Real-Time Communication System Powered by AI for Specially Abled

SUBMITTED BY

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Dr.R.ATHILINGAM

For

Professional Readiness for Innovation, Employability and Entrepreneurship

(HX8001)

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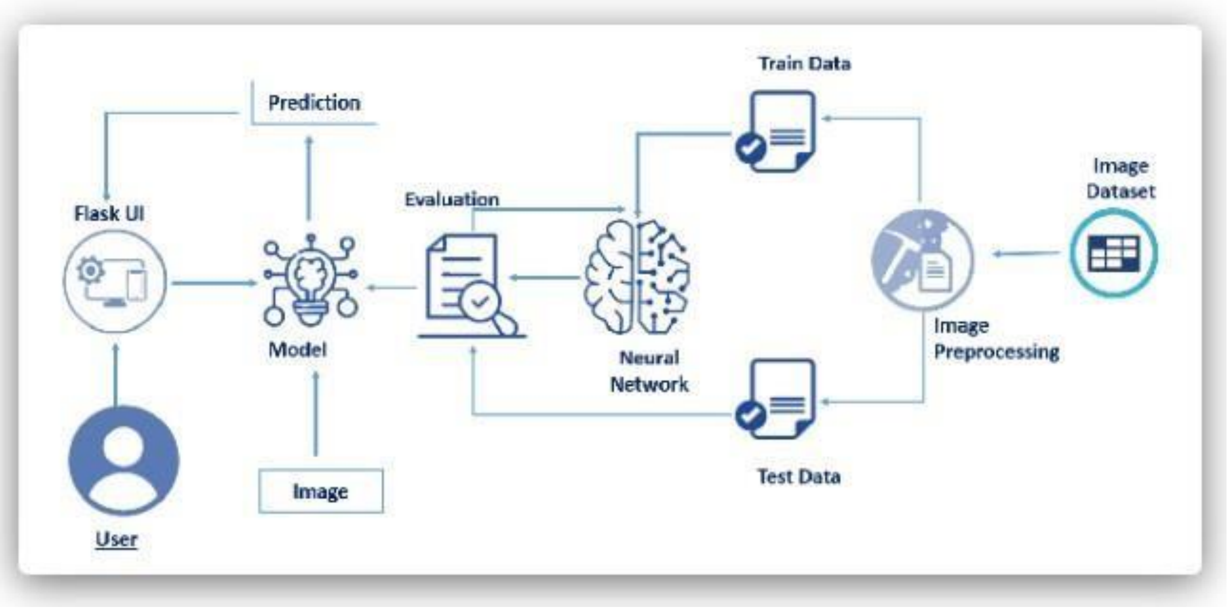
1. INTRODUCTION

1.1 Project Overview

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.

Technical Architecture:



1.2 Purpose

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

2. LITERATURE SURVEY

2.1 Existing problem

2.2 References

2.3 Problem Statement Definition

Survey on Real-Time Communication System Powered By AI for Specially Abled

S.NO	AUTHOR and YEAR	PUBLICATION and TITLE	PROBLEMS and IDENTIFICATION	METHODS	OUTPUT
1.	AUTHOR : Anbarasi Rajamohan, Hemavathy R., Dhanalakshmi M. Year:2013	Publication: International Journal of Scientific Engineering and Technology Title: Deaf-Mute Communication Interpreter	Communications between deaf-mute and a normal person have always been a challenging task. The project aims to facilitate people by means of a glove based deaf-mute communication interpreter system. The glove is internally equipped with five flex sensors, tactile sensors and accelerometer. For each specific gesture, the flex sensor produces a proportional change in resistance and accelerometer measures the orientation of hand. The processing of these hand gestures is in Arduino. The glove includes two modes of operation – training mode to benefit every user and an operational mode. The concatenation of letters to form words is also done in Arduino. In addition, the system also includes a text to speech conversion (TTS) block which translates the matched gestures i.e. text to voice output.	The evaluation of Deaf-mute communication interpreter was carried out for ten beginners for letters _A‘ _B‘ _C‘ _D‘ _F‘ _I‘ _L‘ _O‘ _M‘ _N‘ _T‘ _S‘ _W‘. Word formation from letters is also performed using an end signal. The hand glove is mounted with five flex sensor, an accelerometer and tactile sensors. Table 1 shows the Output voltage across a voltage divider network with constant resistance of 22Kohms, the digital value and the corresponding resistance for different bending angles of flex 2.5‖ mounted in thumb and pinky fingers.	The project proposes a translational device for deaf-mute people using glove technology. The proposed technique has enabled the placement of five flex sensor, 5 tactile sensors and an accelerometer on to a glove. The results demonstrate that sensor glove design with tactile sensor helps to reduce the ambiguity among gestures and shows improved accuracy. Further the device will be an apt tool for deaf-mute community to learn gesture and words easily. The project can be enhanced to include two or more accelerometer‘s to capture the orientation of hand movements once the gesture is made. This will expand the capability to translate larger gestures.

Survey on Real-Time Communication System Powered By AI for Specially Abled

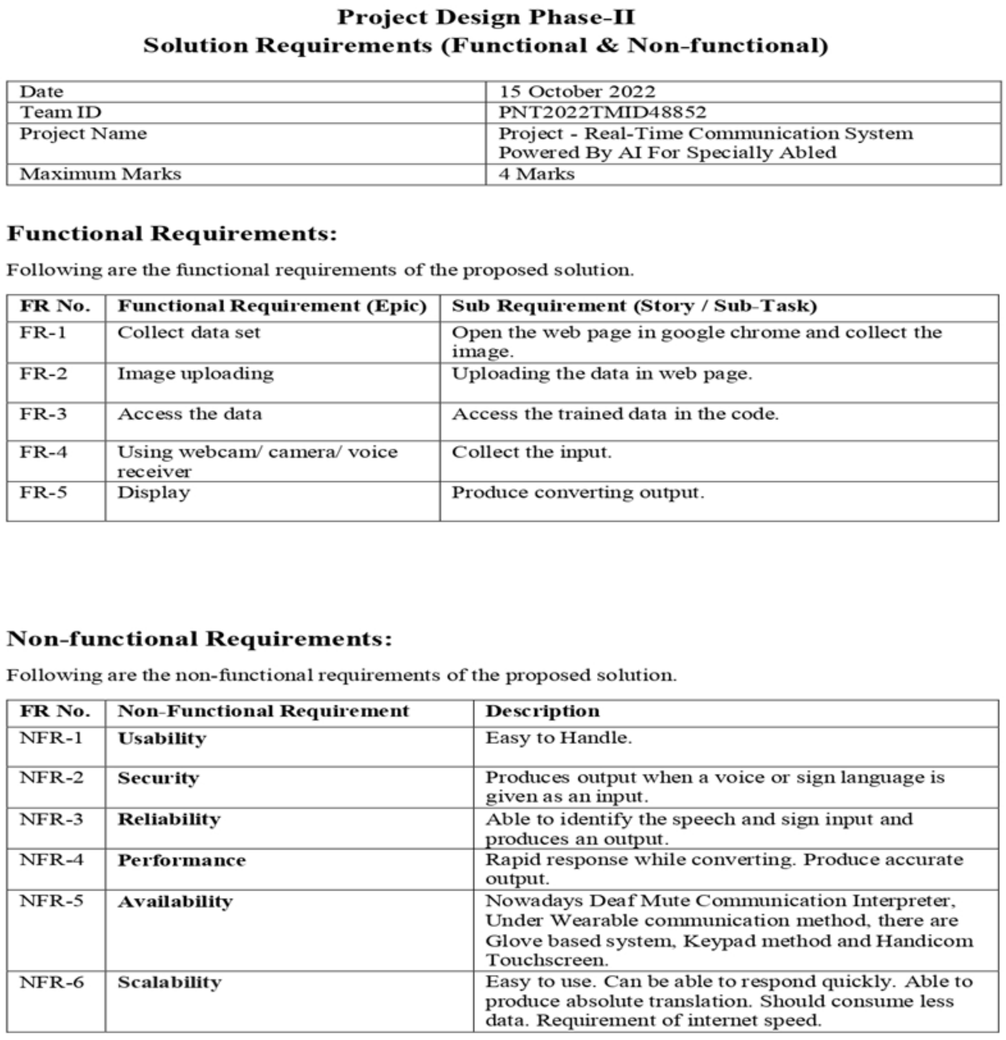
2.	Author: K.Sunitha, Anitha Saraswathi, Aarthi,Jayapriya, Lingam Sunny Year:2016	Publication: ripublication Title: Deaf Mute Communication Interpreter	Communication between the deaf and non-deaf has always been a very cumbersome task. This paper aims to cover the various prevailing methods of deaf-mute communication interpreter system. The two broad classification of the communication methodologies used by the deaf –mute people are Wearable Communication Device and Online Learning System.	The five sub-divided methods are SLIM module, TESSA, Wi-See Technology, SWI_PELE System and Web-Sign Technology. The working of the individual components used and the operation of the whole system for the communication purpose has been explained in detail in this paper.	Under Wearable communication method, there are Glove based system, Keypad method and Handicom Touchscreen. All the above mentioned three sub-divided methods make use of various sensors, accelerometer, a suitable microcontroller, a text to speech conversion module, a keypad and a touch-screen. The need for an external device to interpret the message between a deaf –mute and non-deaf-mute people can be overcome by the second method i.e online learning system. The Online Learning System has different methods under it, five of which are explained in this paper.
3.	Author: B.Jadhav, Nipun Munot, Madhura Hambarde, Jueli Ashtikar Year:2015	Publication: ripublication Title: Hand Gesture Recognition to Speech Conversion in Regional Language	Generally deaf-dumb people use sign language for communication, but they find difficulty in communicating with others who don't understand sign language. Due to which communications between deaf-mute and a normal person have always been a challenging task. We propose to develop a device which can convert the hand gestures of a deaf-mute person into speech.	This methodology provides a map for developing a Digital wireless glove which is fitted with Flex sensors and accelerometer. These sensors sense the gestures of a person in the form of bend of fingers and tilt of the hand fist.	This system includes a voice playback IC to give the real time speech output in regional language as well as a LCD module to display the text. The text display being in English, the voice output of this device will be in regional language (here Marathi). So this device acts as a communicator as well as a translator providing more flexibility in communication.
4.	Author: Alex Rupom Hasdak, Istiaq Al Nur, Adnan Al Neon, Hasan U. Zaman. Year:2018	Publication: IEEE Title: Deaf-Vibe: A Vibrotactile Communication Device Based on Morse Code for	This paper proposes an alternate solution for easy communication by deaf and mute people. A device named Deaf-Vibe has been developed, which	In this method, the voice message is converted to text first and then to equivalent Morse code signals using a built-in	A deaf person wearing the glove senses the vibration in his or her fingers and understands the message. This device can also be used by a mute person to send messages by bending fingers in the Morse code sequence. The flex

		Deaf-Mute Individuals.	enables deaf and mute people to communicate rather easily with others using tactile senses and gestures.	Morse code conversion table. These signals drive vibration motors placed inside the fingers of a wearable glove.	sensors placed within the glove fingers sense the finger movement and generate equivalent electrical signals which are then converted to text using a text-to-voice synthesizer to be finally pronounced and heard as audible messages. The resulting device is a simple, low-cost efficient and wearable solution which can be used by deaf and mute people in their everyday lives as an effective communication tool.
5.	Author: Kedar Potdar, Gauri Nagavkar Year:2017	Publication: computer science Title: Real-time Communication System for the Deaf and Dumb	This project aims to aid the deaf-mute by creation of a new system that helps convert sign language to text and speech for easier communication with audience.	The system consists of a gesture recognizer hand-glove which converts gestures into electrical signals using flex sensors. These electrical signals are then processed using an Arduino microcontroller and a Python-based backend for text-to-speech conversion. The glove includes two modes of operation – phrase fetch mode and letter fetch mode. The phrase fetch mode speaks out words at once, while the letter fetch mode speaks out individual letters.	This project forms a base infrastructure which can later be augmented with addition of different Sign Languages and integrating with other hearing impaired aid systems.

3. REQUIREMENT ANALYSIS

3.1 Functional requirement

3.2 Non-Functional requirements



Project Design Phase-II
Solution Requirements (Functional & Non-functional)

Date	15 October 2022
Team ID	PNT2022TMID48852
Project Name	Project - Real-Time Communication System Powered By AI For Specially Abled
Maximum Marks	4 Marks

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Collect data set	Open the web page in google chrome and collect the image.
FR-2	Image uploading	Uploading the data in web page.
FR-3	Access the data	Access the trained data in the code.
FR-4	Using webcam/ camera/ voice receiver	Collect the input.
FR-5	Display	Produce converting output.

Non-functional Requirements:

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

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Easy to Handle.
NFR-2	**Security**	Produces output when a voice or sign language is given as an input.
NFR-3	**Reliability**	Able to identify the speech and sign input and produces an output.
NFR-4	**Performance**	Rapid response while converting. Produce accurate output.
NFR-5	**Availability**	Nowadays Deaf Mute Communication Interpreter, Under Wearable communication method, there are Glove based system, Keypad method and Handicom Touchscreen.
NFR-6	**Scalability**	Easy to use. Can be able to respond quickly. Able to produce absolute translation. Should consume less data. Requirement of internet speed.

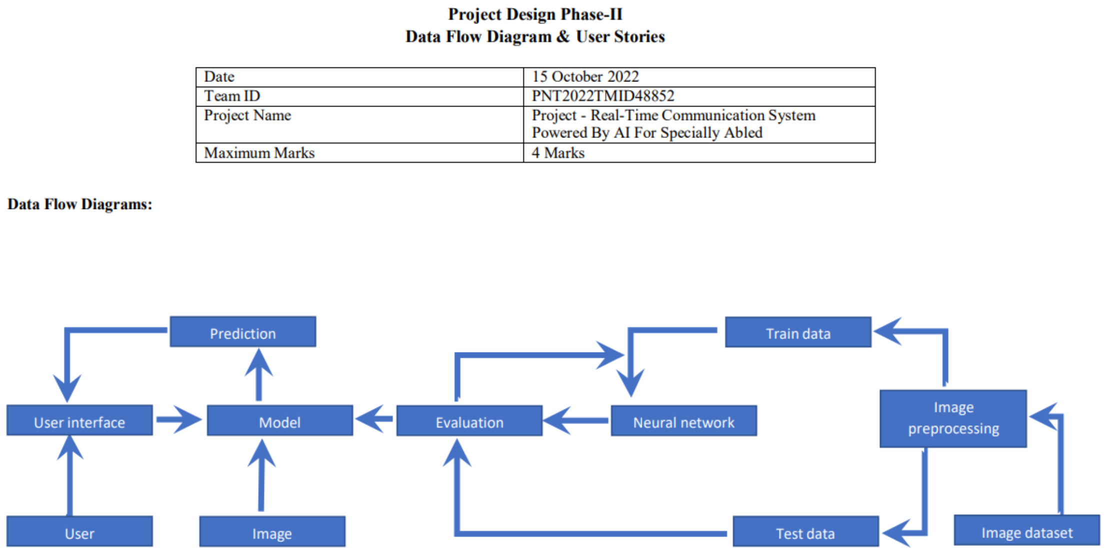
Reference Link: https://github.com/IBM-EPBL/IBM-Project-37834-1660328739/blob/main/PROJECT/TEAM%20LEADER/PROJECT%20DESIGN%20PHASE%201/Proposed%20Solution.docx

PROJECT DESIGN

3.3 Data Flow Diagrams

3.4 Solution & Technical Architecture

3.5 User Stories



Project Design Phase-II
Data Flow Diagram & User Stories

Date	15 October 2022
Team ID	PNT2022TMID48852
Project Name	Project - Real-Time Communication System Powered By AI For Specially Abled
Maximum Marks	4 Marks

Data Flow Diagrams:

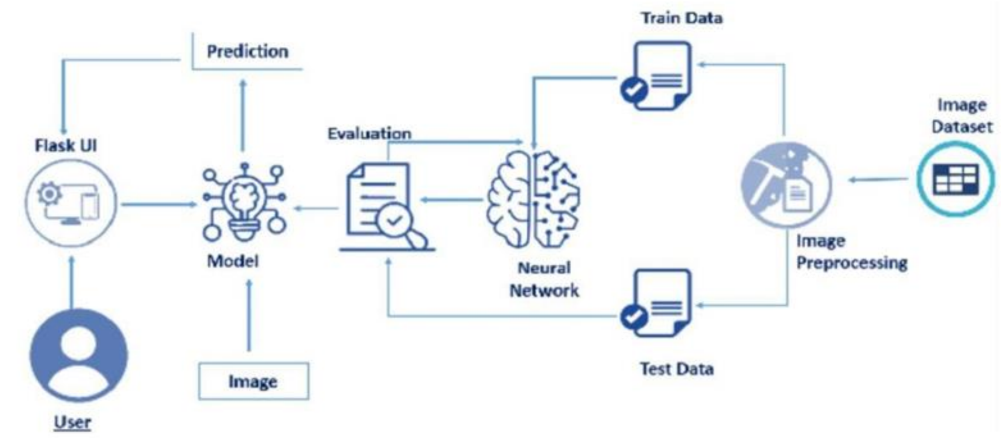
User Stories:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Open application	USN-1	Open the application with a help of web page or mobile application.	Can open in app/chrome	High	Sprint-1
	Home page	USN-2	Link directed into home page.	-	High	Sprint-1
	Introduction page	USN-3	Click on the demo/ introduction.	Introduction page will open. Follow the instructions given.	Medium	Sprint-2
	Launch application	USN-4	Click launch to move the next page.	Launch the application, it will redirected to the next page.	Medium	Sprint-1
	Selecting the conversion	USN-5	User need to select the conversion	User should select the conversion from text to sign or sign to text.	High	Sprint-1
	Output / conversion	USN - 6	Output on regional language	The gesture or text will display		
Customer (Web user)	same for both users					
Customer Care Executive	Same for both normal and specially abled people					
Administrator	same for all the users					

Project Design Phase-II
Technology Stack (Architecture & Stack)

Date	15 October 2022
Team ID	PNT2022TMID48852
Project Name	Project - Real-Time Communication System Powered By AI For Specially Abled
Maximum Marks	4 Marks

Technical Architecture:



Referenc Link: https://github.com/IBM-EPBL/IBM-Project-37834-1660328739/tree/main/PROJECT/TEAM%20LEADER/PROJECT%20DESIGN%20PHASE%202

4. PROJECT PLANNING & SCHEDULING

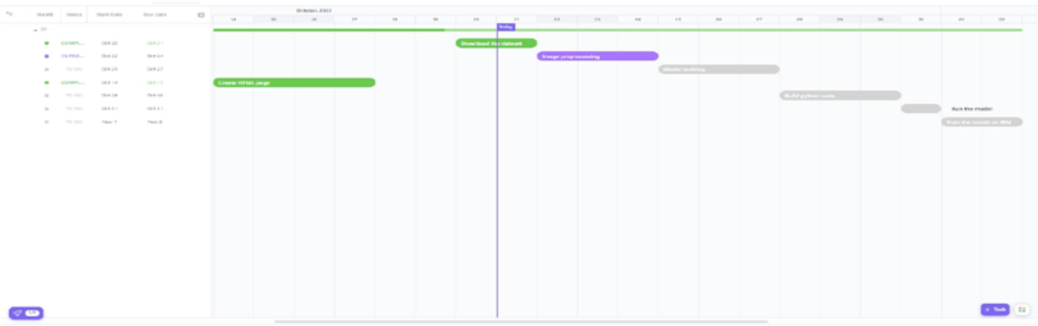
4.1 Sprint Planning & Estimation

4.2 Sprint Delivery Schedule

4.3 Reports from JIRA

Project Planning Phase
Milestones and Tasks

Date	21 October 2022
Team ID	PNT2022TMID48852
Project Name	A Gesture-based Tool for Sterile browsing of Radiology Images
Maximum Marks	8 Marks



Link for the above milestone :https://app.clickup.com/43289481/v/li/205283671

Project Planning Phase

Project Planning Template (Product Backlog, Sprint Planning, Stories, Story points)

Date	21 October 2022
Team ID	PNT2022TMID48852
Project Name	A Gesture-based Tool for Sterile browsing of Radiology Images
Maximum Marks	8 Marks

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	User interface	USN-1	As a user, open the web pageby opening the html file.	2	High	N.JAWHAR RIFFATH V.JEYA SR P.JOVIKA S.REETHA A.RAMYADEVI
Sprint-1		USN-2	The home page will open.	1	High	N.JAWHAR RIFFATH V.JEYA SR P.JOVIKA S.REETHA A.RAMYADEVI
Sprint-2		USN-3	As a user, click on the introduction button.	2	Low	N.JAWHAR RIFFATH V.JEYA SR P.JOVIKA S.REETHA A.RAMYADEVI
Sprint-1		USN-4	As a user, click on the launch button.	2	Medium	N.JAWHAR RIFFATH V.JEYA SR P.JOVIKA S.REETHA A.RAMYADEVI
Sprint-1	Upload the image	USN-5	As a user, click on the upload button to upload the image.	1	High	N.JAWHAR RIFFATH V.JEYA SR P.JOVIKA S.REETHA A.RAMYADEVI
	Open the image	USN-6	The image will open and the camera will automatically turn on to capture the hand gesture actions.	2	High	N.JAWHAR RIFFATH V.JEYA SR P.JOVIKA S.REETHA A.RAMYADEVI

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

Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let’s calculate the team’s average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

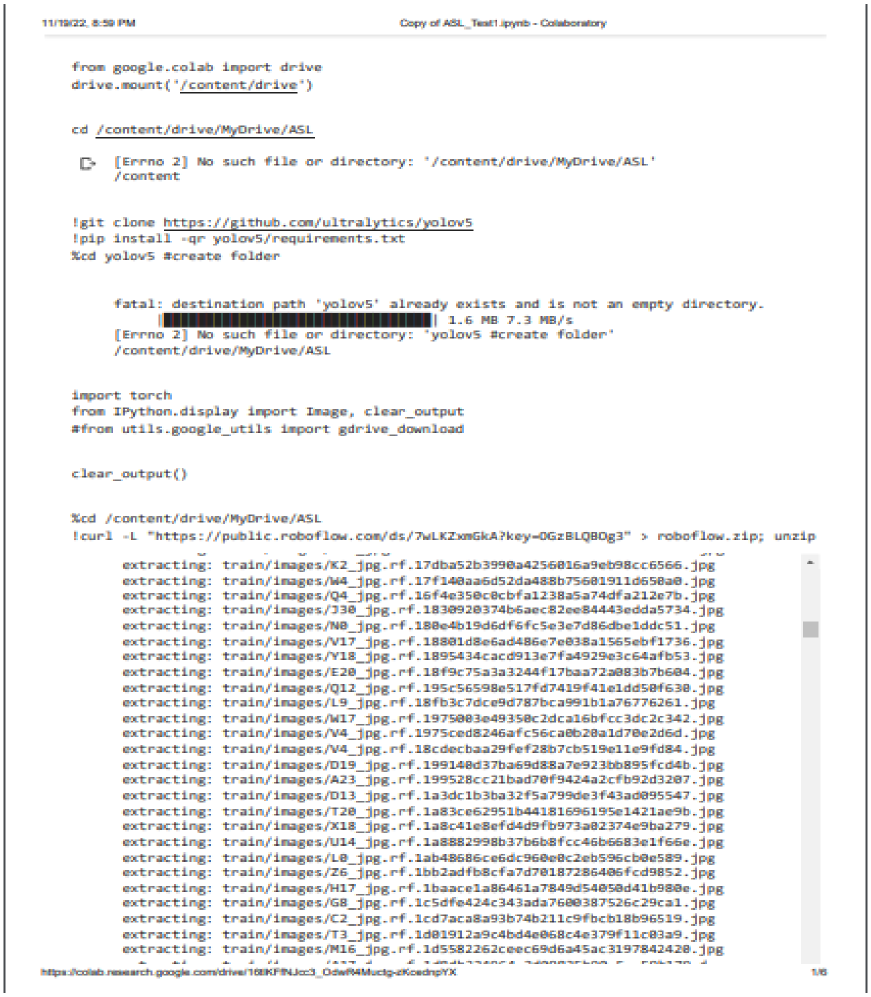
Reference Link: https://github.com/IBM-EPBL/IBM-Project-37834-1660328739/tree/main/PROJECT/TEAM%20LEADER/PROJECT%20PLANNING%20PHASE

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

5.1 Feature 1

5.2 Feature 2

5.3 Database Schema (if Applicable)



11/19/22, 8:59 PM Copy of ASL_Test1.ipynb - Colaboratory

```
from google.colab import drive
drive.mount('/content/drive')
```

```
cd /content/drive/MyDrive/ASL
```

```
[Errno 2] No such file or directory: '/content/drive/MyDrive/ASL'
/content
```

```
!git clone https://github.com/ultralytics/yolov5
!pip install -qr yolov5/requirements.txt
%cd yolov5 #create folder
```

```
fatal: destination path 'yolov5' already exists and is not an empty directory.
     |████████████████████████████████| 1.6 MB 7.3 MB/s
[Errno 2] No such file or directory: 'yolov5 #create folder'
/content/drive/MyDrive/ASL
```

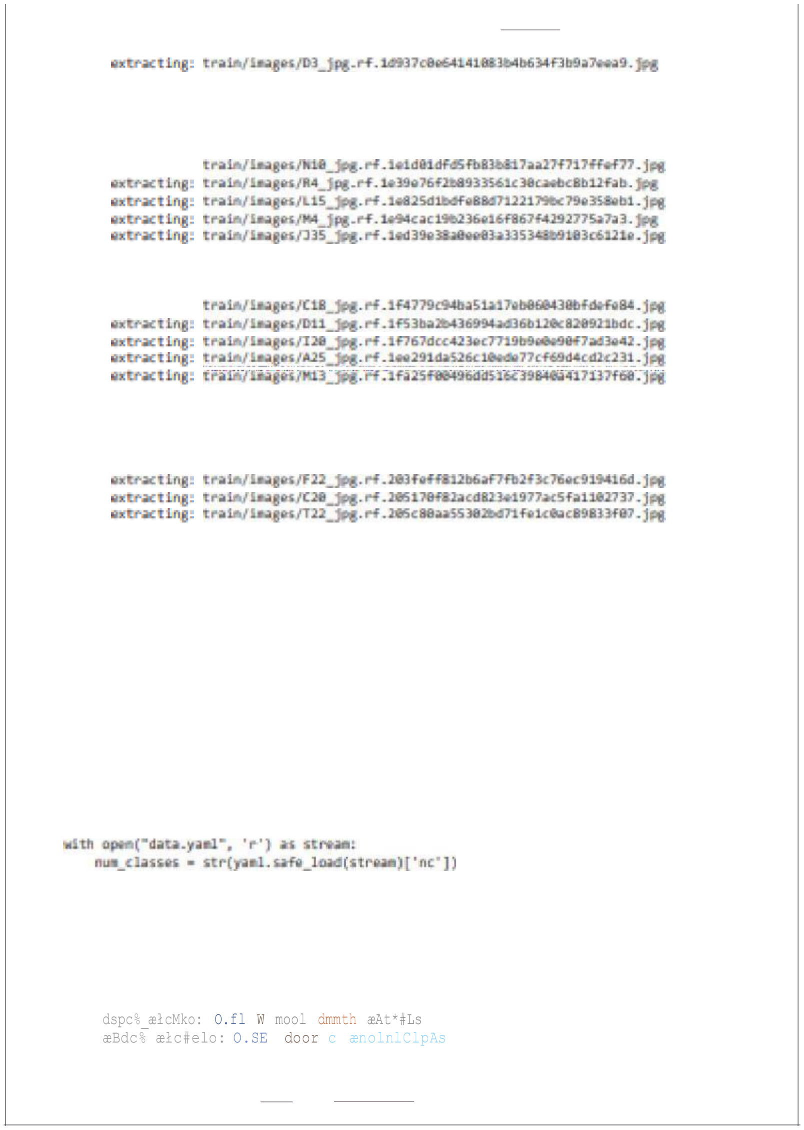
```
import torch
from IPython.display import Image, clear_output
#from utils.google_utils import gdrive_download
```

```
clear_output()
```

```
%cd /content/drive/MyDrive/ASL
!curl -L "https://public.roboflow.com/ds/7wLKZxmGkA?key=OGzBLQBOg3" > roboflow.zip; unzip
```

```
      extracting: train/images/K2_jpg.rf.17dba52b3990a4256016a9eb98cc6566.jpg
      extracting: train/images/W4_jpg.rf.17f140aa6d52da488b75601911d658a0.jpg
      extracting: train/images/Q4_jpg.rf.16f4e350c0cbfa1238a5a74dfa212e7b.jpg
      extracting: train/images/J30_jpg.rf.1830920374b6aec82ee84443edda5734.jpg
      extracting: train/images/N0_jpg.rf.180e4b19d6df6fc5e3e7d86dbe1ddc51.jpg
      extracting: train/images/V17_jpg.rf.18801d8e6ad486e7e038a1565ebf1736.jpg
      extracting: train/images/Y18_jpg.rf.1895434cacd913e7fa4929e3c64afb53.jpg
      extracting: train/images/E20_jpg.rf.18f9c75a3a3244f17baa72a083b7b604.jpg
      extracting: train/images/Q12_jpg.rf.195c56598e517fd7419f41e1dd50f630.jpg
      extracting: train/images/L9_jpg.rf.18fb3c7dce9d787bca991b1a76776261.jpg
      extracting: train/images/W17_jpg.rf.1975003e49350c2dca16bfcc3dc2c342.jpg
      extracting: train/images/V4_jpg.rf.1975ced8246afc56ca0b20a1d70e2d6d.jpg
      extracting: train/images/V4_jpg.rf.18cdecbaa29fef28b7cb519e11e9fd84.jpg
      extracting: train/images/D19_jpg.rf.199140d37ba69d88a7e923bb895fcd4b.jpg
      extracting: train/images/A23_jpg.rf.199528cc21bad70f9424a2cfb92d3207.jpg
      extracting: train/images/D13_jpg.rf.1a3dc1b3ba32f5a799de3f43ad095547.jpg
      extracting: train/images/T20_jpg.rf.1a83ce62951b44181696195e1421ae9b.jpg
      extracting: train/images/X18_jpg.rf.1a8c41e8efd4d9fb973a02374e9ba279.jpg
      extracting: train/images/U14_jpg.rf.1a8882998b37b6b8fcc46b6683e1f66e.jpg
      extracting: train/images/L0_jpg.rf.1ab48686ce6dc960e0c2eb596cb0e589.jpg
      extracting: train/images/Z6_jpg.rf.1bb2adfb8cfa7d70187286406fcd9852.jpg
      extracting: train/images/H17_jpg.rf.1baace1a86461a7849d54050d41b980e.jpg
      extracting: train/images/G8_jpg.rf.1c5dfe424c343ada7600387526c29ca1.jpg
      extracting: train/images/C2_jpg.rf.1cd7aca8a93b74b211c9fbcb18b96519.jpg
      extracting: train/images/T3_jpg.rf.1d01912a9c4bd4e068c4e379f11c03a9.jpg
      extracting: train/images/M16_jpg.rf.1d5582262ceec69d6a45ac3197842420.jpg
```

https://colab.research.google.com/drive/16lKFfNJcc3_OdwR4Muctg-zKcednpYX 1/6



```
extracting: train/images/D3_jpg.rf.1d937c0e64141083b4b634f3b9a7eea9.jpg
```

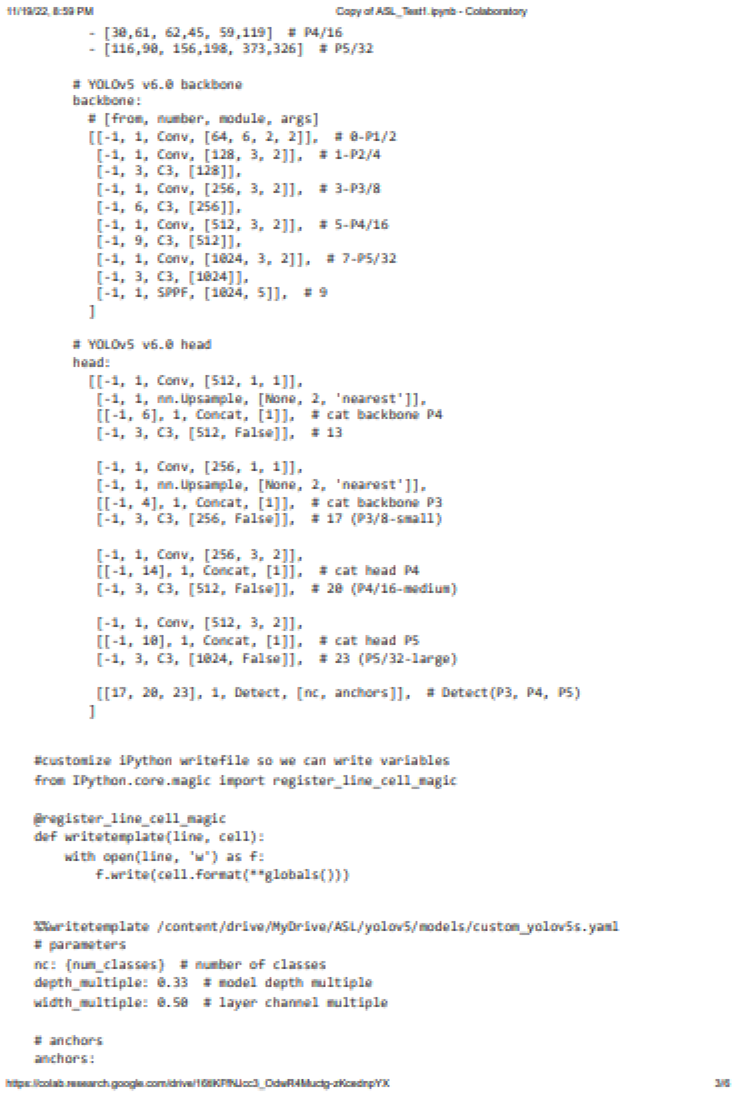
```
            train/images/N10_jpg.rf.1e1d01dfd5fb83b817aa27f717ffef77.jpg
extracting: train/images/R4_jpg.rf.1e39e76f2b8933561c30caebc8b12fab.jpg
extracting: train/images/L15_jpg.rf.1e825d1bdfe88d7122179bc79e358eb1.jpg
extracting: train/images/M4_jpg.rf.1e94cac19b236e16f867f4292775a7a3.jpg
extracting: train/images/J35_jpg.rf.1ed39e38a0ee03a335348b9103c6121e.jpg
```

```
            train/images/C18_jpg.rf.1f4779c94ba51a17eb060430bfdefe84.jpg
extracting: train/images/D11_jpg.rf.1f53ba2b436994ad36b120c820921bdc.jpg
extracting: train/images/I20_jpg.rf.1f767dcc423ec7719b9e0e90f7ad3e42.jpg
extracting: train/images/A25_jpg.rf.1ee291da526c10ede77cf69d4cd2c231.jpg
extracting: train/images/M13_jpg.rf.1fa25f00496dd516c39840a417137f60.jpg
```

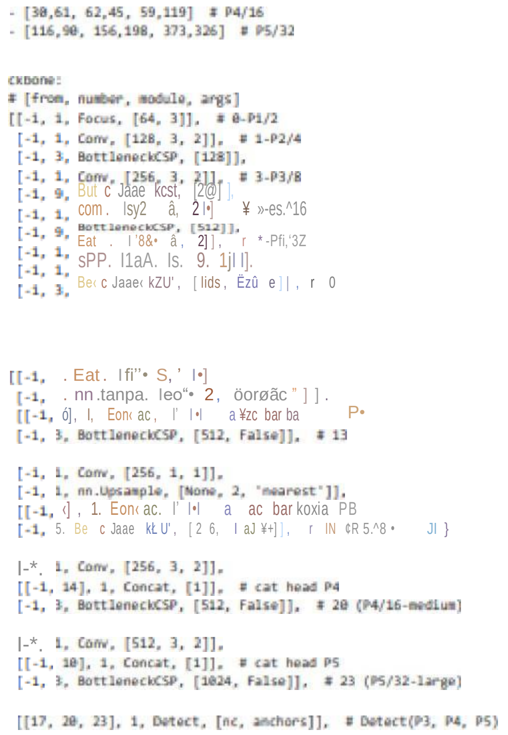
```
extracting: train/images/F22_jpg.rf.203feff812b6af7fb2f3c76ec919416d.jpg
extracting: train/images/C20_jpg.rf.205170f82acd823e1977ac5fa1102737.jpg
extracting: train/images/T22_jpg.rf.205c80aa55302bd71fe1c0ac89833f07.jpg
```

```
with open("data.yaml", 'r') as stream:
    num_classes = str(yaml.safe_load(stream)['nc'])
```

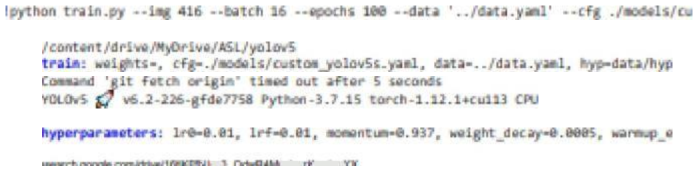
```
dspc%_æłcMko: 0.fl W mool dmmth æAt*#Ls
æBdc% æłc#elo: 0.SE  door c æno1n1C1pAs
```



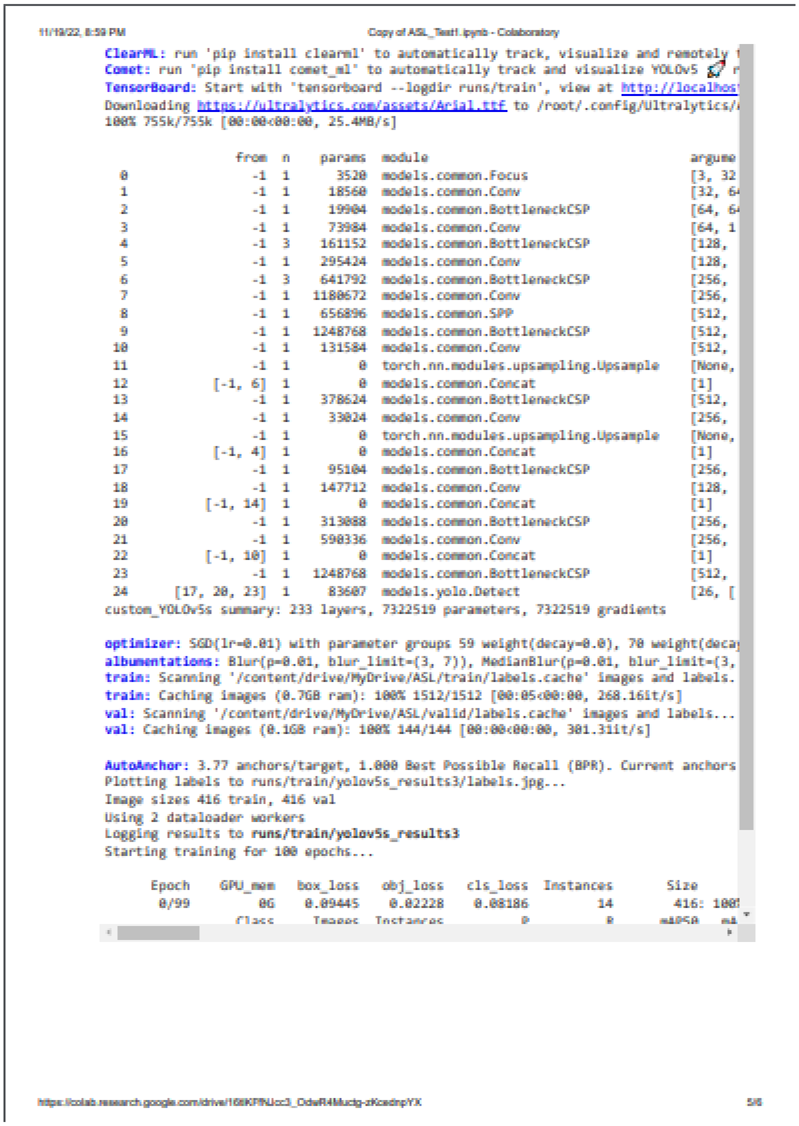
```
      - [30,61, 62,45, 59,119]  # P4/16
      - [116,90, 156,198, 373,326]  # P5/32

    # YOLOv5 v6.0 backbone
    backbone:
      # [from, number, module, args]
      [[-1, 1, Conv, [64, 6, 2, 2]],  # 0-P1/2
       [-1, 1, Conv, [128, 3, 2]],  # 1-P2/4
       [-1, 3, C3, [128]],
       [-1, 1, Conv, [256, 3, 2]],  # 3-P3/8
       [-1, 6, C3, [256]],
       [-1, 1, Conv, [512, 3, 2]],  # 5-P4/16
       [-1, 9, C3, [512]],
       [-1, 1, Conv, [1024, 3, 2]],  # 7-P5/32
       [-1, 3, C3, [1024]],
       [-1, 1, SPPF, [1024, 5]],  # 9
      ]

    # YOLOv5 v6.0 head
    head:
      [[-1, 1, Conv, [512, 1, 1]],
       [-1, 1, nn.Upsample, [None, 2, 'nearest']],
       [[-1, 6], 1, Concat, [1]],  # cat backbone P4
       [-1, 3, C3, [512, False]],  # 13

       [-1, 1, Conv, [256, 1, 1]],
       [-1, 1, nn.Upsample, [None, 2, 'nearest']],
       [[-1, 4], 1, Concat, [1]],  # cat backbone P3
       [-1, 3, C3, [256, False]],  # 17 (P3/8-small)

       [-1, 1, Conv, [256, 3, 2]],
       [[-1, 14], 1, Concat, [1]],  # cat head P4
       [-1, 3, C3, [512, False]],  # 20 (P4/16-medium)

       [-1, 1, Conv, [512, 3, 2]],
       [[-1, 10], 1, Concat, [1]],  # cat head P5
       [-1, 3, C3, [1024, False]],  # 23 (P5/32-large)

       [[17, 20, 23], 1, Detect, [nc, anchors]],  # Detect(P3, P4, P5)
      ]


#customize iPython writefile so we can write variables
from IPython.core.magic import register_line_cell_magic

@register_line_cell_magic
def writetemplate(line, cell):
    with open(line, 'w') as f:
        f.write(cell.format(**globals()))


%%writetemplate /content/drive/MyDrive/ASL/yolov5/models/custom_yolov5s.yaml
# parameters
nc: {num_classes}  # number of classes
depth_multiple: 0.33  # model depth multiple
width_multiple: 0.50  # layer channel multiple

# anchors
anchors:
```



```
- [30,61, 62,45, 59,119]  # P4/16
- [116,90, 156,198, 373,326]  # P5/32

ckbone:
# [from, number, module, args]
[[-1, 1, Focus, [64, 3]],  # 0-P1/2
 [-1, 1, Conv, [128, 3, 2]],  # 1-P2/4
 [-1, 3, BottleneckCSP, [128]],
 [-1, 1, Conv, [256, 3, 2]],  # 3-P3/8
 [-1, 9, But c Jaae kcst, [2@] ],
 [-1, 1, com .  lsy2   â,  2 l•]    ¥ »-es.^16
 [-1, 9, BottleneckCSP, [512]],
 [-1, 1, Eat  .  l '8&•  â ,  2] ] ,   r  * -Pfi,'3Z
 [-1, 1, sPP.  I1aA.  ls.  9.  1jl l].
 [-1, 3, Be‹ c Jaae‹ kZU' ,  [ lids ,  Ëzû  e ] | ,  r  0



[[-1,  . Eat .  I fi''•  S, '  l•]
 [-1,  . nn .tanpa.  leo"•  2 ,  öorøãc " ] ] .
 [[-1, ó], l,  Eon‹ ac ,  l'  l •l    a ¥zc  bar ba       P•
 [-1, 3, BottleneckCSP, [512, False]],  # 13

 [-1, 1, Conv, [256, 1, 1]],
 [-1, 1, nn.Upsample, [None, 2, 'nearest']],
 [[-1, ‹] ,  1.  Eon‹ ac.  l'  l•l    a   ac  bar koxia  PB
 [-1, 5.  Be  c Jaae  kŁ U' ,  [ 2  6,   l  aJ ¥+] ] ,   r  IN  ¢R 5.^8 •     Jl }

 |-*.  1, Conv, [256, 3, 2]],
 [[-1, 14], 1, Concat, [1]],  # cat head P4
 [-1, 3, BottleneckCSP, [512, False]],  # 20 (P4/16-medium)

 |-*.  1, Conv, [512, 3, 2]],
 [[-1, 10], 1, Concat, [1]],  # cat head P5
 [-1, 3, BottleneckCSP, [1024, False]],  # 23 (P5/32-large)

 [[17, 20, 23], 1, Detect, [nc, anchors]],  # Detect(P3, P4, P5)
```



```
!python train.py --img 416 --batch 16 --epochs 100 --data '../data.yaml' --cfg ./models/cu

    /content/drive/MyDrive/ASL/yolov5
    train: weights=, cfg=./models/custom_yolov5s.yaml, data=../data.yaml, hyp=data/hyp
    Command 'git fetch origin' timed out after 5 seconds
    YOLOv5 🚀 v6.2-226-gfde7758 Python-3.7.15 torch-1.12.1+cu113 CPU

    hyperparameters: lr0=0.01, lrf=0.01, momentum=0.937, weight_decay=0.0005, warmup_e

    [illegible]
```



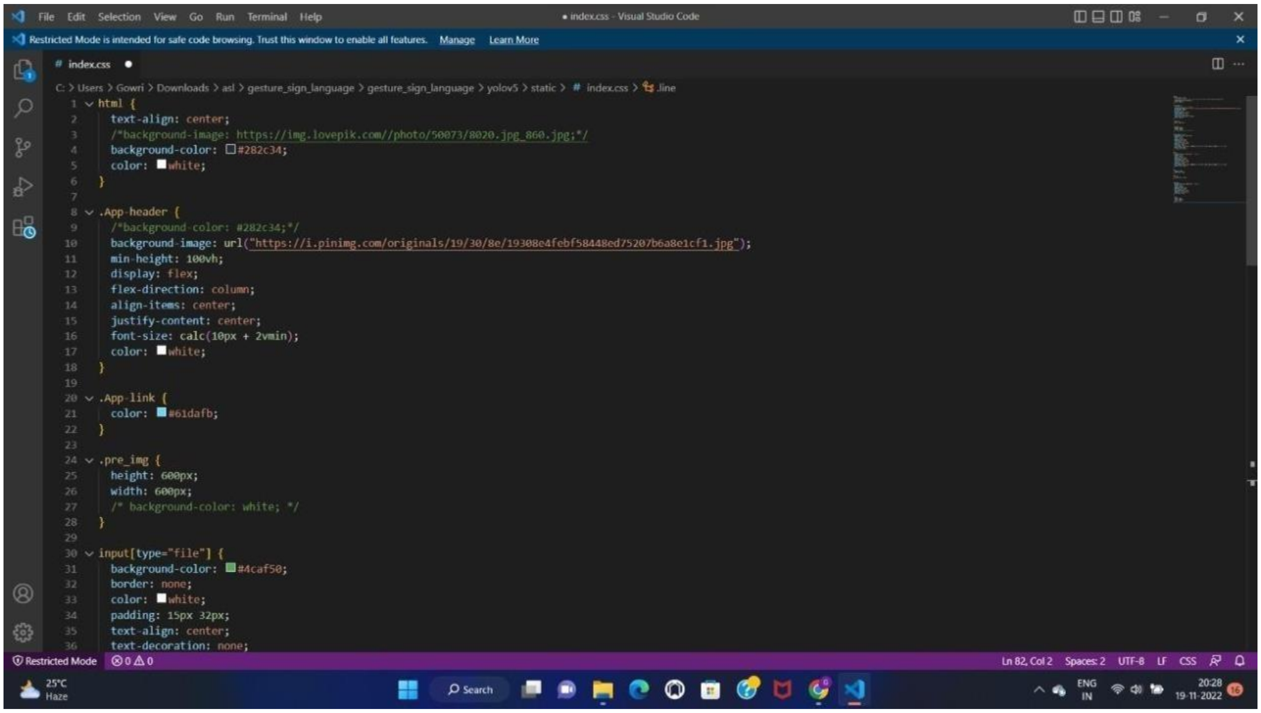
11/19/22, 8:59 PM Copy of ASL_Test1.ipynb - Colaboratory

```
ClearML: run 'pip install clearml' to automatically track, visualize and remotely t
Comet: run 'pip install comet_ml' to automatically track and visualize YOLOv5 🚀 r
TensorBoard: Start with 'tensorboard --logdir runs/train', view at http://localhos
Downloading https://ultralytics.com/assets/Arial.ttf to /root/.config/Ultralytics/
100% 755k/755k [00:00<00:00, 25.4MB/s]

                 from  n    params  module                                  argume
  0                -1  1      3520  models.common.Focus                     [3, 32
  1                -1  1     18560  models.common.Conv                      [32, 6
  2                -1  1     19904  models.common.BottleneckCSP             [64, 6
  3                -1  1     73984  models.common.Conv                      [64, 1
  4                -1  3    161152  models.common.BottleneckCSP             [128,
  5                -1  1    295424  models.common.Conv                      [128,
  6                -1  3    641792  models.common.BottleneckCSP             [256,
  7                -1  1   1180672  models.common.Conv                      [256,
  8                -1  1    656896  models.common.SPP                       [512,
  9                -1  1   1248768  models.common.BottleneckCSP             [512,
 10                -1  1    131584  models.common.Conv                      [512,
 11                -1  1         0  torch.nn.modules.upsampling.Upsample    [None,
 12           [-1, 6]  1         0  models.common.Concat                    [1]
 13                -1  1    378624  models.common.BottleneckCSP             [512,
 14                -1  1     33024  models.common.Conv                      [256,
 15                -1  1         0  torch.nn.modules.upsampling.Upsample    [None,
 16           [-1, 4]  1         0  models.common.Concat                    [1]
 17                -1  1     95104  models.common.BottleneckCSP             [256,
 18                -1  1    147712  models.common.Conv                      [128,
 19          [-1, 14]  1         0  models.common.Concat                    [1]
 20                -1  1    313088  models.common.BottleneckCSP             [256,
 21                -1  1    590336  models.common.Conv                      [256,
 22          [-1, 10]  1         0  models.common.Concat                    [1]
 23                -1  1   1248768  models.common.BottleneckCSP             [512,
 24      [17, 20, 23]  1     83607  models.yolo.Detect                      [26, [
custom_YOLOv5s summary: 233 layers, 7322519 parameters, 7322519 gradients

optimizer: SGD(lr=0.01) with parameter groups 59 weight(decay=0.0), 70 weight(decay
albumentations: Blur(p=0.01, blur_limit=(3, 7)), MedianBlur(p=0.01, blur_limit=(3,
train: Scanning '/content/drive/MyDrive/ASL/train/labels.cache' images and labels.
train: Caching images (0.7GB ram): 100% 1512/1512 [00:05<00:00, 268.16it/s]
val: Scanning '/content/drive/MyDrive/ASL/valid/labels.cache' images and labels...
val: Caching images (0.1GB ram): 100% 144/144 [00:00<00:00, 301.31it/s]

AutoAnchor: 3.77 anchors/target, 1.000 Best Possible Recall (BPR). Current anchors
Plotting labels to runs/train/yolov5s_results3/labels.jpg...
Image sizes 416 train, 416 val
Using 2 dataloader workers
Logging results to runs/train/yolov5s_results3
Starting training for 100 epochs...

      Epoch    GPU_mem   box_loss   obj_loss   cls_loss  Instances       Size
       0/99         0G    0.09445    0.02228    0.08186         14        416: 100
                 Class     Images  Instances          P          R      mAP50   mA
```

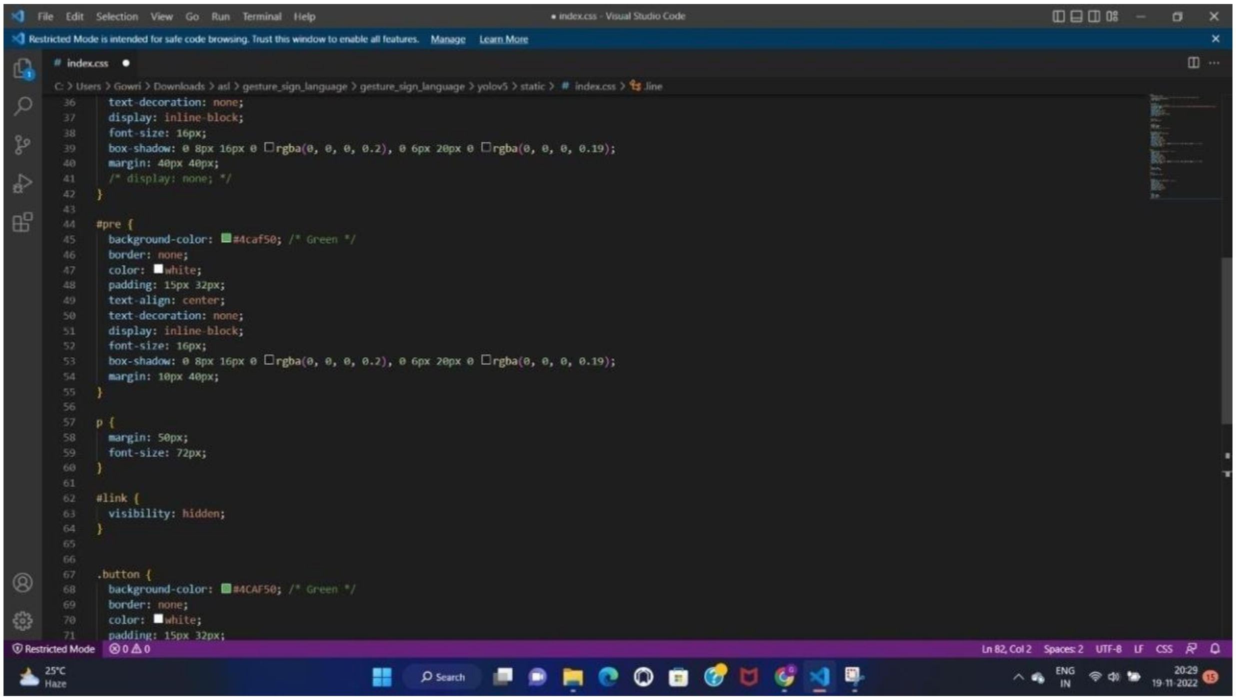
https://colab.research.google.com/drive/166KPfNJcc3_OdeR4Mucg-zKcadnpYX 5/6

Reference link: http://localhost:8888/notebooks/Downloads/ASL.ipynb

CSS:


File Edit Selection View Go Run Terminal Help
• index.css - Visual Studio Code
Restricted Mode is intended for safe code browsing. Trust this window to enable all features. Manage Learn More
index.css
C: > Users > Gowri > Downloads > asl > gesture_sign_language > gesture_sign_language > yolov5 > static > # index.css > .line
Restricted Mode ⊗ 0 ⚠ 0
Ln 82, Col 2 Spaces: 2 UTF-8 LF CSS
25°C Haze
Search
ENG IN
20:28 19-11-2022

```css
html {
  text-align: center;
  /*background-image: https://img.lovepik.com//photo/50073/8020.jpg_860.jpg;*/
  background-color: #282c34;
  color: white;
}

.App-header {
  /*background-color: #282c34;*/
  background-image: url("https://i.pinimg.com/originals/19/30/8e/19308e4febf58448ed75207b6a8e1cf1.jpg");
  min-height: 100vh;
  display: flex;
  flex-direction: column;
  align-items: center;
  justify-content: center;
  font-size: calc(10px + 2vmin);
  color: white;
}

.App-link {
  color: #61dafb;
}

.pre_img {
  height: 600px;
  width: 600px;
  /* background-color: white; */
}

input[type="file"] {
  background-color: #4caf50;
  border: none;
  color: white;
  padding: 15px 32px;
  text-align: center;
  text-decoration: none;
```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Restricted Mode ⊗ 0 ⚠ 0
Ln 82, Col 2 Spaces: 2 UTF-8 LF CSS
25°C Haze
Search
ENG IN
20:29 19-11-2022

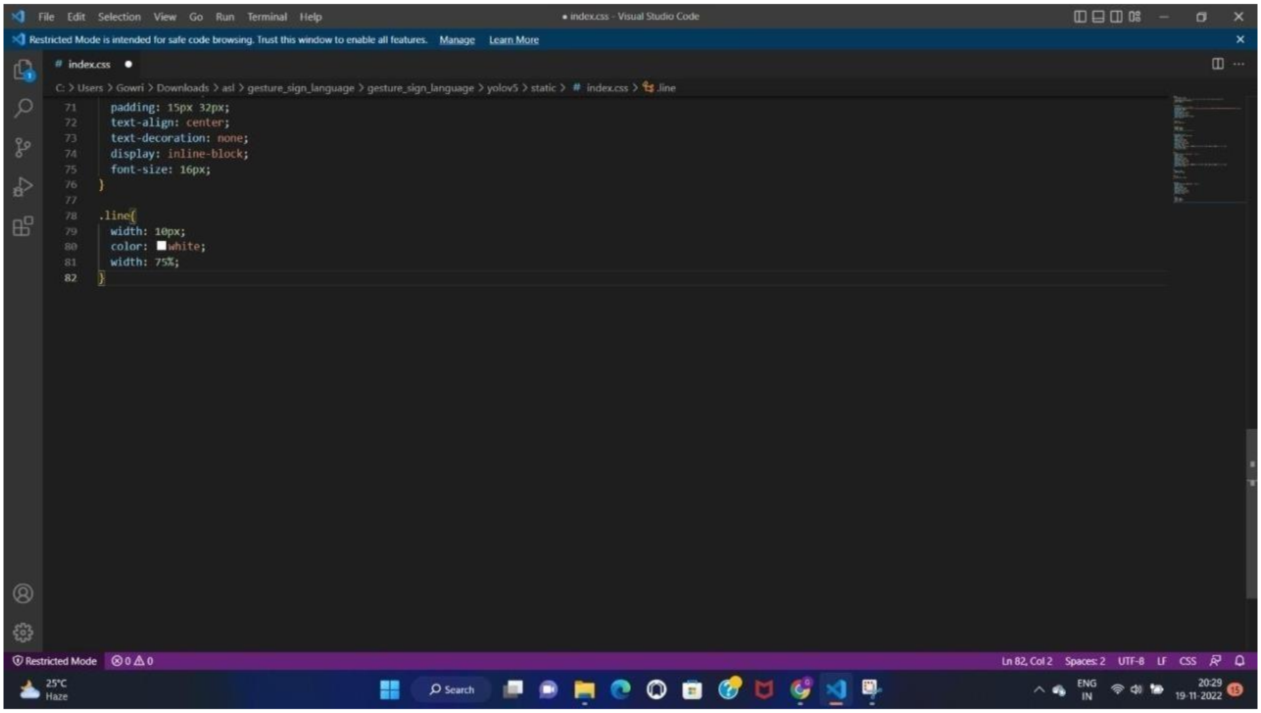
```css
  text-decoration: none;
  display: inline-block;
  font-size: 16px;
  box-shadow: 0 8px 16px 0 rgba(0, 0, 0, 0.2), 0 6px 20px 0 rgba(0, 0, 0, 0.19);
  margin: 40px 40px;
  /* display: none; */
}

#pre {
  background-color: #4caf50; /* Green */
  border: none;
  color: white;
  padding: 15px 32px;
  text-align: center;
  text-decoration: none;
  display: inline-block;
  font-size: 16px;
  box-shadow: 0 8px 16px 0 rgba(0, 0, 0, 0.2), 0 6px 20px 0 rgba(0, 0, 0, 0.19);
  margin: 10px 40px;
}

p {
  margin: 50px;
  font-size: 72px;
}

#link {
  visibility: hidden;
}


.button {
  background-color: #4CAF50; /* Green */
  border: none;
  color: white;
  padding: 15px 32px;
```



File Edit Selection View Go Run Terminal Help
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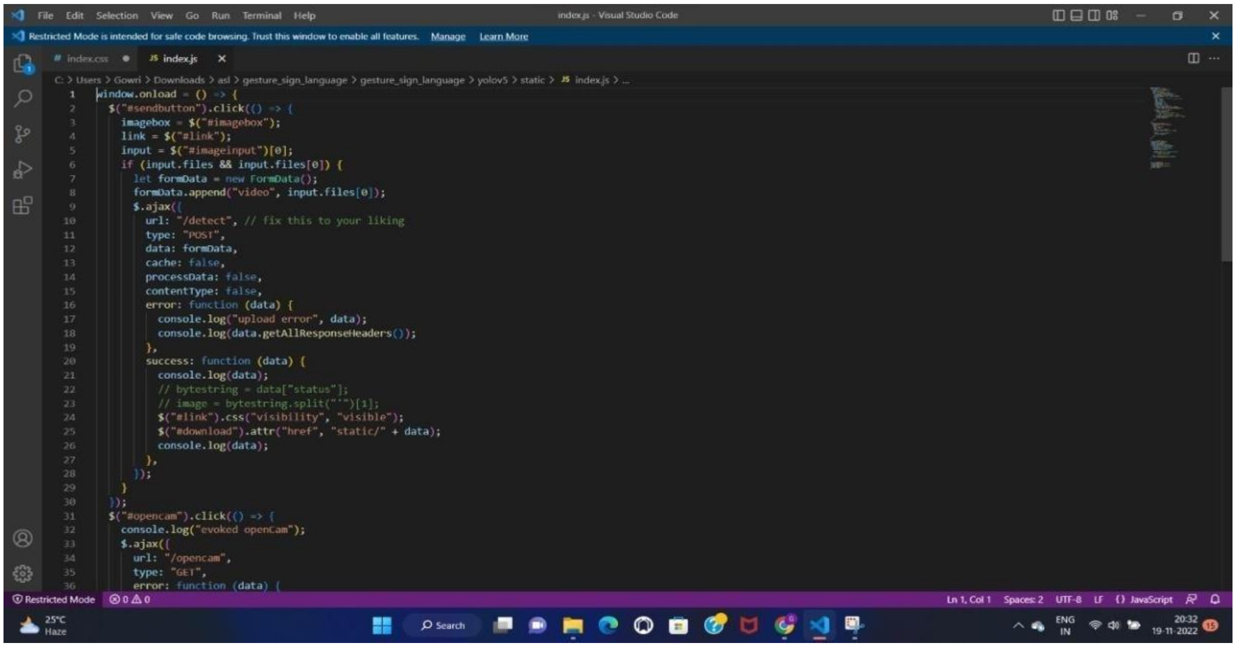
index.css
C: > Users > Gowri > Downloads > asl > gesture_sign_language > gesture_sign_language > yolov5 > static > index.css > .line
Restricted Mode
Ln 82, Col 2 Spaces: 2 UTF-8 LF CSS
25°C Haze
Search
ENG IN
20:29 19-11-2022

```css
  padding: 15px 32px;
  text-align: center;
  text-decoration: none;
  display: inline-block;
  font-size: 16px;
}

.line{
  width: 10px;
  color: white;
  width: 75%;
}
```

JSS:



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index.js - Visual Studio Code
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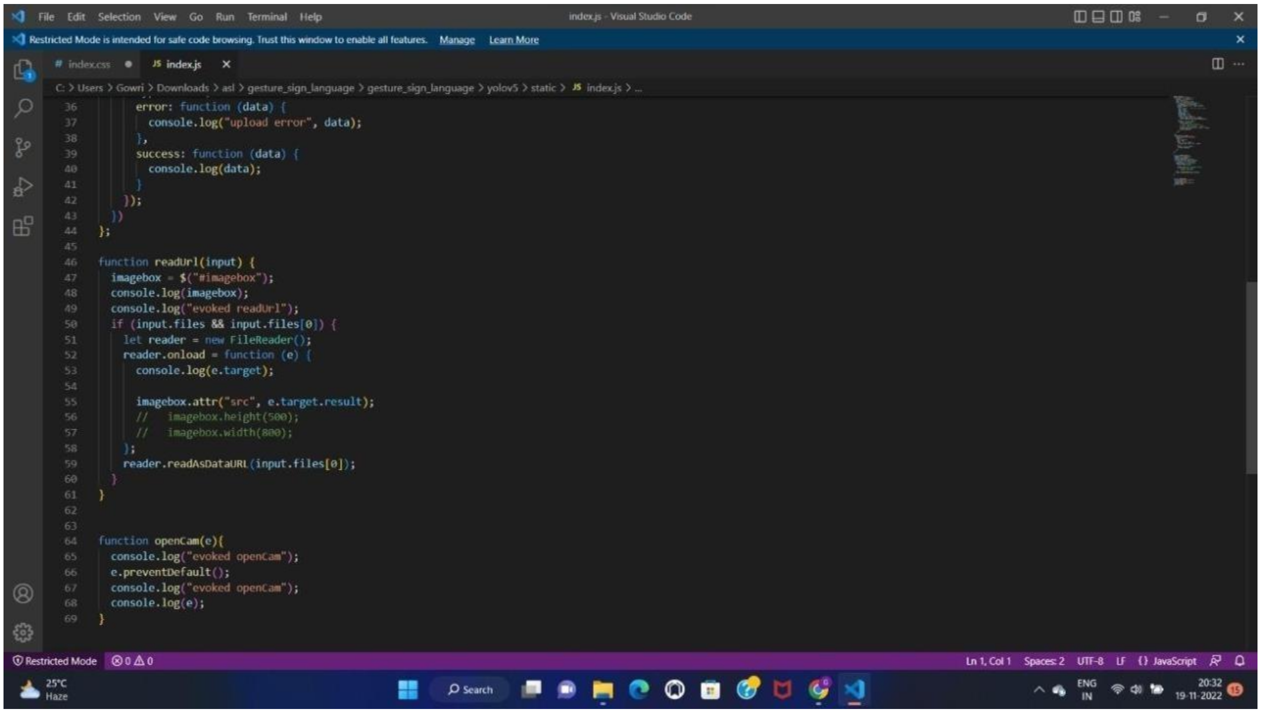
index.css index.js
C: > Users > Gowri > Downloads > asl > gesture_sign_language > gesture_sign_language > yolov5 > static > index.js > ...
Restricted Mode
Ln 1, Col 1 Spaces: 2 UTF-8 LF {} JavaScript
25°C Haze
Search
ENG IN
20:32 19-11-2022

```javascript
window.onload = () => {
  $("#sendbutton").click(() => {
    imagebox = $("#imagebox");
    link = $("#link");
    input = $("#imageinput")[0];
    if (input.files && input.files[0]) {
      let formData = new FormData();
      formData.append("video", input.files[0]);
      $.ajax({
        url: "/detect", // fix this to your liking
        type: "POST",
        data: formData,
        cache: false,
        processData: false,
        contentType: false,
        error: function (data) {
          console.log("upload error", data);
          console.log(data.getAllResponseHeaders());
        },
        success: function (data) {
          console.log(data);
          // bytestring = data["status"];
          // image = bytestring.split("'")[1];
          $("#link").css("visibility", "visible");
          $("#download").attr("href", "static/" + data);
          console.log(data);
        },
      });
    }
  });
  $("#opencam").click(() => {
    console.log("evoked openCam");
    $.ajax({
      url: "/opencam",
      type: "GET",
      error: function (data) {
```



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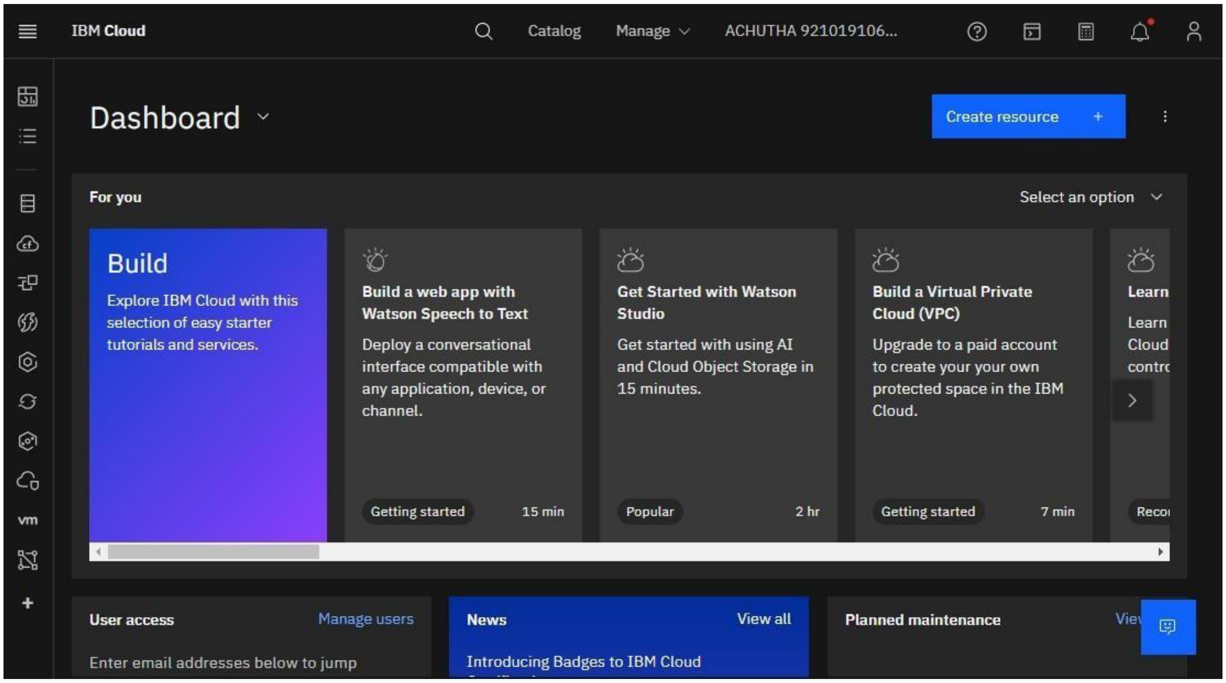
index.js - Visual Studio Code
Restricted Mode is intended for safe code browsing. Trust this window to enable all features. Manage Learn More
# index.css
JS index.js
C: > Users > Gowri > Downloads > asl > gesture_sign_language > gesture_sign_language > yolov5 > static > JS index.js > ...

```
      error: function (data) {
        console.log("upload error", data);
      },
      success: function (data) {
        console.log(data);
      }
    });
  })
};

function readUrl(input) {
  imagebox = $("#imagebox");
  console.log(imagebox);
  console.log("evoked readUrl");
  if (input.files && input.files[0]) {
    let reader = new FileReader();
    reader.onload = function (e) {
      console.log(e.target);

      imagebox.attr("src", e.target.result);
      //   imagebox.height(500);
      //   imagebox.width(800);
    };
    reader.readAsDataURL(input.files[0]);
  }
}


function openCam(e){
  console.log("evoked openCam");
  e.preventDefault();
  console.log("evoked openCam");
  console.log(e);
}
```

6. TESTING

6.1 Test Cases

6.2 User Acceptance Testing



Build

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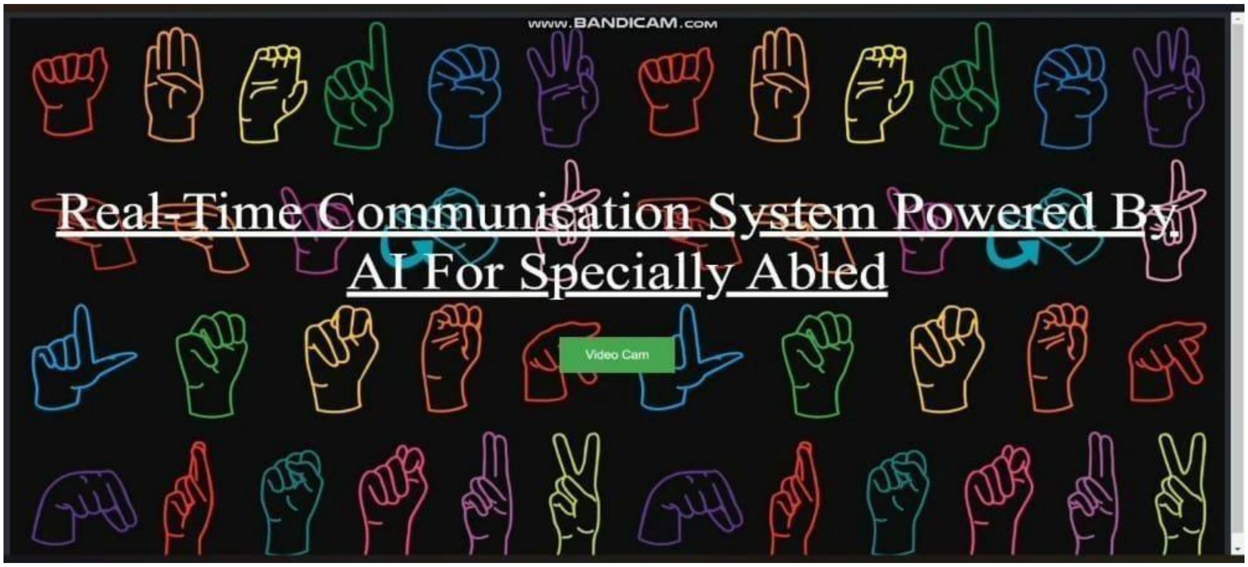
7. RESULTS

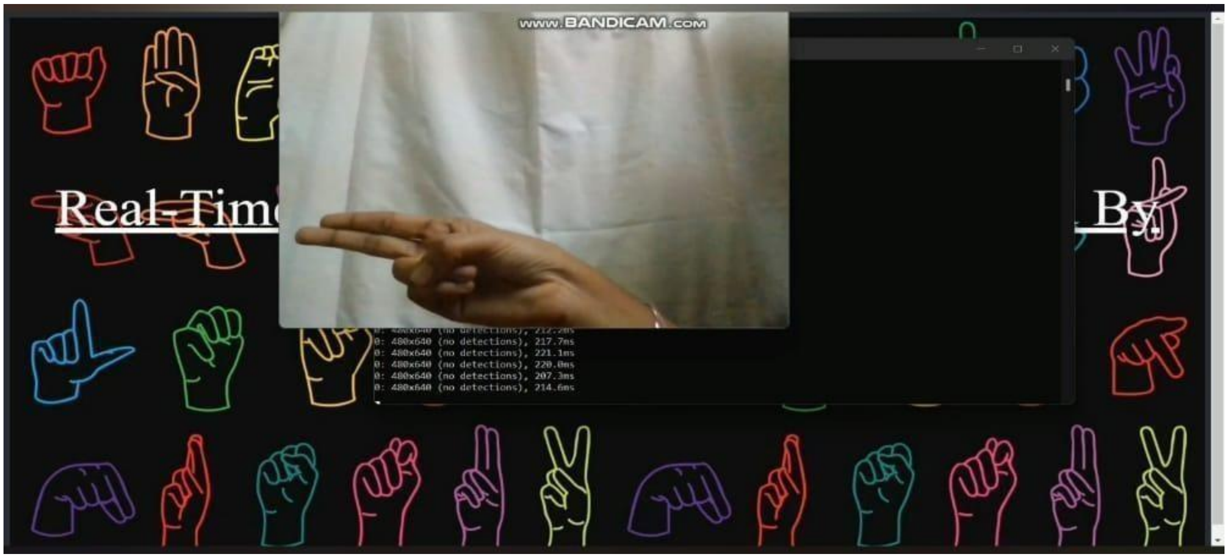
7.1 Performance Metrics

1. Output Screen



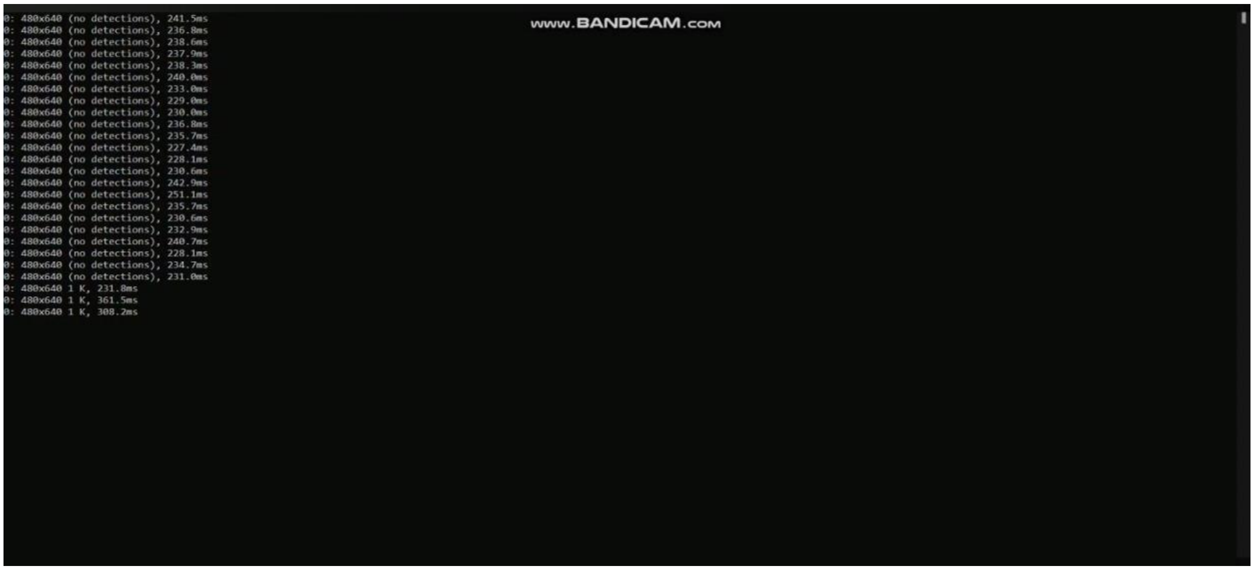
Real-Time Communication System Powered By AI For Specially Abled

2. Camera will pop up



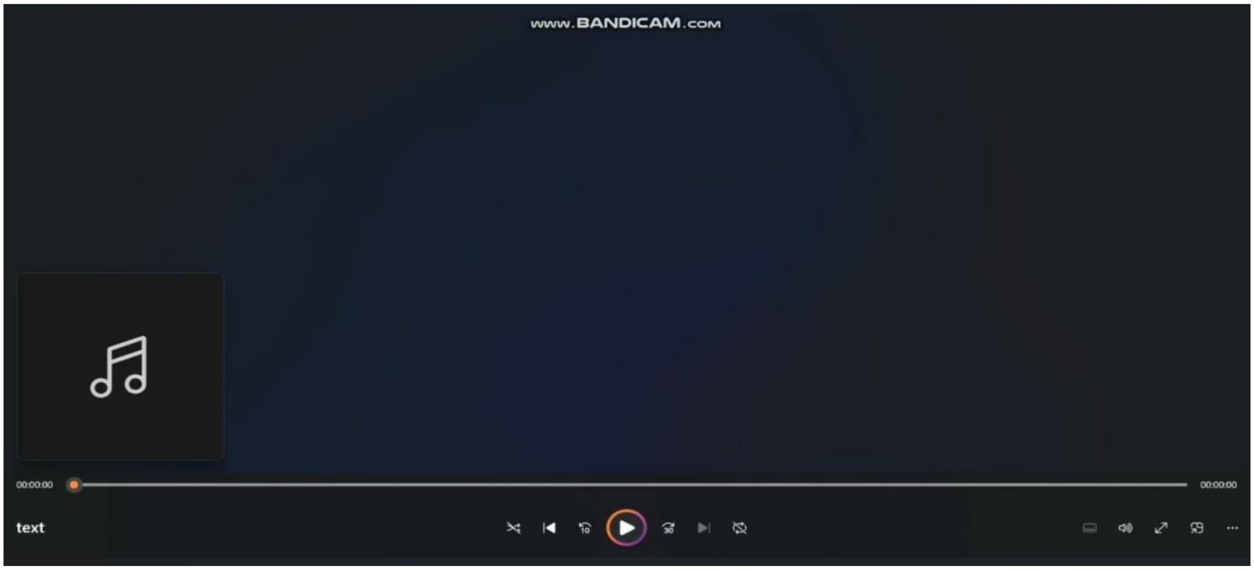
```
0: 480x640 (no detections), 212.2ms
0: 480x640 (no detections), 217.7ms
0: 480x640 (no detections), 221.1ms
0: 480x640 (no detections), 220.0ms
0: 480x640 (no detections), 207.3ms
0: 480x640 (no detections), 214.6ms
```

3. It will detect and display in command prompt



```
0: 480x640 (no detections), 241.5ms
0: 480x640 (no detections), 236.8ms
0: 480x640 (no detections), 238.6ms
0: 480x640 (no detections), 237.9ms
0: 480x640 (no detections), 238.3ms
0: 480x640 (no detections), 240.0ms
0: 480x640 (no detections), 233.0ms
0: 480x640 (no detections), 229.0ms
0: 480x640 (no detections), 230.0ms
0: 480x640 (no detections), 236.8ms
0: 480x640 (no detections), 235.7ms
0: 480x640 (no detections), 227.4ms
0: 480x640 (no detections), 228.1ms
0: 480x640 (no detections), 230.6ms
0: 480x640 (no detections), 242.9ms
0: 480x640 (no detections), 251.1ms
0: 480x640 (no detections), 235.7ms
0: 480x640 (no detections), 230.6ms
0: 480x640 (no detections), 232.9ms
0: 480x640 (no detections), 240.7ms
0: 480x640 (no detections), 228.1ms
0: 480x640 (no detections), 234.7ms
0: 480x640 (no detections), 231.0ms
0: 480x640 1 K, 231.8ms
0: 480x640 1 K, 361.5ms
0: 480x640 1 K, 308.2ms
```

4. It will convert detected alphabet to audio



10. ADVANTAGES

- Ease of communication between specially abled and a normal person.
- Easy to handle both specially abled and a normal person.
- Help full in emergency situations.
- Rapid Response.

DISADVANTAGES

- Content delivery need to be improved.
- Improper translation may occur.
- May need high speed data connectivity.

11. CONCLUSION

The main objective of this research has been achieved successfully.

Gesture interpretation works best in case users who understand sign language may interact with people who are unfamiliar with sign language. Speech interpretation is helpful for sign language non-speakers who want the accompanying hand sign to be understood. Room conditions such as lighting can play a role in predicting the outcome of poor lighting. The light that is either too bright or too dim will result in inaccurate hand segmentation, resulting in inaccurate gesture prediction. The type of inaccuracy can emerge from the user's peripherals, such as poor web camera performance or poor microphone quality. In a nutshell, the development of technology is essential, and its deployment in sign language is highly critical. It will serve to bring efficiency in communication, not only to the deaf and dumb but those with the ability to hear and speak as well. In addition to creating opportunities for their career growth, it will enhance their social life through effective communication. Making an impact and changing the lives of the deaf and dump through technology will be an innovation of the year worth the time and resources.

12. FUTURE SCOPE

We can develop a model for ISL word and sentence level recognition. This will require a system that can detect changes with respect to the temporal space. 2. We can develop a complete product that will help the speech and hearing impaired people, and thereby reduce the communication gap.

13. APPENDIX

Source Code

https://github.com/IBM-EPBL/IBM-Project-37834-1660328739

GitHub & Project Demo Link

https://drive.google.com/file/d/1CYPFpORJKj-NbPuYxKQlpUNveVa4xrTt/view?usp=drivesdk