



**REAL TIME COMMUNICATION
SYSTEM POWERED BY AI
FOR SPECIALLY ABLED
NALAIYA THIRAN PROJECT BASED LEARNING
On
PROFESSIONAL READINESS FOR
INNOVATION,
EMPLOYABILITY AND ENTREPRENEURSHIP**

A PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that project report “**REAL TIME COMMUNICATION SYSTEM POWERED BY AI FOR SPECIALLY ABLED**” is the bona fide work of “MONISHA.E,VEERADHARSHINI.A,ANITHA.S,SUGANYA.C” who carried out the project work under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other

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1. INTRODUCTION

In our society, we have people with disabilities. The technology is developing day by day but no significant developments are undertaken for the betterment of these people. Communications between deaf-mute and a normal person has always been a challenging task.

It is very difficult for mute people to convey their message to normal people. Since normal people are not trained on hand sign language. In emergency times conveying their message is very difficult. The human hand has remained a popular choice to convey information in situations where other forms like speech cannot be used.

Voice Conversion System with Hand Gesture Recognition and translation will be very useful to have a proper conversation between a normal person and an impaired person in any language.

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

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

1.1 PROJECT OVERVIEW

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

convey their information using signs which get converted to human-understandable language and speech is given as output.

1.2 PURPOSE

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

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM

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

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

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

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

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

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

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

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

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

ARSL is categorized into two groups:

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

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

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

2.2 REFERENCES

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

Nidhi Kawale, Divya Hiranwar, Mayuri Bomewar An Android Messenger Application for Deaf and dumb 2017

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

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

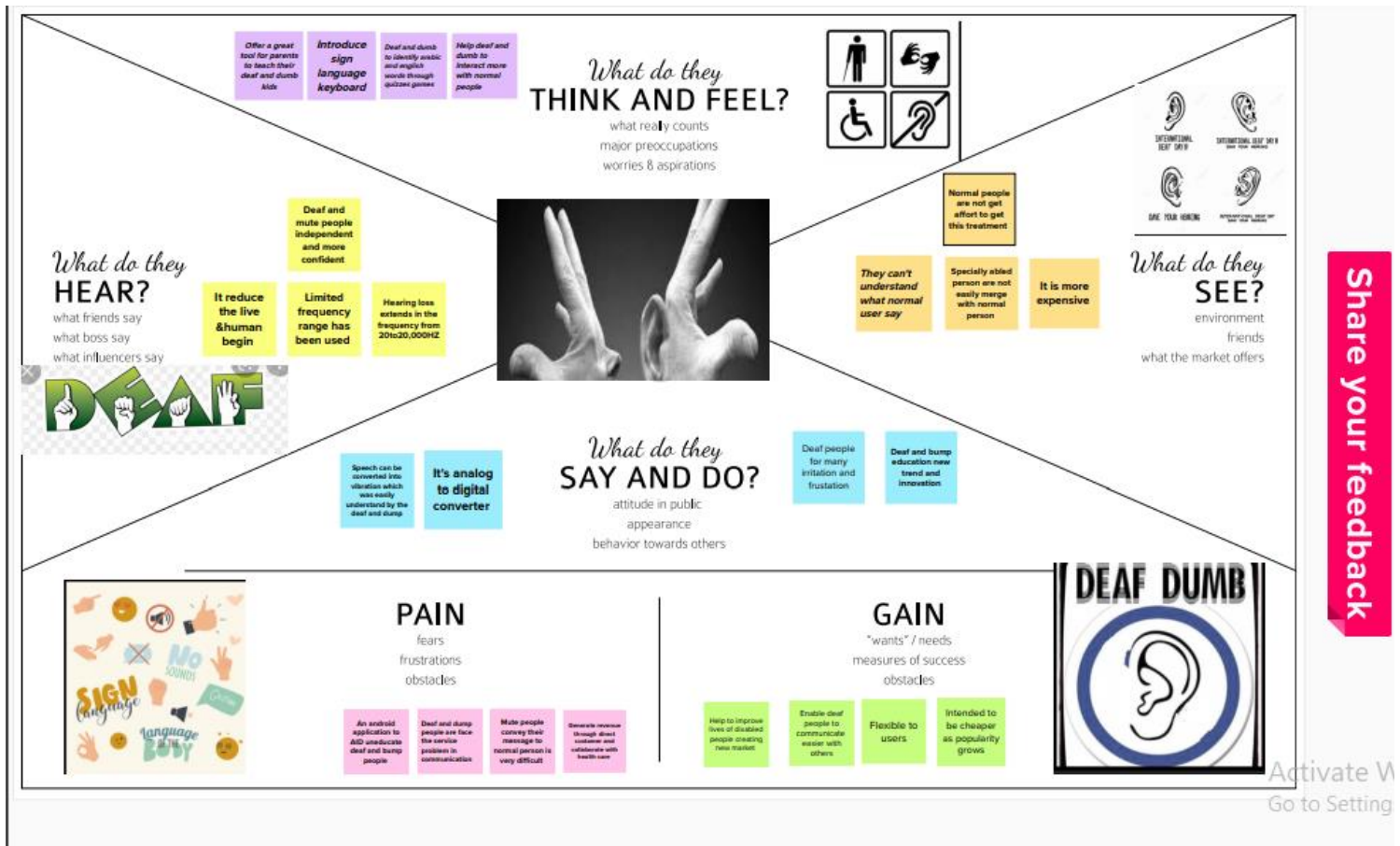
2.3 PROBLEM STATEMENT DEFINITION



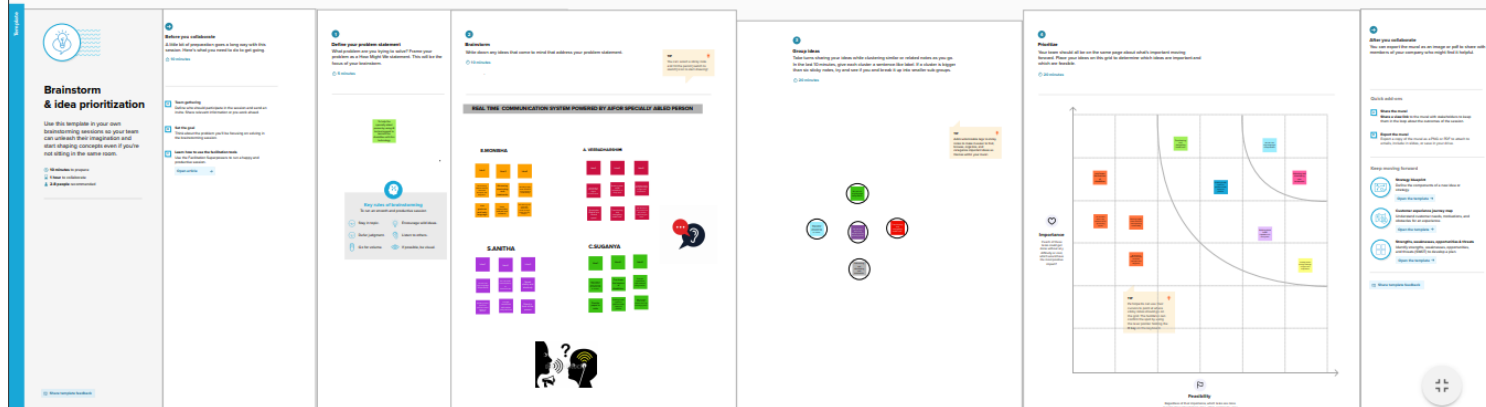
Problem Statement (PS):	People with disabilities are not able to communicate with the people and society. Though technologies are evolving but there is no significant growth for these people. So, an AI system is developed to communicate with people in real time.
I am (Specially abled person)	A Specially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

3. IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



3.2 IDEATION AND BRAINSTORMING



3.3 PROPOSED SOLUTION

S.NO	PARAMETERS	DESCRIPTION
1.	Problem Statements (Problem to be saved)	Coining the term "specially-abled" to replace "disabled" was perhaps the most significant positive step towards creating an inclusive workplace. Not only did it help in breaking the shackles of incapacity and low self-esteem, but it also reinforced a feeling of empathy in the ecosystem that has proved to be invaluable in downplaying the stigma attached to a disabled person. You will now find people welcoming the specially-abled to the workplace, helping them adjust to their work environment and treating them at par with other members of the team.
2.	Idea/Solution description	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.

3.	Novelty/Uniqueness	<p>Creating new tools could help integrate a segment of our population that has often been left out of routine daily life activities and job opportunities. The unemployment rate is twice as high for Americans with disabilities, according to the Bureau of Labor Statistics. Worldwide, only one in 10 people who could use assistive products have access to them. Disabilities, whether related to vision, hearing, mental health, learning, cognition, or mobility, can be permanent, temporary, or even situational. Designing new products with different levels of abilities in mind—a concept called inclusive design—has gone a long way in ensuring that technology works for everyone.</p>
4.	Social impact/ Customer Satisfaction	<p>Communicating with others and being connected. Depending on the type of disability and profile, communicating with others can be a challenge. The same holds true for staying connected to others in a world that's more and more digitized with the growing importance of social media and our dependence on the Internet. But technology and AI leave no one behind and can beat the service of people with disabilities. AI-powered apps use artificial intelligence to favor accessibility.</p>
5.	Business model (Revenue model)	<ul style="list-style-type: none"> • able to get accurate results • easy to use for specially abled • specially abled person can use this feature by their own • low cost
6.	Scalability of the solution	<ul style="list-style-type: none"> • This model ensures the safety and accuracy of specially abled • specially abled persons and their families need not to worry about their future

3.4 PROBLEM SOLUTION FIT

4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	SubRequirement (Story/ Sub-Task)
FR-1	User Registration	<ul style="list-style-type: none">• Registration through Form• Registration through Gmail
FR-2	User Confirmation	<ul style="list-style-type: none">• Confirmation via Email• Confirmation via OTP
FR-3	System	<ul style="list-style-type: none">• Desktop with high resolution camera.• Provides Access to capture Image through the Camera.• Provides Access to Upload the Captured image through Gallery.
FR-4	Text conversion	Convert the Sign language into text using Convolutional Neural Network (CNN) Model.
FR-5	Sentence Translation	Recognizes these separate Signs of One-By-One and it could provide a Translation in the situation where Signed Extract System (SEE) is provided.
FR-6	Review	Users Can Give their Feedback on the Review page about the Application.

4.2 NON-FUNCTIONAL REQUIREMENT

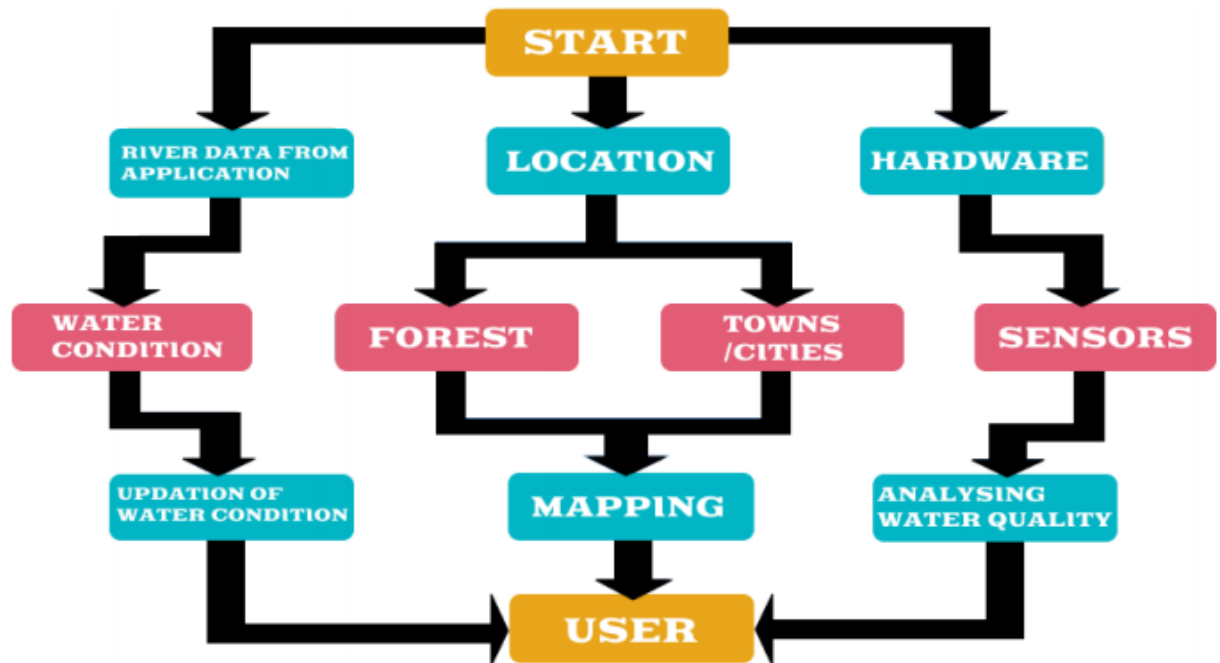
Non-functional Requirements:

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

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	To convey a message to normal people, as well as convert speech into understandable sign language for the deaf and dumb people.
NFR-2	Security	Converted information using signs into speech is accessed only by the user.
NFR-3	Reliability	Sign Method is Relevant to use for Differently abled persons.
NFR-4	Performance	The time for converting signs into speech should be faster for the real-time communication.
NFR-5	Availability	Provides automatic recovery as much as possible.
NFR-6	Scalability	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.

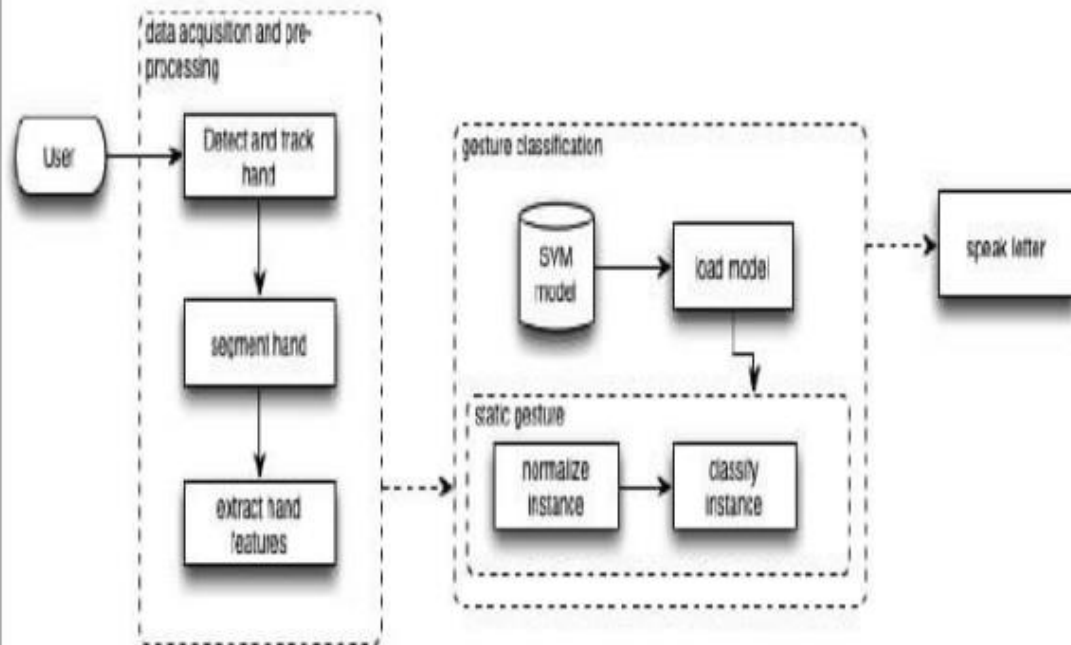
5. PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS



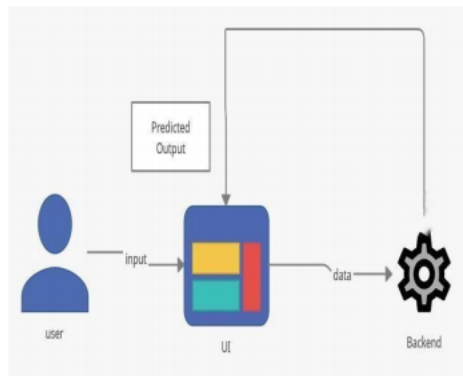
5.2 SOLUTION AND TECHNICAL ARCHITECTURE

Vision-based Sign Language Recognition

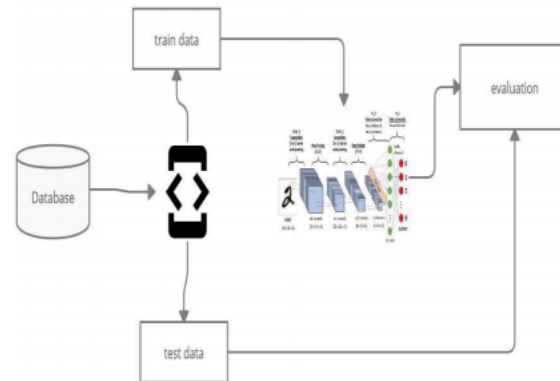


TechnicalArchitecture:

The Deliverables as below and the information as per the table 1.



DEPLOYMENT



TRAINING AND EVALUATION

5.3 USER STORIES

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 email, password, and confirming my password.	I can access my account/ dashboard	High	Sprint-1
		USN-2	As a user, I will receive a confirmation email once I have registered for the application	I can receive a confirmation email & click confirm	High	Sprint-2
		USN-3	As a user, I can register for the application through Google	I can register & access the dashboard with Google	High	Sprint-1
		USN-4	As a user, I can register for the application through Gmail	I can register through the email.	Medium	Sprint-2
Customer (Web user)	Login	USN-5	As a user, I can log into the application by entering email, password & captcha	I can receive login credentials.	High	Sprint-1
	Interface	USN-6	As a user, the interface should be user-friendly manner	I can able to access easily.	Medium	Sprint-1
	dashboard	USN-7	As a user, I can access the specific info (ph value, temperature, humidity, quality).	I can able to know the quality of the water.	High	Sprint-1
	View manner	USN-8	As a user, I can view data in visual representation manner (graph)	I can easily understand by visuals.	High	Sprint-1
Customer (input)	Taste	USN-9	As a user, I can view the quality (salty) of the water	I can easily know whether it is salty or not.	High	Sprint-1
	Colour visibility	USN-10	As a user, I can predict the water colour	I can easily know the condition by colour.	High	Sprint-1
Administrator	Risk tolerant	USN-11	An administrator who is handling the system should update and take care of the application.	Admin should monitor the records properly.	Medium	Sprint-2

Activate Windows
Go to Settings to activate

6. PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION

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

Use the below template to create product backlog and sprint schedule

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

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Go to Settings to activate Windows

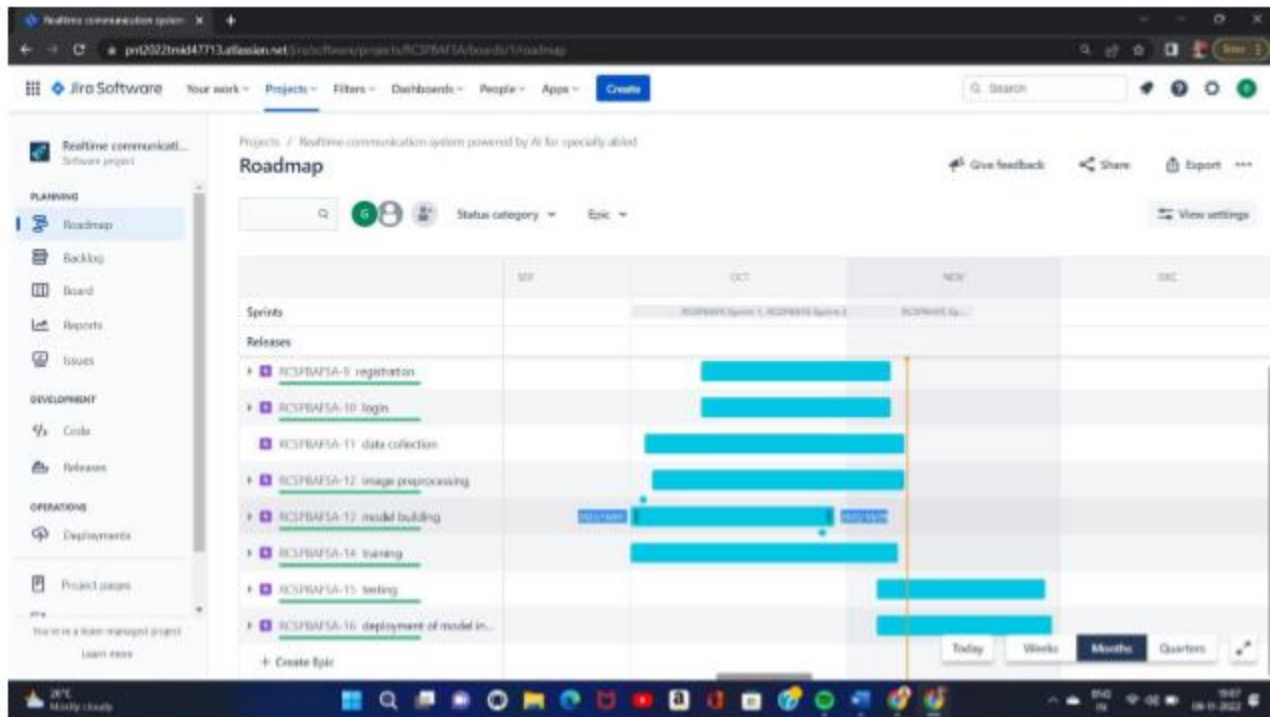
6.2 SPRINT DELIVERY SCHEDULE

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

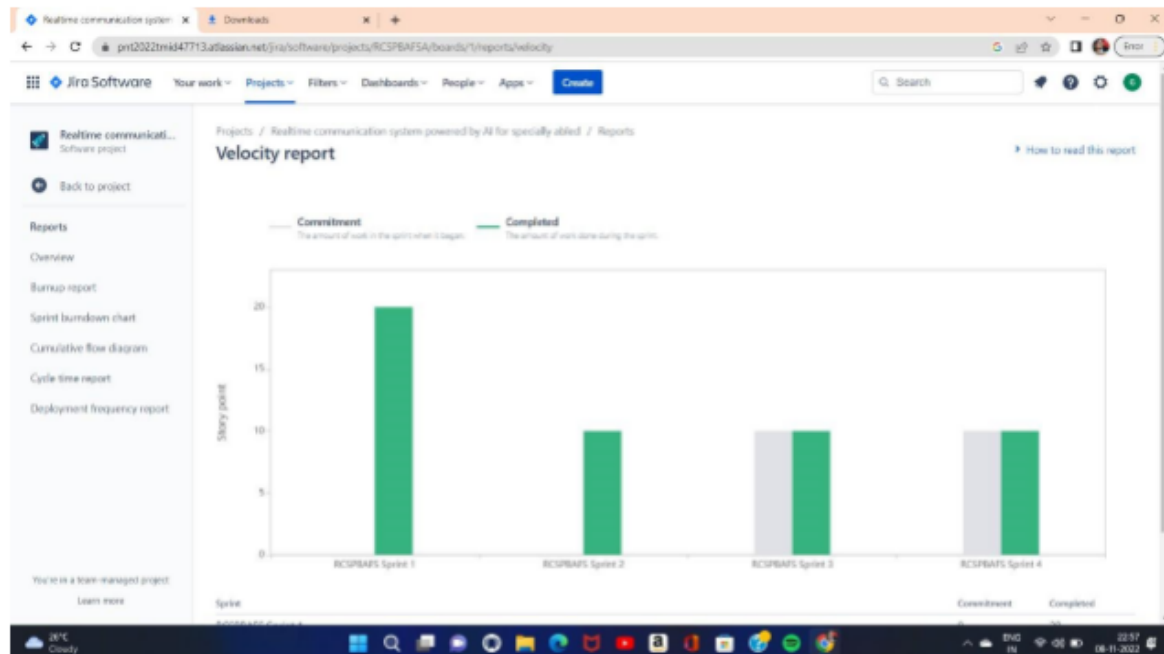
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	26 Oct 2022	29 Oct 2022	20	30 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

6.3 REPORTS FROM JIRA

ROADMAP FOR THE PROJECT



VELOCITY FOR THE PROJECT



7. CODING AND SOLUTIONING

7.1 FEATURE 1

- Feature 1: Registration
- Feature 2: Login
- Feature 3: User interface
- Feature 4: Store database
- Feature 5: Send Alert Emails to us

8. TESTING

8.1 Test Cases & User Acceptance Testing

- Login Page (Functional)
- Login Page (UI)
- Add Expense Page (Functional)

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	10	10	20	10	20
Duplicate	10	20	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37
Not Reproduced	10	10	10	10	10
Skipped	10	0	1	10	20
Won't Fix	10	15	20	10	30
Totals	24	14	13	26	77

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

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	0	0	17
Client Application	51	0	0	51
Security	2	0	0	12
Outsource Shipping	13	0	0	3
Exception Reporting	19	0	0	9
Final Report Output	14	0	0	14
Version Control	12	0	0	2

9.RESULTS

9.1 PERFORMANCE METRICS

5	Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	TC for Automation(Y/N)	
6	LoginPage_TC_001	Functional	Login page	Verify user is able to log into website with Valid credentials	Login first	1.Go to login page 2.Enter email ID and password 3.click to register	monielango2@gmail.com	successfully log in to the website	Working as expected	Pass	YES	
7	homepage_TC_002	Functional	home page	verify the product available in the website and able to know the quantity & update the product	Home page	1.Login to home page 2.click an add product 3.enter name,price,quantity	update quantity of the product	Successfully updated the product	Working as expected	pass	YES	
8	pythoncode_TC_003	code	python3.11	verify python code run without error	software	1.download the python version 3.11 2.type the program and save it 3.verify its run continuously	type python code to create backend	successfully created to the website	working as expected	pass	YES	
9	webUI_TC_004	Functional	Python flask	To create a web UI to interact with user	python IDE	1.Go to dashboard 2.open a web link 3.display the result	monielango2@gmail.com	website should show the accurate quantity of the product	Working as expected	pass	YES	
10	IBMcloud_TC_005	Functional	IBM Cloud service	verify login to the cloud service	IBM cloud service	1.log in to IBM.cloud.com 2.create your own account	monielango2@gmail.com	successfully created an account	Working as expected	Pass	YES	
11	IBM DB2_TC_006	Functional	Dataset	Verify the database is created in the IBM cloud and get the service credentials	IBM cloud service	1.Go to the catalog 2.to create the database , go to the cloudant 3.launch dashboard	create a database with click create button and store the quantity of the product	successfully created a database in DB2	Working as expected	Pass	YES	
12	Sendgrid_TC_007	Functional	E-mail	Verify user is able to receive the	software	1.To send mails from the application 2.we need to integrate the sendgrid serve	send alert mail to the user	successfully get the alert mail	Working as expected	pass	YES	
13												
14												
15												

10. ADVANTAGES & DISADVANTAGES

Advantages

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

Disadvantages

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

11.CONCLUSION

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

12.FUTURE SCOPE

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

13.APPENDIX

13.1 SOURCE CODE

```

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

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

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

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

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

```

APP.PY:

BANNER HEADING:

```

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

```

HTML.PY:

```

<!DOCTYPE html>
<html lang="en">

<head>
  <meta charset="utf-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0, shrink-to-fit=no">
  <title>Sign Language Detection</title>
  <link rel="stylesheet" href="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/css/bootstrap.min.css">
  <link rel="stylesheet" href="https://use.fontawesome.com/releases/v5.12.0/css/all.css">
  <link rel="stylesheet" href="assets/css/Banner-Heading-Image.css">
  <link rel="stylesheet" href="assets/css/Navbar-Centered-Brand.css">
  <link rel="stylesheet" href="assets/css/styles.css">
</head>

<body style="background: ■rgb(247, 246, 244);">
  <nav class="navbar navbar-light navbar-expand-md py-3" style="background: □#212529;">
    <div class="container">
      <div></div><a class="navbar-brand d-flex align-items-center" href="#"><span
        class="bs-icon-sm bs-icon-rounded bs-icon-primary d-flex justify-content-center align-items-center me-2 bs-icon"><i
          class="fas fa-flask"></i></span><span style="color: ■rgb(255,255,255);">Real-Time Communication
        System Powered By AI&nbsp;&nbsp;&nbsp;For Specially Abled</span></a>
      <div></div>
    </div>
  </nav>
  <section>
    <div class="d-flex flex-column justify-content-center align-items-center">
      <div class="d-flex flex-column justify-content-center align-items-center" id="div-video-feed"
        style="width: 640px;height: 480px;margin: 10px;min-height: 480px;min-width: 640px;border-radius: 10px;border: 4px dashed □rgb(0, 0,
        
      </div>
    </div>
    <div class="d-flex flex-column justify-content-center align-items-center" style="margin-bottom: 10px;"><button

```

Activate Windows

HTML.PY:

```

class="btn btn-info" type="button" data-bs-target="#modal-1" data-bs-toggle="modal">Quick Reference
</strong> ASL Alphabets</strong></button></div>
</section>
<section>
  <div class="container">
    <div class="accordion text-white" role="tablist" id="accordion-1">
      <div class="accordion-item" style="background: #rgb(33,37,41);">
        <h2 class="accordion-header" role="tab"><button class="accordion-button" data-bs-toggle="collapse"
          data-bs-target="#accordion-1 .item-1" aria-expanded="true"
          aria-controls="accordion-1 .item-1"
          style="background: #rgb(39,43,48);color: #rgb(255,255,255);">About The Project</button></h2>
        <div class="accordion-collapse collapse show item-1" role="tabpanel" data-bs-parent="#accordion-1">
          <div class="accordion-body">
            <p class="mb-0">Artificial Intelligence has made it possible to handle our daily activities
              in new and simpler ways. With the ability to automate tasks that normally require human
              intelligence, such as speech and voice recognition, visual perception, predictive text
              functionality, decision-making, and a variety of other tasks, AI can assist people with
              disabilities by significantly improving their ability to get around and participate in
              daily activities.<br><br>Currently, Sign Recognition is available <strong>only for
              alphabets A-I</strong> and not for J-Z, since J-Z alphabets also require Gesture
              Recognition for them to be able to be predicted correctly to a certain degree of
              accuracy.</p>
          </div>
        </div>
      </div>
    </div>
  </div>
</section>
<div class="modal fade" role="dialog" tabindex="-1" id="modal-1">
  <div class="modal-dialog" role="document">
    <div class="modal-content">
      <div class="modal-header">

```

Activate V
Code Editor

HTML.PY:

```

<div class="modal-header">
  <h4 class="modal-title">American Sign Language - Alphabets</h4><button type="button"
    class="btn-close" data-bs-dismiss="modal" aria-label="Close"></button>
</div>
<div class="modal-body"></div>
<div class="modal-footer"><button class="btn btn-secondary" type="button"
  data-bs-dismiss="modal">Close</button></div>
</div>
</div>
<script src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/js/bootstrap.bundle.min.js"></script>
</body>
</html>

```

MAIN.PY:

```
import cv2
video = cv2.VideoCapture(0)

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

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

NAVBAR CENTERED:

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

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

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

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

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

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

```
.bs-icon.bs-icon-primary {  
  color: var(--bs-white);  
  background: var(--bs-primary);  
}  
  
.bs-icon.bs-icon-primary-light {  
  color: var(--bs-primary);  
  background: rgba(var(--bs-primary-rgb), .2);  
}  
  
.bs-icon.bs-icon-semi-white {  
  color: var(--bs-primary);  
  background: rgba(255, 255, 255, .5);  
}  
  
.bs-icon.bs-icon-rounded {  
  border-radius: .5rem;  
}  
  
.bs-icon.bs-icon-circle {  
  border-radius: 50%;  
}
```

WEBSTREAMING:

```

1 from flask import Flask, Response, render_template
2 from camera import Video
3
4 app = Flask(__name__)
5 @app.route('/')
6 def index():
7     return render_template('index.html')
8
9 def gen(camera):
10     while True:
11         frame = camera.get_frame()
12         yield(b'--frame\r\n'
13              b'Content-Type: image/jpeg\r\n\r\n' + frame +
14              b'\r\n\r\n')
15
16 @app.route('/video_feed')
17 def video_feed():
18     video = Video()
19     return Response(gen(video), mimetype='multipart/x-mixed-replace; boundary = frame')
20
21
22 if __name__ == '__main__':
23     app.run()

```

13.2 GitHub & Project Demo link

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

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