

Project Report

1. INTRODUCTION

- Smart waste management system in metropolitan cities is about using technology and data to create a more efficient waste industry based on IOT technology

1.1 Project Overview

- The project is based on a real-time smart garbage bin mechanism for solid waste management in smart cities

1.2 Purpose

- A waste management system is the strategy an organization uses to dispose of, reduce, reuse and prevent waste

2. LITERATURE SURVEY

2.1 Existing problem

Heavy metals and other toxic compounds from landfills, pollution.

2.2 References

1. Abhishek, K. S., Qubeley, L. C. F., & Ho, D. (2016, August). Glove-based hand gesture recognition sign language translator using capacitive touch sensor. In 2016 IEEE International Conference on Electron Devices and Solid-State Circuits (EDSSC) (pp. 334-337). IEEE.
<https://doi.org/10.1109/EDSSC.2016.7785276>
2. Ahmed, M. A., Zaidan, B. B., Zaidan, A. A., Salih, M. M., & Lakulu, M. M. B. (2018). A review on systems-based sensory gloves for sign language recognition state of the art between 2007 and

2017. Sensors, 18(7), 2208.

<https://doi.org/10.3390/s18072208>

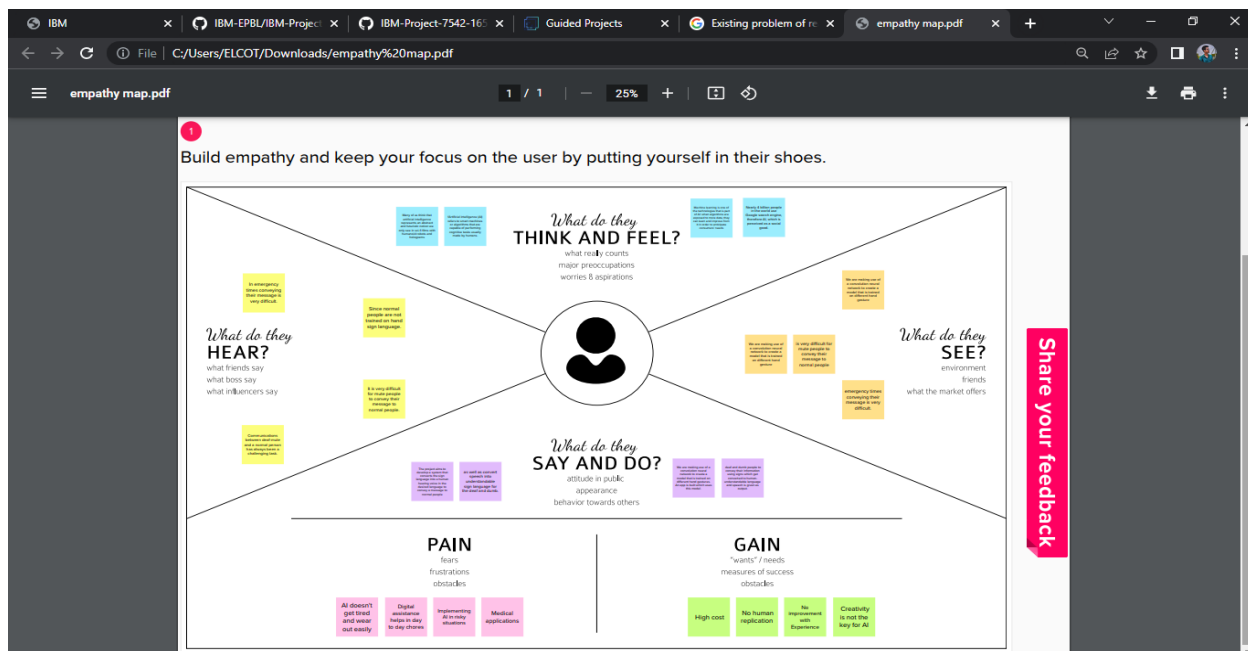
3. Ahmed, M., Idrees, M., ul Abideen, Z., Mumtaz, R., & Khalique, S. (2016, July). Deaf talk using 3D animated sign language: A sign language interpreter using Microsoft's kinect v2. In 2016 SAI Computing Conference (SAI) (pp. 330-335). IEEE.
<https://doi.org/10.1109/SAI.2016.7556002>

2.3. Problem Statement Definition

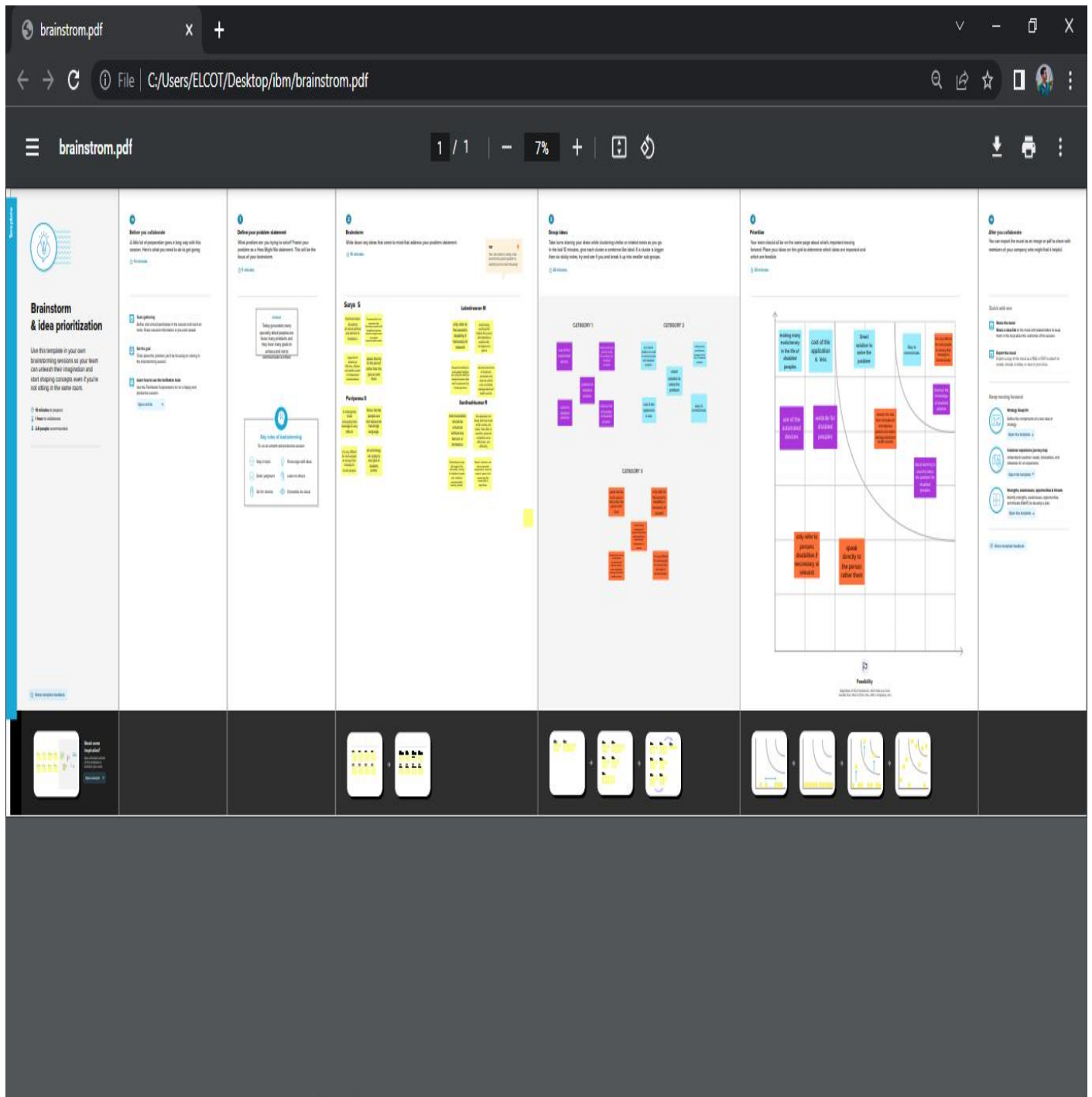
- Indiscriminate disposal of waste is a major issue in most developing countries' urban centers and poses a serious threat to the healthy living of the citizens. The fill level of waste in each of the containers, which are strategically situated across the communities, is detected using sensors.

3. IDEATION & PROPOSED SOLUTION

3.1. Empathy Map Canvas



3.2. Ideation & Brainstorming



3.3Proposed Solution

S.NO	PARAMETER	DESCRIPTION
1	Problem Statement(problem to be solved)	We are making use of a convolution neural network to create a model that is trained on different hand gestures.
2	Idea / Solution description	Our main goal is to help unlock the hidden potential of many more visually impaired people through cutting – edge tech.
3	Novelty / Uniqueness	AI technology can empower people living with limited physical mobility.
4	Social Impact / Customer Satisfaction	AI can dramatically improve the efficiencies of our work places and can augment the work humans can do.
5	Business Model (Revenue Model)	Technology solutions can often multitask to reduce costs. For example , Lighting Control Systems provide an accessible control system, plus they can also be programmed to illuminate the home at a particular level to save energy costs.
6	Scalability of the Solution	The most frequent scalability consideration is performance. We want our software to become

		<p>faster and more responsive as additional users, data, and features are added. If an application has 1000 client connections, it will have effectively scaled performance when its response times.</p>
--	--	--

3.4. Problem Solution fit

Solution Fit

1 / 1 | - 55% +

Download Print

Solution fit

<div>1. CUSTOMER SEGMENT(S) Specially abled people are the customers who are not able to easily communicate with others.</div> <div>Define CS, fit into CC</div> <div>CS</div>	<div>6. CUSTOMER CONSTRAINTS While communicating, they can only able to communicate with the people those who know sign language.</div> <div>CC</div>	<div>5. AVAILABLE SOLUTIONS The available solutions are not so accuracy in image processing and the output was not so efficient.</div> <div>AS</div> <div>Explore AS, differentiate</div>
<div>2. JOBS-TO-BE-DONE / PROBLEMS Only sign language knows people can communicate so we introduced a new system to communicate all specially abled people.</div> <div>Focus on J&P, tap into BE, understand RC</div> <div>J&P</div>	<div>9. PROBLEM ROOT CAUSE Due to the inability to communicate with others by the specially abled people's</div> <div>RC</div>	<div>7. BEHAVIOUR Finding the right signs and converting into correct communication between the people's</div> <div>BE</div> <div>Focus on J&P, tap into BE, understand RC</div>
<div>3. TRIGGERS Some of the triggers are introducing in all hospitals, medical trusts and also in advertisements.</div> <div>Identify strong TR & EM</div> <div>TR</div>	<div>10. YOUR SOLUTION Created an application using AI, that will able to convert the sign language by image processing of the specially abled people.</div> <div>SL</div>	<div>8. CHANNELS of BEHAVIOUR 8.1 ONLINE We can update our application and use it in a very efficient way. 8.2 OFFLINE In offline mode we use it but not so efficient we can use it with a recently updated application.</div> <div>Extract online & offline CH of BE</div> <div>CH</div>
<div>4. EMOTIONS: BEFORE / AFTER specially abled people hesitate to communicate with others but know using this system they can easily communicate with others.</div> <div>EM</div>		

4. REQUIREMENT ANALYSIS

4.1. Functional requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	LOWVISION: A sauser who hastrouble reading ue to low vision,want to be able to make the text larger on the screen so that I can read it. Registration through Gmail
FR-2	User Confirmation	IM PAIRED USER: A sa user who is hearing impaired, I want a turn on video captions so that I can understand what is being said in videos. Confirmation via Email
FR-3	User Registration.	COLORBLINDNESS: A sauser who is color blind ,I want to link to be distinguishable on the page so that I can find the links and navigatethe site. Registrationthrough Gmail

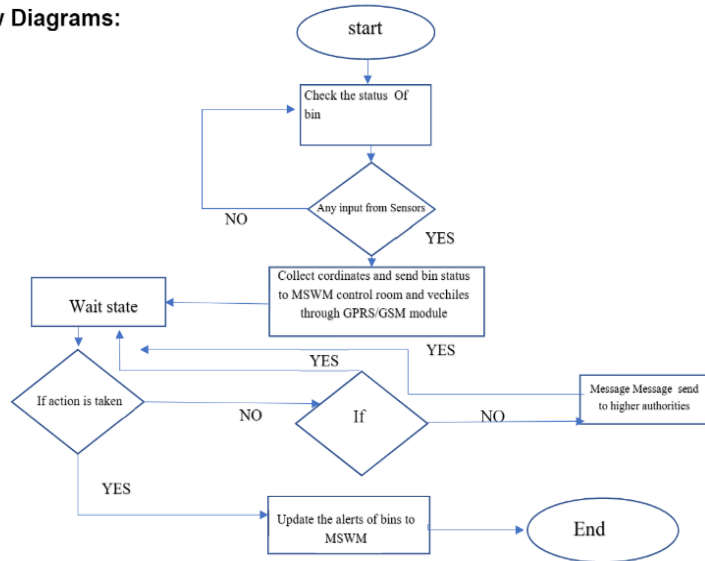
3.2. Non-Functional requirements

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	<ul style="list-style-type: none">•Visual and Audio Help•Text size scaling•Reverse contrast
NFR-2	Security	Important information: <ul style="list-style-type: none">•Walking in single file or in narrow space.•Steps, Stairs and Slope.•Kerb and Roads.
NFR-3	Reliability	To determine reliability measures are: <ul style="list-style-type: none">•Test-Retest Repeatability•Individual Repeatability
NFR-4	Performance	To determine predictor for success in reading with low vision aids, interms of reading acuity, optimum Acuity reserve, and maximum reading speed, for observers with low vision for various causes.

5. PROJECT DESIGN

5.1. Data Flow Diagrams

Data Flow Diagrams:



5.2. Solution & Technical Architecture

Technical Architecture:

Table-1 : Components & Technologies:

Table-1 : Components & Technologies:

S • N o	Component	Description	Technology

1	User Interface	User Interface provides options for the user to either upload a photo or turn on live camera for the prediction of sign language	HTML, CSS, JavaScript/React JS
2	Application Logic-1	The user input is taken and passed on to the model for feature extraction and prediction of the sign language.	Python
3	Application Logic-2	The output is produced in speech format using the IBM Watson Text To Speech service.	IBM Watson TTS service
4	Database	The user login details and credentials are stored and processed using MySQL database.	MySQL.
5	Cloud Database	We use IBM cloud data storage to store and manage user data.	IBM DB2, IBM Cloudant etc.

6	Machine Learning Model	Our Machine learning model is used to predict sign language with precision and accuracy.	Hand gesture recognition, etc.
7	Infrastructure (Cloud)	Our application is deployed using IBM Watson services	IBM watson services

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1	Open-Source Frameworks	Flask web application, Google colab	<ul style="list-style-type: none"> • HTML • CSS • Javascript • Flask • Google colab
2	Security Implementations	User login credentials and other details will be secured Using MD5 encryption and	MD5, Encryptions, IAM Controls, OWASP etc.

		IAM Controls.	
3	Scalable Architecture	This project enables the developer to add more templates and it also paves the path to train the model in-case if there is a need to train the model with new sign language.	Technology used Machine learning
4	Availability	This is an open source application and it is available to all users and it manages all the customers without any network glitch	Technology used Flask web application
5	Performance	This app will quickly upload and process the images because it predicts the sign language using CNN	Technology used

		model and it gives high accuracy.	
--	--	-----------------------------------	--

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	US N-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	Surya S
Sprint-2		US N-2	As a user, I will receive confirmation email once I have registered for the application	1	High	Puviyarasu s
Sprint-1	Login	US N-3	As a user, I can log into the application by entering email & Password	1	Medium	Lokeshwaran M
Sprint	Dashbo	USN	As a user, I	2	Hi	Santhosh

//t-2	ard	-4	can log into my account in a given Dashboard		gh	Kumar R
Sprint-1	User interface	USN-5	Professional responsible for user requirements & needs	2	High	Surya S

6. PROJECT PLANNING & SCHEDULING

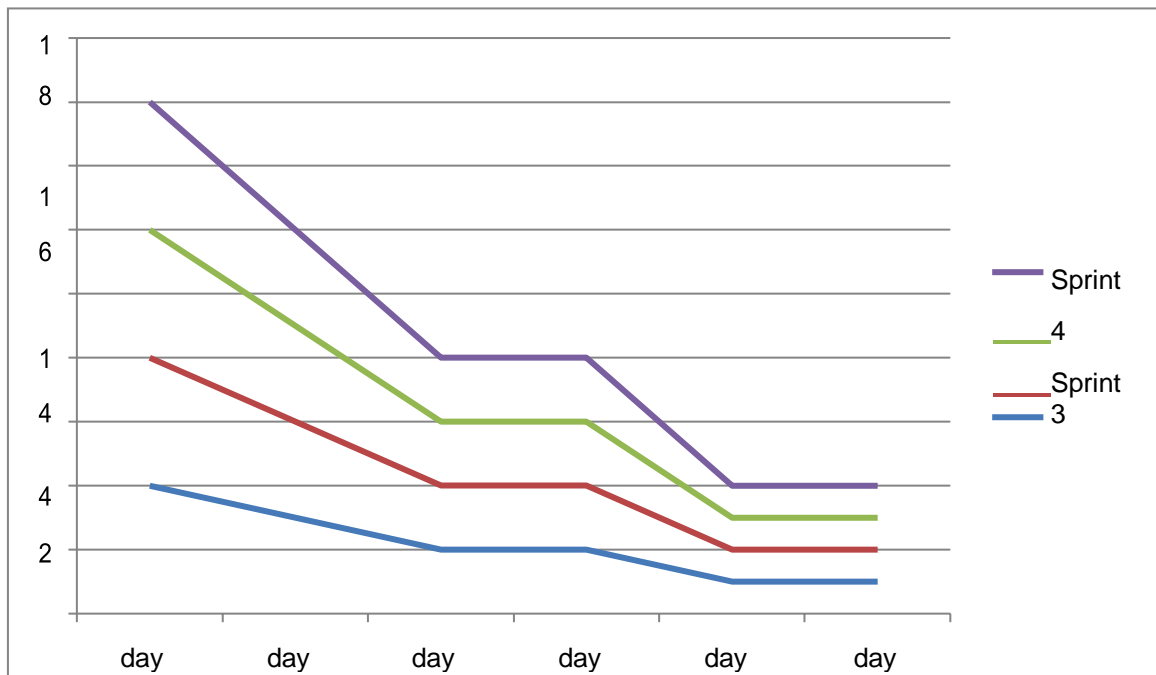
6 1. Sprint Planning & Estimation

Sprint-3	Objective	USN-6	The goal is to describe all the inputs and outputs	1	High	Santhosh Kumar R
Sprint-4	Privacy	USN-7	The developed application should be secure for the users	1	High	Puviyarasu S

6. 2. Sprint Delivery Schedule

Sprint	T o t a l S t o r y P o i n t s	Dur atio n	Sprint Start Date	Spr int En d Dat e (Pl ann ed)	Story Point s Com plete d (as on Plann ed End Date)	Sprint Release ate (Actual) D
Sprint-1	20	6 Day s	25 Oct 2022	03 Nov 2022	20	03 Nov 2022
Sprint-2	20	6 Day s	25 Oct 2022	03 Nov 2022	20	03 Nov 2022
Sprint-3	20	6 Day s	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Day s	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

6.3 Reports from JIRA



7. CODING & SOLUTIONING (Explain the features added in the project along with code)

7.1 Feature 1

HTML CODE

```
<!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>REAL TIME COMM</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="static/Navbar-Centered-Brand.css">
</head>
```

```

<body style="background: #f5ad41;">
  <nav class="navbar navbar-light navbar-expand-md py-3" style="background:
#22697a;">
    <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><h4 style="color:
#a5eb24; font-style: oblique; text-align: center;"><strong> Real-Time
Communication
      System Powered By AI&nbsp;For Specially
Abled</strong></h4></a>
      <div></div>
    </div>
  </nav>
  <div>
    <h2 style="text-align: center; -webkit-text-fill-color:
#045816;"><strong>TEAMID-- PNT2022TMID42423</strong></h2>
  </div>
  <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: 800px;height: 600px;margin: 10px;min-height:
480px;min-width: 640px;border-radius: 50px;border: 10px groove #045816 ;">
        
      </div>
    </div>
    <div class="d-flex flex-column justify-content-center align-items-center"
style="margin-bottom: 20px;"><button
      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="font-style: oblique;
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="font-style:inherit; background: #3E6D9C;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">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..</p>
            </div>
        </div>
    </div>
    <div class="accordion-item" style="font-style: oblique;
background: rgb(33,37,41);">
        <h2 class="accordion-header" role="tab"><button
class="accordion-button collapsed"
        data-bs-toggle="collapse" data-bs-target="#accordion-
1 .item-2" aria-expanded="false"
        aria-controls="accordion-1 .item-2"
        style="font-style: oblique; background:
#3E6D9C;color: rgb(231,241,255);">Developed By</button></h2>
        <div class="accordion-collapse collapse item-2"
role="tabpanel" data-bs-parent="#accordion-1">
            <div class="accordion-body">
                <p class="mb-0">Students From CHRIST THE KING
ENGINEERING COLLEGE<br><br>TEAM ID-- <strong>PNT2022TMID42423</strong><br><br>1.
<strong>SURYA S</strong> <br>2.
                <strong>PUVIYARASU S</strong> <br>3.
<strong>LOKESHWARAN M</strong><br>4. <strong>SANTHOSH KUMAR R</strong>
            </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">
                <h4 class="modal-title">American Sign Language -
Alphabets</h4><button type="button"
                class="btn-close" data-bs-dismiss="modal" aria-
label="Close"></button>
            </div>
            <div class="modal-body"><img src='ASL_Alphabet.jpg' height=100%
width="450px"></div>
            <div class="modal-footer"><button class="btn btn-secondary"
type="button"
                data-bs-dismiss="modal">Close</button></div>
        </div>
    </div>
</div>
<script
src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/js/bootstrap.bundle.min.js
"></script>
</body>

</html>

```

CAMERA.PY

```

import cv2
import numpy as np
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
import os

class Video(object):
    def __init__(self):
        self.video = cv2.VideoCapture(0)
        self.roi_start = (50, 150)
        self.roi_end = (250, 350)
        #self.model = load_model('asl_model.h5') # Execute Local Trained Model
        self.model = load_model('aslpng1.h5') # Execute IBM Trained Model
        self.index=['A','B','C','D','E','F','G','H','I']
        self.y = None
    def __del__(self):
        k = cv2.waitKey(1)

```

```

        self.video.release()
def get_frame(self):
    ret, frame = self.video.read()
    frame = cv2.resize(frame, (640, 480))
    copy = frame.copy()
    copy = copy[150:150+200, 50:50+200]
    # prediction starts
    cv2.imwrite('image.jpg', copy)
    copy_img = image.load_img('image.jpg', target_size=(64, 64, 3))
    x = image.img_to_array(copy_img)
    x = np.expand_dims(x, axis=0)
    pred = np.argmax(self.model.predict(x), axis=1)
    self.y = pred[0]
    cv2.putText(frame, 'The Predicted Alphabet is:
'+str(self.index[self.y]), (100, 50), cv2.FONT_HERSHEY_SIMPLEX, 1, (0, 0, 0), 3)
    ret, jpg = cv2.imencode('.jpg', frame)
    return jpg.tobytes()

```

APP.PY

```

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()

```

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()
```

CSS

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

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

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

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

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

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

.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);
}

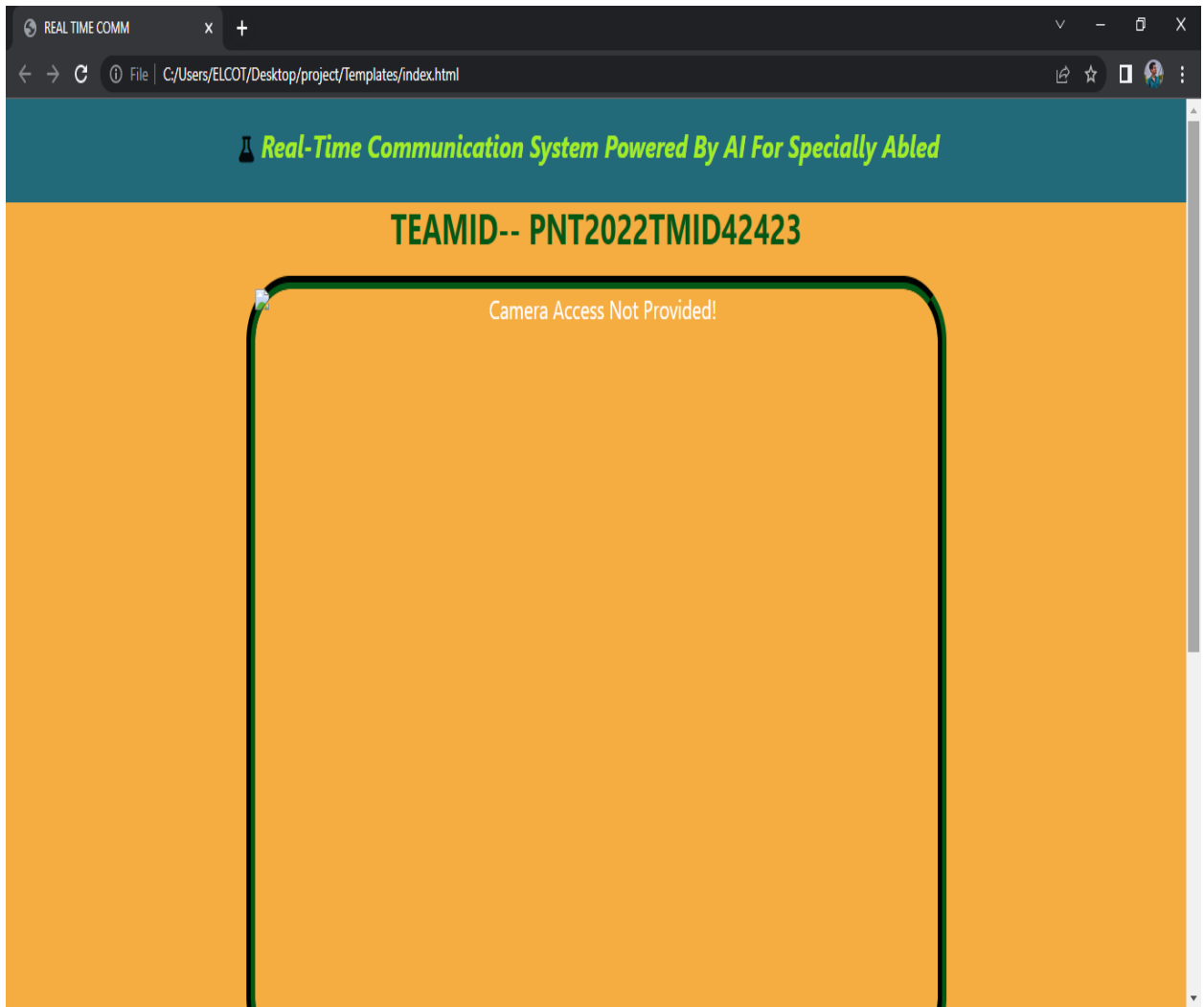
.bs-icon.bs-icon-rounded {
  border-radius: .5rem;
}

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

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

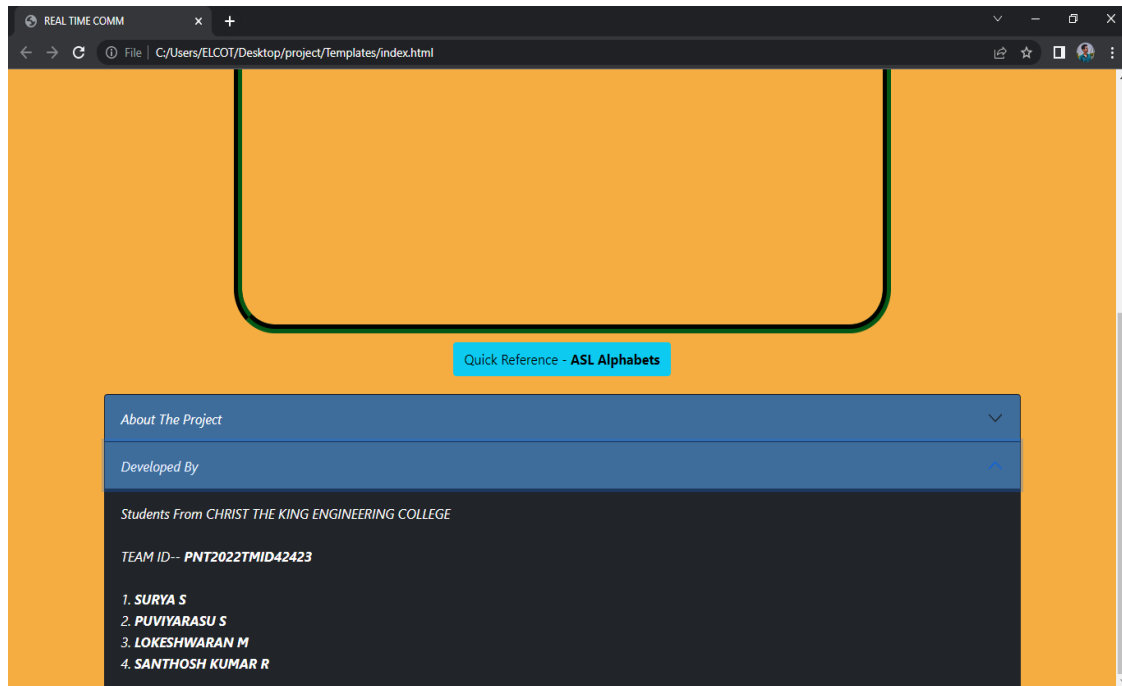
.teamid{
  text-align: center;
}
```

CREATED A WEBSITE APPLICATION

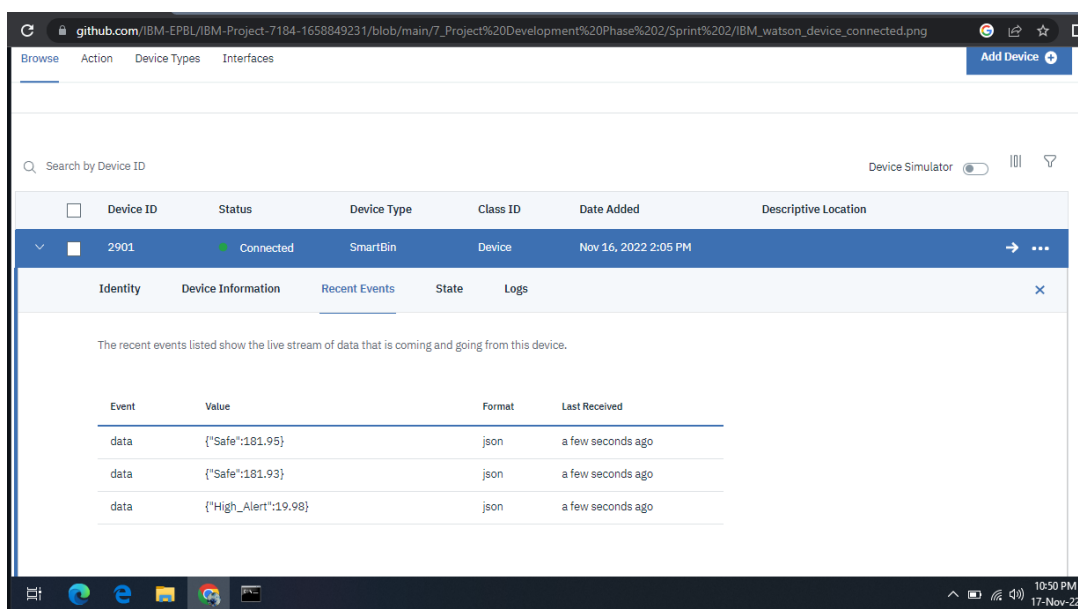


7.2 Feature 2

APPLICATION output



IBM Watson device connected



8. TESTING

8.1 User Acceptance Testing

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	4	3	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	78

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	0	0	7
Client Application	51	0	0	51

9. RESULTS

9.1 Performance Metrics

There are many different measurement frameworks, including the balanced scorecard, activity based costing, competitive benchmarking, and shareholder value added. Each of these provides a unique and different lens through which to view an organization's performance.

10. ADVANTAGES & DISADVANTAGES

ADVANTAGES

- ➡ AI drives down the time taken to perform a task. It enables multi-tasking and eases the workload for existing resources.
- ➡ AI enables the execution of hitherto complex tasks without significant cost outlays.
- ➡ AI operates 24x7 without interruption or breaks and has no downtime
AI augments the capabilities of differently abled individuals
- ➡ AI has mass market potential, it can be deployed across industries.
- ➡ AI facilitates decision-making by making the process faster and smarter.

DIS-ADVANTAGES

- ➡ High Costs. The ability to create a machine that can simulate human intelligence.
- ➡ No creativity. A big disadvantage of AI is that it cannot learn to think outside.
- ➡ Make Humans Lazy, No Ethics, Emotionless, No Improvement.

11. CONCLUSION

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.

12. FUTURE SCOPE

The goal is to create computer intelligence programmes that can handle real-time problems and help organisations and everyday people achieve their goals. Machine games, speech recognition, language detection, computer vision, expert systems, robotics, and other fields have potential.

13. APPENDIX

Source Code:

```
<!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>REAL TIME COMM</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="static/Navbar-Centered-Brand.css">
</head>

<body style="background: #f5ad41;">
  <nav class="navbar navbar-light navbar-expand-md py-3" style="background:
#22697a;">
    <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
```


`<p class="mb-0">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..</p>`

`</div>`

`</div>`

`</div>`

`<div class="accordion-item" style="font-style: oblique; background: rgb(33,37,41);">`

`<h2 class="accordion-header" role="tab"><button class="accordion-button collapsed" data-bs-toggle="collapse" data-bs-target="#accordion-1 .item-2" aria-expanded="false"`

`aria-controls="accordion-1 .item-2" style="font-style: oblique; background: #3E6D9C;color: rgb(231,241,255);">Developed By</button></h2>`

`<div class="accordion-collapse collapse item-2" role="tabpanel" data-bs-parent="#accordion-1">`

`<div class="accordion-body">`

`<p class="mb-0">Students From CHRIST THE KING ENGINEERING COLLEGE

TEAM ID-- PNT2022TMID42423

1. SURYA S
2.`

`PUVIYARASU S
3. LOKESHWARAN M
4. SANTHOSH KUMAR R`

`</p>`

`</div>`

`</div>`

`</div>`

`</div>`

`</div>`

`</div>`

`<div class="modal fade" role="dialog" tabindex="-1" id="modal-1">`

`<div class="modal-dialog" role="document">`

`<div class="modal-content">`

`<div class="modal-header">`

`<h4 class="modal-title">American Sign Language - Alphabets</h4><button type="button"`

```

        class="btn-close" data-bs-dismiss="modal" aria-
label="Close"></button>
    </div>
    <div class="modal-body"><img src='ASL_Alphabet.jpg' height=100%
width="450px"></div>
    <div class="modal-footer"><button class="btn btn-secondary"
type="button"
        data-bs-dismiss="modal">Close</button></div>
    </div>
</div>
</div>
<script
src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/js/bootstrap.bundle.min.js
"></script>
</body>

</html>

```

GitHub & Project Demo Link

GitHub: [gh repo clone IBM-EPBL/IBM-Project-7542-1658889257](https://github.com/IBM-EPBL/IBM-Project-7542-1658889257)