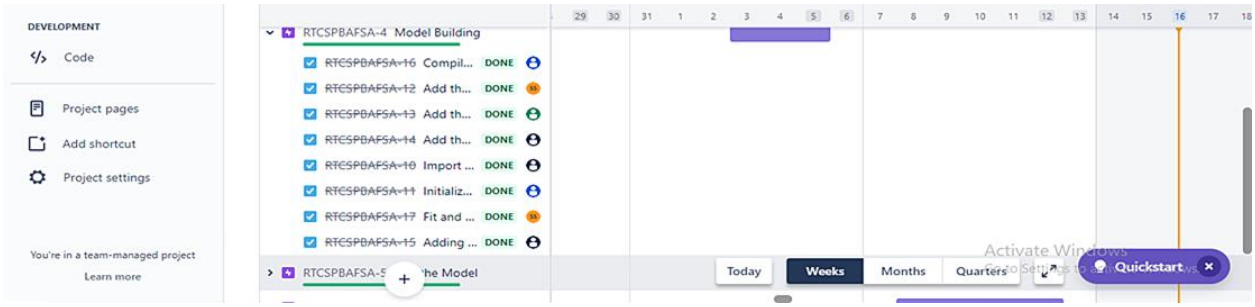
1. EPICS:



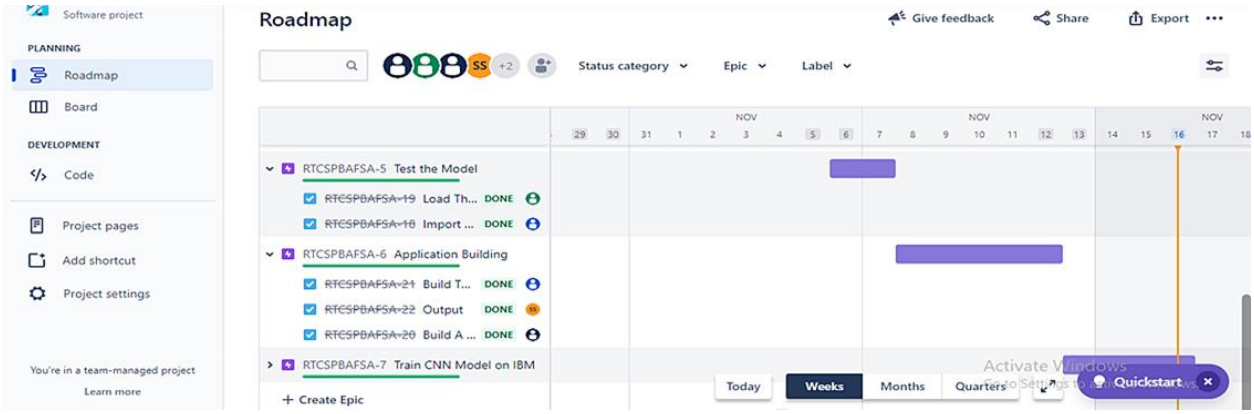
DATA COLLECTION AND IMAGE PREPROCESSING



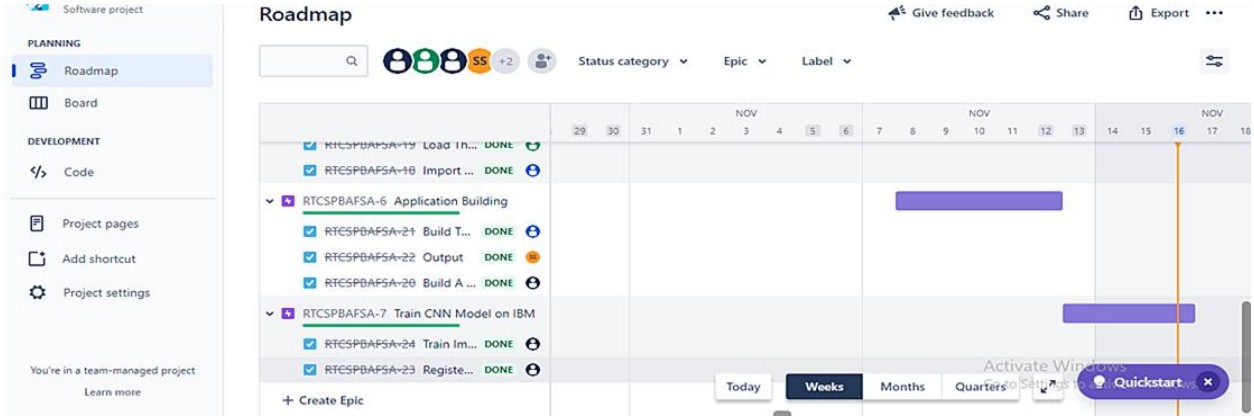
MODEL BUILDING



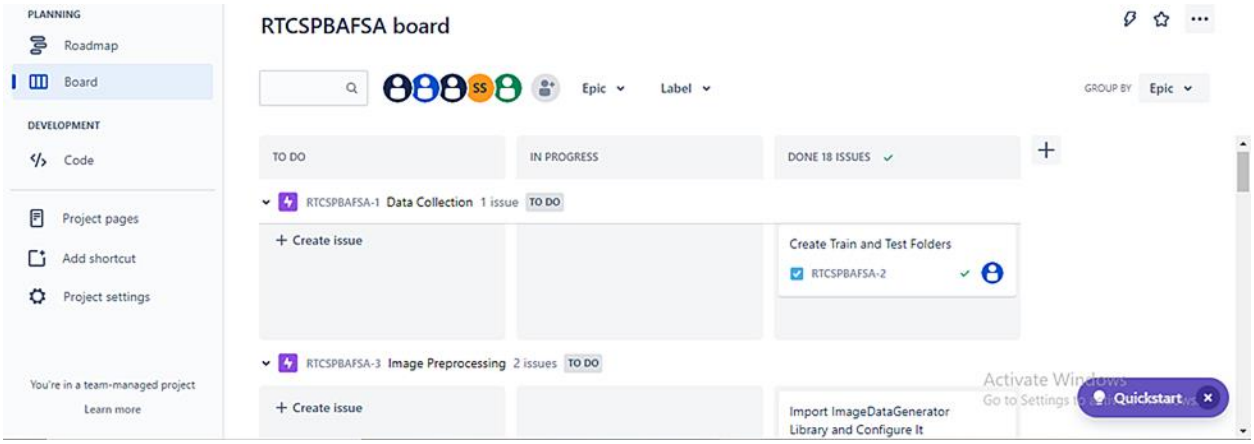
TEST THE MODEL AND APPLICATION BUILDING

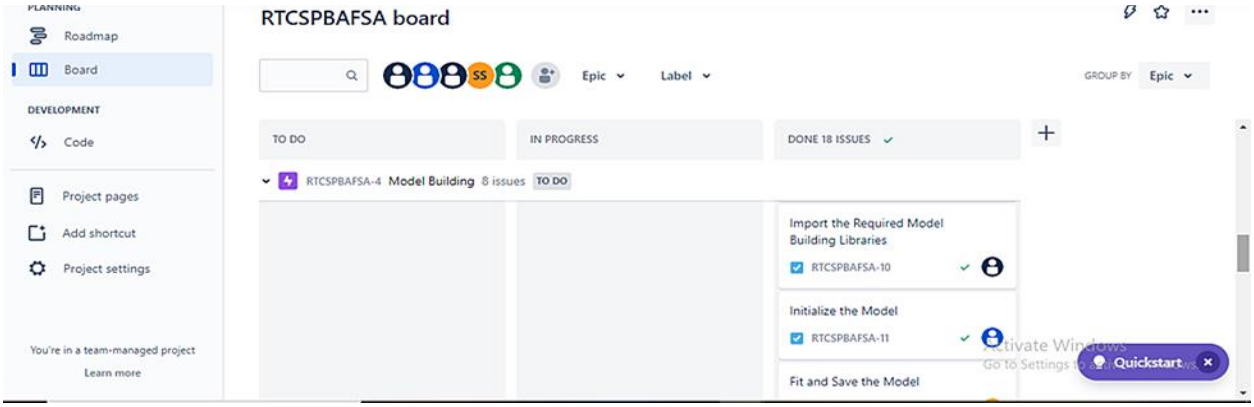


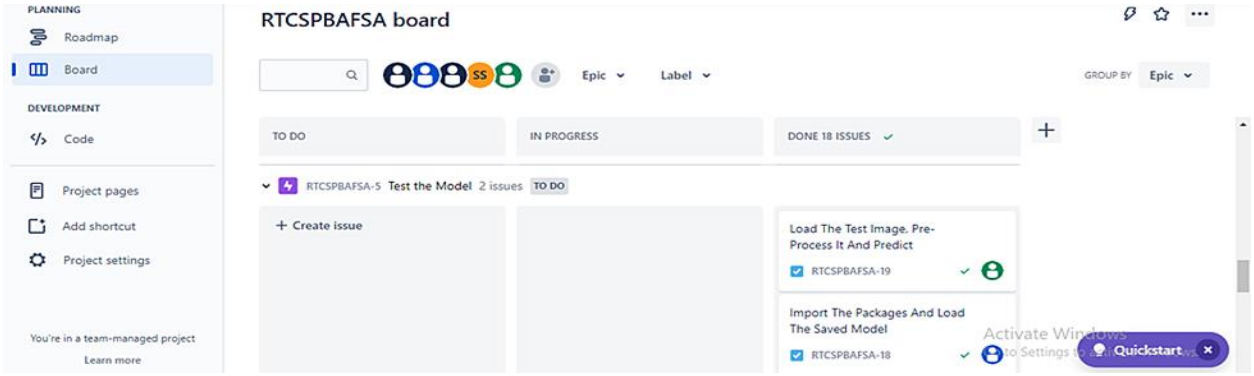
TRAIN CNN MODEL ON IBM

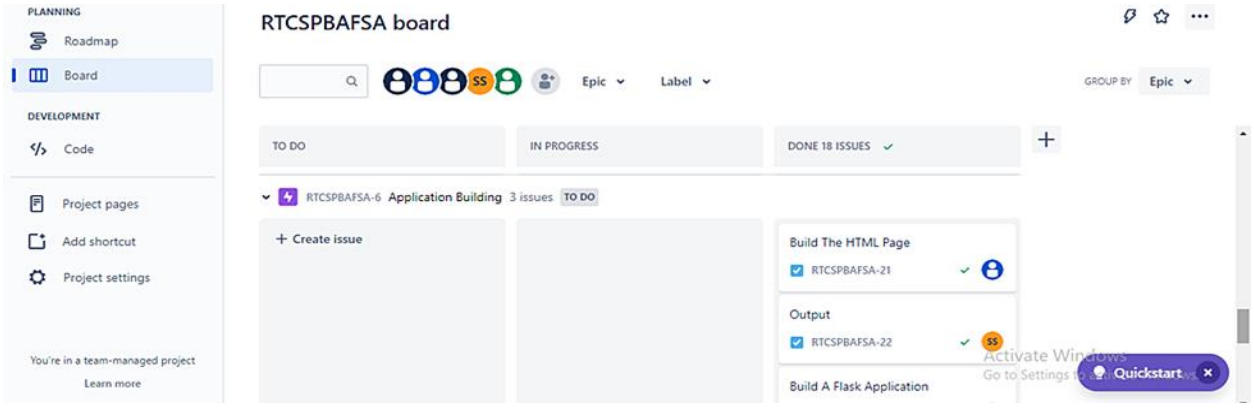


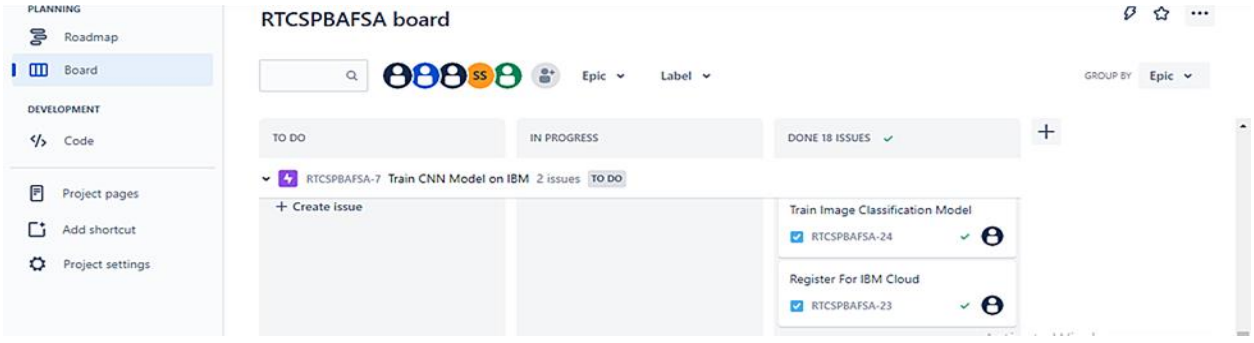
2. RTCSPBAFSA board




RTCSPBAFSA board
PLANNING
Roadmap
Board
DEVELOPMENT
Code
Project pages
Add shortcut
Project settings
You're in a team-managed project
Learn more
Epic
Label
GROUP BY
Epic
TO DO
IN PROGRESS
DONE 18 ISSUES
RTCSPBAFSA-4 Model Building 8 issues TO DO
Import the Required Model Building Libraries
RTCSPBAFSA-10
Initialize the Model
RTCSPBAFSA-11
Fit and Save the Model
Quickstart


RTCSPBAFSA board
PLANNING
Roadmap
Board
DEVELOPMENT
Code
Project pages
Add shortcut
Project settings
You're in a team-managed project
Learn more
Epic
Label
GROUP BY
Epic
TO DO
IN PROGRESS
DONE 18 ISSUES
RTCSPBAFSA-5 Test the Model 2 issues TO DO
+ Create issue
Load The Test Image, Pre-Process It And Predict
RTCSPBAFSA-19
Import The Packages And Load The Saved Model
RTCSPBAFSA-18
Quickstart


RTCSPBAFSA board
PLANNING
Roadmap
Board
DEVELOPMENT
Code
Project pages
Add shortcut
Project settings
You're in a team-managed project
Learn more
Epic
Label
GROUP BY
Epic
TO DO
IN PROGRESS
DONE 18 ISSUES
RTCSPBAFSA-6 Application Building 3 issues TO DO
+ Create issue
Build The HTML Page
RTCSPBAFSA-21
Output
RTCSPBAFSA-22
Build A Flask Application
Quickstart


RTCSPBAFSA board
PLANNING
Roadmap
Board
DEVELOPMENT
Code
Project pages
Add shortcut
Project settings
Epic
Label
GROUP BY
Epic
TO DO
IN PROGRESS
DONE 18 ISSUES
RTCSPBAFSA-7 Train CNN Model on IBM 2 issues TO DO
+ Create issue
Train Image Classification Model
RTCSPBAFSA-24
Register For IBM Cloud
RTCSPBAFSA-23

CHAPTER - 7

CODING & SOLUTIONING

1. PRE-REQUISITIES

Anaconda

Anaconda is a distribution (a bundle) of Python, R, and other languages, as well as tools tailored for data science (i.e., Jupyter Notebook and RStudio). It also provides an alternative package manager called conda. Anaconda is an open-source distribution of the Python and R programming languages for data science that aims to simplify package management and deployment.

Computer Vision

Computer vision is a field of artificial intelligence (AI) that enables computers and systems to derive meaningful information from digital images, videos and other visual inputs — and take actions or make recommendations based on that information. Computer vision is a field of AI that trains computers to capture and interpret information from image and video data.

Flask Framework

Flask is a micro web framework written in Python. It is classified as a microframework because it does not require particular tools or libraries. It has no database abstraction layer, form validation, or any other components where pre-existing third-party libraries provide common functions.

2. PYTHON PACKAGES

Tensorflow

TensorFlow is a free and open-source software library for machine learning and artificial intelligence. It can be used across a range of tasks but has a particular focus on training and inference of deep neural networks.

Keras

Keras is an open-source software library that provides a Python interface for artificial neural networks. Keras acts as an interface for the TensorFlow library. Up until version 2.3, Keras supported multiple backends, including TensorFlow, Microsoft Cognitive Toolkit, Theano, and PlaidML.

OpenCV

OpenCV is a library of programming functions mainly aimed at real-time computer vision. Originally developed by Intel, it was later supported by Willow Garage then Itseez. The library is cross-platform and free for use under the open-source Apache 2 License.

Flask Framework

Flask is a micro web framework written in Python. It is classified as a microframework because it does not require particular tools or libraries. It has no database abstraction layer, form validation, or any other components where pre-existing third-party libraries provide common functions.

3. LANGUAGES USED IN THE PROJECT

PYTHON

Python is a high-level, general-purpose programming language. Its design philosophy emphasizes code readability with the use of significant indentation. Python is dynamically-typed and garbage-collected. It supports multiple programming paradigms, including structured, object-oriented and functional programming.

HTML

The HyperText Markup Language or HTML is the standard markup language for documents designed to be displayed in a web browser. It can be assisted by technologies such as Cascading Style Sheets and scripting languages such as JavaScript.

CSS

Cascading Style Sheets is a style sheet language used for describing the presentation of a document written in a markup language such as HTML or XML. CSS is a cornerstone technology of the World Wide Web, alongside HTML and JavaScript.

JS

JavaScript, often abbreviated as JS, is a programming language that is one of the core technologies of the World Wide Web, alongside HTML and CSS. As of 2022, 98% of websites use JavaScript on the client side for webpage behavior, often incorporating third-party libraries.

4. SERVICES USED ON IBM CLOUD

IBM WATSON STUDIO

Watson Studio, formerly Data Science Experience or DSX, is IBM's software platform for data science. The platform consists of a workspace that includes multiple collaboration and open-source tools for use in data science. In Watson Studio, a data scientist can create a project with a group of collaborators, all having access to various analytics models and using various languages (R/Python/Scala). Watson Studio brings together staple open source tools including RStudio, Spark and Python in an integrated environment, along with additional tools such as a managed Spark service and data shaping facilities, in a secure and governed environment.

WATSON MACHINE LEARNING

Watson Machine Learning provides a full range of tools and services so that you can build, train, and deploy Machine Learning models. Choose the tool with the level of automation or autonomy that matches your needs, from a fully automated process to writing your own code.

IBM CLOUD OBJECT STORAGE

IBM Cloud Object Storage is a service offered by IBM for storing and accessing unstructured data. The object storage service can be deployed on-premise, as part of IBM Cloud Platform offerings, or in hybrid form.

7.1 Feature 1

LOGIN PAGE

The login page allows a user to gain access to an application by entering their username and password or by authenticating using a social media login. The login form gives access to your website or web application and therefore to your data. This form fulfills a fundamental task of security; but many times it is omitted to evaluate if the procedures of user name (user), keys (passwords) and authentication comply with the security recommendations.

LOGIN PAGE HTML CODING:

```
<html>
<head>
<title>Login page</title>
<style>

        .bg-dark {
                background-color:  #21618C!important;
        }
        #result {
                color: #ffffff;
        }
        body
{
   background-image:                                                    url("https://encrypted-
tbn0.gstatic.com/images?q=tbn:ANd9GcSvfuxVXA2WcuI7RFQ7Te01ne7bls63vUOUbw&usqp=CAU");
   background-size: cover;
}
 table{text-align: center;}


        </style>
</head>
   <body>
   <h1> <nav class="navbar navbar-dark bg-dark">
       <div class="container">
          <a class="white" href="#"><font color="white">  Real Time Communication System Powered
By AI For Specially Abled Using CNN</font></a>
       </div>
    </nav>
    </h1>
    <br>
     <br>
      <form action='http://127.0.0.1:5000/login' method="get">
        <div>
          <table align="center">
           <br>
           <br>
                   <tr>
              <td>Username</td>
```

```
        <td><input type='text' name="uname"></td>
    </tr>
    <br>
    <br>
            <tr>
        <td>Password</td>
        <td><input type='password' name="pass"></td>
    </tr>
    <br>
    <br>
            <tr>
        <td>
            
        <a class ="button" href="http://127.0.0.1:5000/homepage">click here</a></td>
    </tr>

  </table>

<p>               &nbs
p                &
nbsp               &nb
sp                
                &n
bsp               &nbs
p                &
nbsp               &nb
sp         

<imgsrc="
```


//8yXggoKCglJSUiIiItWwDb49QwXQAfHx9gfkn5+fkqKirNzc38/Pzm5uYuLi7x8fFycnLv7+9TU1Ph4eG9vb0
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</p>

</form>

</body>

</html>

7.2 Feature 2

HOME PAGE

A home page is the main web page of a website. The term may also refer to the start page shown in a web browser when the application first opens. Usually, the home page is located at the root of the website's domain or subdomain. They take that first impression and use it to judge, either positive or negative, your business. The homepage is no longer a marketing piece. Or a brochure or advertisement out on the Web. It has become the front window to your business.

HOME PAGE HTML CODING:

THIS THE CODE

```
<html>
<head>
<title>Home page</title>
 <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <meta http-equiv="X-UA-Compatible" content="ie=edge">
    <link href="https://cdn.bootcss.com/bootstrap/4.0.0/css/bootstrap.min.css" rel="stylesheet">
```

```
    <script src="https://cdn.bootcss.com/popper.js/1.12.9/umd/popper.min.js"></script>
    <script src="https://cdn.bootcss.com/jquery/3.3.1/jquery.min.js"></script>
    <script src="https://cdn.bootcss.com/bootstrap/4.0.0/js/bootstrap.min.js"></script>
    <link href="/static/main.css" rel="stylesheet">
<style>

            .bg-dark {
                    background-color:          #21618C!important;
            }
            #result {
                    color: #ffffff;
            }
            body
{
    background-image:                                                                    url("https://encrypted-
tbn0.gstatic.com/images?q=tbn:ANd9GcSvfuxVXA2WcuI7RFQ7Te01ne7bls63vUOUbw&usqp=CAU");

    background-size: cover;
}

<style>
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        h3{text-align: center;}
        img{text-align: center;}
         h4{text-align: center;}
        h1{text-align: center;}
        p{text-align: justify;}
    </style>

            </style>
</head>
    <body>
   <h3> <nav class="navbar navbar-dark bg-dark">
        <div class="container">
            <a class="white" href="#"><font color="white">  Real Time Communication System Powered
By AI For Specially Abled Using CNN</font></a>
        </div>
    </nav>
    </h3>
    <br>
     <br>
```

<h1> Hi ! User </h1>

<h3> You have login successfully</h3>

<h2>   Welcome you to The Real Time Communication System Powered By AI For Spcially Abled</h2>

<h5><div><p> 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. </p>

<p> 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. </p>

<p> Text Conversion System with Hand Gesture Recognition and translation will be very useful to have a proper conversation between a normal person and an impaired

person in any language.The project aims to develop a system that converts the sign language into a human understandable text in the desired language to convey a message to normal people.</p>

<p> We are making use of a convolution neural network to create a model that is trained on different hand gestures. An Web Application 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 text is given as output.</p></div>

<div>

<h4>
<p>

<img
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7.3 Database Schema

NOSQL

NoSQL, also referred to as “not only SQL”, “non-SQL”, is an approach to database design that enables the storage and querying of data outside the traditional structures found in relational databases. Examples of column-based NoSQL databases include Cassandra, HBase, and Hypertable. NoSQL databases are non-tabular databases and store data differently than relational tables.

CHAPTER 8
TESTING

8.1 Test Cases

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite
LoginPage_TC_OO1	Functional	Home Page	Verify user is able to see the Login/Signup popup when user clicked on My account button	Domain name,Web Hosting.
LoginPage_TC_OO2	UI	Home Page	Verify the UI elements in Login/Signup popup	Logo design,Text content. WebDesigner.
LoginPage_TC_OO3	Functional	Login page	Verify user is able to log into application with InValid credentials	'Email/Phone Number/Username' Textbox, 'Password' Textbox, 'Remember Me' Checkbox.
LoginPage_TC_OO4	Functional	Login page	Verify user is able to log into application with InValid credentials	'Login' Button, Forgot Password' Link. 'Sign up
LoginPage_TC_OO5	Functional	Login page	Verify user is able to log into application with InValid credentials	Create an account' Link, CAPTCHA.

Steps To Execute	Test Data	Expected Result	Actual Result	Status
1.Enter URL and click go 2.Click on My Account dropdown button 3.Verify login/Singup popup displayed or not	https://shopenzer.com/	Login/Signup popup should display	Working as expected	Pass

1.Enter URL and click go 2.Click on My Account dropdown button 3.Verify login/Singup popup with below UI elements: a.email text box b.password text box c.Login button d.New customer? Create account link e.Last password? Recovery password link	https://shopenzer.com/	Application should show below UI elements: a.email text box b.password text box c.Login button with orange colour d.New customer? Create account link e.Last password? Recovery password link	Working as expected	PASS
1.Enter URL(https://shopenzer.com/) and click go 2.Click on My Account dropdown button 3.Enter InValid username/email in Email text box	Username: SOWMIYA password: TEST123	Application should show 'Incorrect email or password ' validation message.	Working as expected	PASS
1.Enter URL(https://shopenzer.com/) and click go 2.Click on My Account dropdown button 3.Enter Valid username/email in Email text box 4.Enter Invalid password in password text box 5.Click on login button	Username: chalam@gmail.com password: Testing123678686786876876	Application should show 'Incorrect email or password ' validation message.	Working as expected	PASS
1.Enter URL(https://shopenzer.com/) and click go 2.Click on My Account dropdown button 3.Enter InValid username/email in Email text box 4.Enter Invalid password in password text box 5.Click on login button	Username: SITA password: SITA2123*	Application should show 'Incorrect email or password ' validation message.	Working as expected	PASS

8.2 User Acceptance Testing

Defect Analysis

This reportshows the numberof resolved or closed bugs at each severity level, and how they were resolved

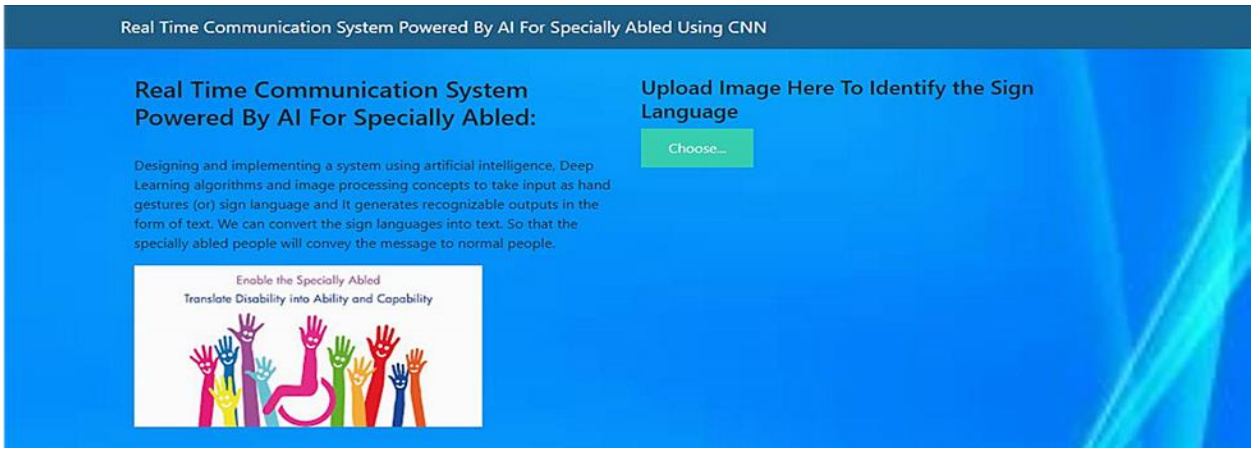
Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	4	2	3	20
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	24	14	13	26	77

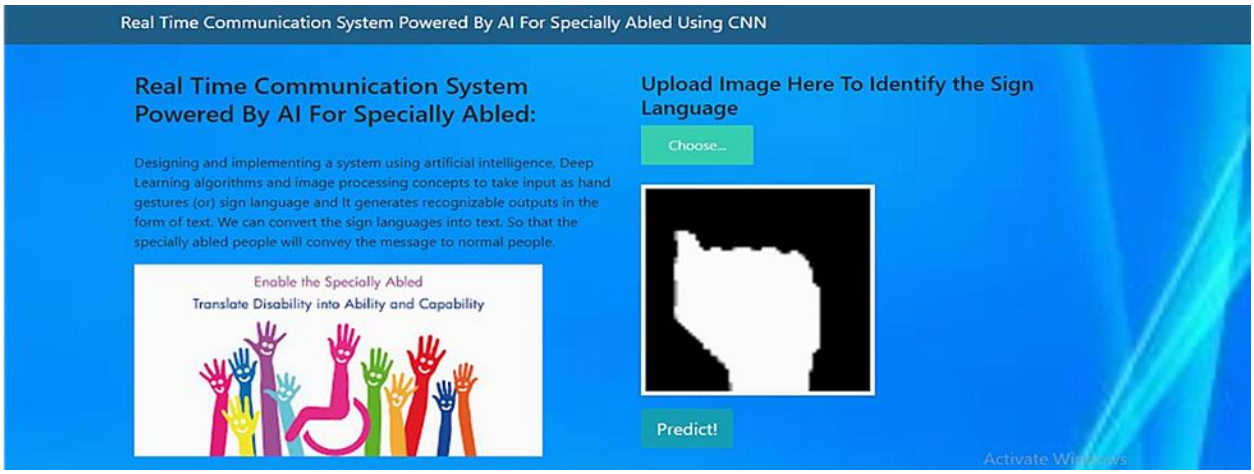
Test Case Analysis

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

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	6	0	0	7
Client Application	40	0	0	40
Security	2	0	0	2
Outsource Shipping	4	0	0	4
Exception Reporting	9	0	0	9
Final ReportOutput	3	0	0	3
Version Control	2	0	0	2

CHAPTER 9
RESULTS





9.1 Performance Metrics

Project metrics are key indicators that help to track a project's performance. To be a successful project manager, one must monitor the team's progress and lead the efforts to the project's goals. Metrics also help to implement corrective measures in case the numbers don't align with the expectations.

Accuracy

Accuracy describes the closeness of values to a true value – in other words, how correct they are compared to your target or goal. When you measure your results and find them very close to your target value, they are accurate. Accurate project estimates help identify cost and schedule requirements with relative precision, and reduce the risk of running out of time, resources, and budget during a project.

Training Accuracy - 0.9956 %

Validation Accuracy – 0.9756 %

```
In [21]: model.fit(x_train,epochs=9,validation_data=x_test,steps_per_epoch=len(x_train),validation_steps=len(x_test))
Epoch 1/9
525/525 [==============================] - 329s 616ms/step - loss: 0.3160 - accuracy: 0.8886 - val_loss: 0.1389 - val_accuracy:
0.9644
Epoch 2/9
525/525 [==============================] - 251s 478ms/step - loss: 0.0592 - accuracy: 0.9810 - val_loss: 0.2418 - val_accuracy:
0.9662
Epoch 3/9
525/525 [==============================] - 271s 515ms/step - loss: 0.0345 - accuracy: 0.9886 - val_loss: 0.2308 - val_accuracy:
0.9680
Epoch 4/9
525/525 [==============================] - 240s 457ms/step - loss: 0.0244 - accuracy: 0.9923 - val_loss: 0.1640 - val_accuracy:
0.9711
Epoch 5/9
525/525 [==============================] - 217s 412ms/step - loss: 0.0258 - accuracy: 0.9914 - val_loss: 0.0888 - val_accuracy:
0.9769
Epoch 6/9
525/525 [==============================] - 267s 509ms/step - loss: 0.0171 - accuracy: 0.9942 - val_loss: 0.2250 - val_accuracy:
0.9782
Epoch 7/9
525/525 [==============================] - 344s 655ms/step - loss: 0.0139 - accuracy: 0.9955 - val_loss: 0.1629 - val_accuracy:
0.9773
Epoch 8/9
525/525 [==============================] - 356s 678ms/step - loss: 0.0107 - accuracy: 0.9964 - val_loss: 0.1430 - val_accuracy:
0.9631
Epoch 9/9
525/525 [==============================] - 363s 692ms/step - loss: 0.0136 - accuracy: 0.9956 - val_loss: 0.2175 - val_accuracy:
0.9756
Out[21]: <keras.callbacks.History at 0x231bd228e20>
```

CHAPTER 10
ADVANTAGES & DISADVANTAGES

ADVANTAGES

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 text is given as output. They can participate in daily activities rather than being inactive and can get good job opportunities. Adaptive learning platforms also provide personalized learning experiences tailored to the specific needs of students with disabilities. This application aims to help deaf and dumb by providing them with an attractive communication.

DISADVANTAGES

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. AI-based tools can also be used to help with interactions by people who are unable to see content. Tools like Apple Siri and Amazon Echo and Alexa provide ways of interacting with content through a spoken dialogue model.

CHAPTER 11
CONCLUSION

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. As the specially abled people feel very difficult to convey their message to normal people in emergency times as well as in normal times. The main purpose of this application is to make deaf-mute people feel independent and more confident. The system can generate revenue through direct customers and collaborate with health care sector and generate revenue from their customers.

AI holds the key to unlocking a magnificent future where, driven by data and computers that understand our world, we will all make more informed decisions. These computers of the future will understand not just how to turn on the switches but why the switches need to be turned on. Designing and implementing a system using artificial intelligence, Deep Learning algorithms and image processing concepts to take input as hand gestures (or) sign language and It generates recognizable outputs in the form of text and voice. We can convert the sign languages into voice or text. So that the specially abled people will convey the message to normal people. They can participate in daily activities rather than being inactive and can get good job opportunities. Adaptive learning platforms also provide personalised learning experiences tailored to the specific needs of students with disabilities. This application aims to help deaf and dumb by providing them with an attractive communication.

CHAPTER 12
FUTURE SCOPE

Applying augmentations to the dataset can make the model training more accurate but also stabilize it at higher accuracies. Thereby depicting its caliber to make highly accurate predictions with an accuracy rate of 99%. we examined and assessed the deep learning techniques used to classify a sign language. The project aims to develop a system that converts the sign language into a human hearing voice or text in the desired language to convey a message to normal people, as well as convert speech or text into understandable sign language for the deaf and dumb. The Deaf/Dump people needs a way to communicate easily and quickly with the normal people, so that the Deaf/Dump people feel confident enough to express there thought, ideas, and can make conversation with the normal people.

Designing and implementing a system using artificial intelligence, Deep Learning algorithms and image processing concepts to take input as hand gestures (or) sign language and It generates recognizable outputs in the form of text. The system uses neural networks and Computer vision to recognizes the video or image of sign language then smart deep learning algorithms translate it into text. As the specially abled people feel very difficult to convey their message to normal people in emergency times as well as in normal times. The main purpose of this application is to make deaf-mute people feel independent and more confident. They can participate in daily activities rather than being inactive and can get good job opportunities. Adaptive learning platforms also provide personalised learning experiences tailored to the specific needs of students with disabilities. This application aims to help deaf and dumb by providing them with an attractive communication.

CHAPTER 13

APPENDIX

13.1 Source Code

Real-Time Communication System Powered by AI for Specially Abled Project

Image Preprocessing

Import ImageDataGenerator Library And Configure It

```
from tensorflow.keras.preprocessing.image import ImageDataGenerator
train_datagen=ImageDataGenerator(rescale=1./255,horizontal_flip=True,vertical_flip=True,zoom_range=0.2)
test_datagen=ImageDataGenerator(rescale=1./255)
```

Apply ImageDataGenerator Functionality To Train And Test Set

```
x_train=train_datagen.flow_from_directory(r"C:\Users\Acer\Downloads\conversation engine for deaf and dumb\Dataset\training_set",target_size=(64,64),
    class_mode="categorical",batch_size=30)
Found 15750 images belonging to 9 classes.
I
x_test=test_datagen.flow_from_directory(r"C:\Users\Acer\Downloads\conversation engine for deaf and dumb\Dataset\test_set",target_size=(64,64),
class_mode="categorical",batch_size=30)
Found 2250 images belonging to 9 classes.
```

Model Building

Import The Required Model Building Libraries

```
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

```
model=Sequential()
```

Add The Convolution Layer

```
model.add(Convolution2D(32,(3,3),activation="relu",input_shape=(64,64,3)))
#No of feature detectors, size of feature detector, image size, activation function
```

Add The Pooling Layer

```
model.add(MaxPooling2D(pool_size=(2,2)))
```

Add The Flatten Layer

```
model.add(Flatten())
```

Adding The Dense Layers

```
model.add(Dense(200,activation='relu'))
model.add(Dense(200,activation='relu'))
model.add(Dense(9,activation="softmax"))
```

Compile The Model

```
model.compile(loss="categorical_crossentropy",metrics=["accuracy"],optimizer='adam')
len(x_train)
525
len(x_test)
75
```

Fit And Save The Model Fit the neural network model with the train and test set, number of epochs, and validation steps. The weights are to be saved for future use. The weights are saved in signlanguage.h5 file using save().

```
model.fit(x_train,epochs=9,validation_data=x_test,steps_per_epoch=len(x_train),validation_steps=le
n(x_test))
Epoch 1/9
525/525 [==============================] - 329s 616ms/step - loss: 0.3160 - accuracy: 0.8886
- val_loss: 0.1389 - val_accuracy: 0.9644
Epoch 2/9
525/525 [==============================] - 251s 478ms/step - loss: 0.0592 - accuracy: 0.9810
- val_loss: 0.2418 - val_accuracy: 0.9662
Epoch 3/9
525/525 [==============================] - 271s 515ms/step - loss: 0.0345 - accuracy: 0.9886
- val_loss: 0.2308 - val_accuracy: 0.9680
Epoch 4/9
525/525 [==============================] - 240s 457ms/step - loss: 0.0244 - accuracy: 0.9923
- val_loss: 0.1640 - val_accuracy: 0.9711
Epoch 5/9
525/525 [==============================] - 217s 412ms/step - loss: 0.0258 - accuracy: 0.9914
- val_loss: 0.0888 - val_accuracy: 0.9769
Epoch 6/9
525/525 [==============================] - 267s 509ms/step - loss: 0.0171 - accuracy: 0.9942
- val_loss: 0.2250 - val_accuracy: 0.9782
Epoch 7/9
525/525 [==============================] - 344s 655ms/step - loss: 0.0139 - accuracy: 0.9955
- val_loss: 0.1629 - val_accuracy: 0.9773
Epoch 8/9
525/525 [==============================] - 356s 678ms/step - loss: 0.0107 - accuracy: 0.9964
- val_loss: 0.1430 - val_accuracy: 0.9631
Epoch 9/9
525/525 [==============================] - 363s 692ms/step - loss: 0.0136 - accuracy: 0.9956
- val_loss: 0.2175 - val_accuracy: 0.9756


model.save("signlanguage-new.h5")
```

Test The Model

Import The Packages And Load The Saved Model

```
from keras.models import load_model
import numpy as np
import cv2
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
import numpy as np
model=load_model("signlanguage.h5")
```

Load The Test Image, Pre-Process It And Predict

```
img=image.load_img("16.png",target_size=(64,64))
img
```

```
type(img)
PIL.Image.Image
x = image.img_to_array(img)
x
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.],
        ...,
```

```
       [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)

x.shape
(64, 64, 3)
x                    =                    np.expand_dims(x,axis=0)
x.shape
(1, 64, 64, 3)
pred_prob = model.predict(x)
1/1 [==============================] - 1s 1s/step
pred_prob
array([[1., 0., 0., 0., 0., 0., 0., 0., 0.]], dtype=float32)
class_name=["A","B","C","D","E","F","G","H","I"]
pred_id = pred_prob.argmax(axis=1)[0]
pred_id
0
print("the alphabet is  ",str(class_name[pred_id]))
the alphabet is   A
```

Build A Flask Application

```
import
numpy
as np
        import os
        from tensorflow.keras.models import load_model
        from tensorflow.keras.preprocessing import image
        from flask import Flask,render_template,request


        app=Flask(__name__)


        model=load_model(r'C:/Users/Acer/IBM --TRAINING SESSION/PROJECT/signlanguage.h5')
```

```
@app.route('/loginpage',methods=['GET'])


def login():
    if (request.method == 'GET' != " "):
        uname=request.args.get('uname')
        password=request.args.get('pass')
        if uname=='uname' and password=='pass':
         return render_template("afterlogin1.html",name = uname)
    return render_template("login1.html")


@app.route('/homepage')
def home():
    return render_template("afterlogin1.html")


@app.route('/')
def index():
    return render_template("index.html")


@app.route('/predict',methods=['GET','POST'])
def upload():
    if request.method=='POST':
        f=request.files['image']
        basepath=os.path.dirname(__file__)
        filepath=os.path.join(basepath,r'C:/Users/Acer/IBM --TRAINING
SESSION/PROJECT/flask/uploads',f.filename)
        f.save(filepath)
        img=image.load_img(filepath,target_size=(64,64))
        x=image.img_to_array(img)
        x=np.expand_dims(x,axis=0)
        pred=np.argmax(model.predict(x),axis=1)
        index=["A","B","C","D","E","F","G","H","I"]
        text="The Predicted Alphabet is : " +str(index[pred[0]])
    return text
if __name__=='__main__':
    app.run(debug=True)
```

Build The HTML

```
<html
lang="en"
>


            <head>
                <meta charset="UTF-8">
                <meta name="viewport" content="width=device-width, initial-scale=1.0">
                <meta http-equiv="X-UA-Compatible" content="ie=edge">
                <title>Real Time Communication System Powered By AI For Specially
            Abled</title>
                <link href="https://cdn.bootcss.com/bootstrap/4.0.0/css/bootstrap.min.css"
            rel="stylesheet">
                <script
            src="https://cdn.bootcss.com/popper.js/1.12.9/umd/popper.min.js"></script>
                <script src="https://cdn.bootcss.com/jquery/3.3.1/jquery.min.js"></script>
                <script
            src="https://cdn.bootcss.com/bootstrap/4.0.0/js/bootstrap.min.js"></script>
                <link href="{{ url_for('static', filename='main.css') }}" rel="stylesheet">
                   <style>

                   .bg-dark {
                          background-color:     #21618C!important;
                   }
                   #result {
                          color: #ffffff;
                   }
                   body
            {
                background-image: url("https://encrypted-
            tbn0.gstatic.com/images?q=tbn:ANd9GcSvfuxVXA2WcuI7RFQ7Te01ne7bls63vUOUbw&usqp=C
            AU");

                background-size: cover;
            }



                   </style>
            </head>
```

```
<body>

    <nav class="navbar navbar-dark bg-dark">
        <div class="container">
            <a class="navbar-brand" href="#">Real Time Communication System
Powered By AI For Specially Abled Using CNN</a>
        </div>
    </nav>
    <div class="container">
        <div id="content" style="margin-top:2em">
              <div class="container">
                <div class="row">
                     <div class="col-sm-6 bd">
                       <h3 color="white">Real Time Communication System
Powered By AI For Specially Abled: </h3>
                       <br>
                       <p> Designing and implementing a system using
artificial intelligence, Deep Learning algorithms and image processing concepts
to take input as hand gestures (or) sign language and It generates recognizable
outputs in the form of text. We can convert the sign languages into text. So
that the specially abled people will convey the message to normal people. </p>
                            <img src="https://encrypted-
tbn0.gstatic.com/images?q=tbn:ANd9GcQ1904-
GZIGvQT5QTkIUcjyqqMmotD05KHFTw&usqp=CAU" height="50%",width="20%">
                     </div>
                     <div class="col-sm-6">
                            <div>
                                   <h4>Upload Image Here To Identify the Sign
Language</h4>
                     <form action = "http://localhost:5000/" id="upload-file"
method="post" enctype="multipart/form-data">
                            <label for="imageUpload" class="upload-label">
                                   Choose...
                            </label>
                            <input type="file" name="image" id="imageUpload"
accept=".png, .jpg, .jpeg">
                     </form>



                     <div class="image-section" style="display:none;">
                            <div class="img-preview">
                                   <div id="imagePreview">
```

```
                                        </div>
                                    </div>
                                    <div>
                                        <button type="button" class="btn btn-info
btn-lg " id="btn-predict">Predict!</button>
                                    </div>
                                </div>


                                <div class="loader" style="display:none;"></div>


                                <h3>
                                    <span id="result"> </span>
                                </h3>


                            </div>
                                </div>

                              </div>
                            </div>
                            </div>
        </div>
    </body>


    <footer>
        <script src="{{ url_for('static', filename='main.js') }}"
    type="text/javascript"></script>
    </footer>


    </html>
```

13.2 GitHub & Project Demo Link

GitHub Link

https://github.com/IBM-EPBL/IBM-Project-21713-1659789146

Project Demo Link

https://youtu.be/TK7Yv5WgKJ4