

A MINI PROJECT REPORT
ON
Sign Language Recognition Using Hand Gestures

Submitted to Mumbai University
In the partial fulfillment of the requirement for the award of the degree of

Bachelor of Engineering
In
COMPUTER ENGINEERING

By

Mr. Shadab Shaikh. (17DCO74)

Mr. Obaid Kazi. (17DCO69)

Mr. Mohd Adnan Ansari. (17DCO63)

Under the guidance of
Mr. Muhammed Salman Shamsi
Assistant Professor



Department of Computer Engineering
Anjuman-I-Islam's Kalsekar Technical Campus

Affiliated to Mumbai University

KHANDA GOAN, NEW PANVEL, NAVI MUMBAI, MAHARASHTRA

2018-2019

Department of Computer Engineering
Anjuman-I-Islam's Kalsekar Technical Campus
Affiliated to Mumbai University
KHANDA GAON, NEW PANVEL, NAVI MUMBAI, MAHARASHTRA
2018-2019



DECLARATION BY THE CANDIDATE

Shadab Shaikh, Obaid Kazi, Mohd Adnan Ansari bearing **Roll number: 17DCO74, 17DCO69, 17DCO63** respectively, hereby declare that the mini project report entitled **“Sign language recognition using hand gestures”**, is a record of bonafide work carried out by me and the results embodied in this project have not been reproduced or copied from any source. The results of this project report have not been submitted to any other University or Institute for the award of any other Degree or Diploma.

Shadab Shaikh	17DCO74
Obaid Kazi	17DCO69
Mohd Adnan Ansari	17DCO63

Department of Computer Engineering
Anjuman-I-Islam's Kalsekar Technical Campus
Affiliated to Mumbai University
KHANDA GAON, NEW PANVEL, NAVI MUMBAI, MAHARASHTRA
2018-2019



CERTIFICATE

This is to certify that the project report entitled “**Sign Language Recognition Using Hand Gestures**”, submitted by **Mr. Shadab Shaikh, Mr. Obaid Kazi, Mr. Mohd Adnan Ansari** bearing **Roll. No.: 17DCO74, 17DCO69, 17DCO63** respectively, in the partial fulfillment of the requirements for the award of the degree of **Bachelor of Computer Engineering** is a record of bonafide work carried out by him for the course **Mini Project CSM605**.

Mini Project Guide
(Prof. Muhammed Salman Shamsi)

Mini Project Coordinator
(Prof. Muhammed Salman Shamsi)

Program Owner
(Prof. Tabrez Khan)

INDEX

CONTENTS

CHAPTER 1: INTRODUCTION

1.1 Introduction.....	00
1.2 Scope.....	03
1.3 Problem Statement.....	03

CHAPTER 2 SYSTEM SPECIFICATION

2.1 System Requirement.....	26
2.2 System Features.....	26

CHAPTER 3: SYSTEM DESIGN

3.1 System Architecture.....	47
3.2 Modules in the System.....	47
3.3 Use Case Diagram	47
3.4 Activity Sequence Diagram.....	47

CHAPTER 4: IMPLEMENTATION

4.1 Code Snippets.....	50
4.2 Screen Shots.....	70

CHAPTER 5: CONCLUSION

5.1 Conclusion.....	75
5.1 Future Scope.....	75

REFERENCES.....	76
-----------------	----

APPENDICES.....	78
-----------------	----

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Some of the major problems faced by a person who are unable to speak is they cannot express their emotion as freely in this world. Use that voice recognition and voice search features in smartphone(s)^[1]. Audio results cannot be retrieved. They are unable to use (Artificial Intelligence/personal Butler) like google assistance,^[2] or Apple's SIRI etc. because all those apps are based on voice controlling.

There is a need for such platforms for such kind of people. American Sign Language (ASL) is a complete, complex language that employs signs made by moving the hands combined with facial expressions and postures of the body. It is the primary language of many North Americans who are deaf and is one of several communication options used by people who are deaf or hard-of-hearing.^[3]

While sign language is very important to deaf-mute people, to communicate both with normal people and with themselves, is still getting little attention from the normal people^[4]. The importance of sign language has been tending to ignored, unless there are areas of concern with individuals who are deaf-mute. One of the solutions to communicate with the deaf-mute people is by using the services of sign language. But the usage of sign language interpreter can be costly.^[5]

Hand gesture is one of the methods used in sign language for non-verbal communication. It is most commonly used by deaf & dumb people who have hearing or speech problems to communicate among themselves or with normal people^[3]. Various sign language systems have been developed by many makers around the world but they are neither flexible nor cost-effective for the end users.^[7]

1.2 SCOPE

One of the solutions to communicate with the deaf-mute people is by using the services of sign language interpreter. But the usage of sign language interpreter can be costly.

Cheap solution is required so that the deaf-mute and normal people can communicate normally.

Our strategy involves implementing such an application which detects pre-defined American signed language (ASL) through hand gestures. For the detection of movement of gesture, we would use basic level of hardware component like camera and interfacing is required. Our application would be a comprehensive User-friendly Based system built on PyQt5 module.

Instead of using high-end technology like gloves or kinect, we aim to solve this problem using state of the art computer vision and machine learning algorithms.

This application will comprise of two core module one is that simply detects the gesture and displays appropriate alphabet. The second is after a certain amount of interval period the scanned frame would be stored into buffer so that a string of character could be generated forming a meaningful word.

Additionally, an-addon facility for the user would be available where a user can build their own custom-based gesture for a special character like period (.) or any delimiter so that a user could form a whole bunch of sentences enhancing this into paragraph and likewise. Whatever the predicted outcome was, it would be stored into a .txt file.

1.3 PROBLEM STATEMENT

Given a hand gesture, implementing such an application which detects pre-defined American signed language (ASL) in a real time through hand gestures and providing facility for the user to be able to store the result of the character detected in a txt file, also allowing such users to build their customized gesture so that the problems faced by persons who aren't able to talk vocally can be accommodated with technological assistance and the barrier of expressing can be overshadowed.

CHAPTER 2

SYSTEM SPECIFICATION

2.1 SYSTEM REQUIREMENT

2.1.1 HARDWARE REQUIREMENTS

- Intel Core i3 3rd gen processor or later.
- 512 MB disk space.
- 512 MB RAM.
- Any external or inbuild camera with minimum pixel resolution 200 x 200 (300ppi or 150lpi) 4-megapixel cameras and up.

2.1.2 SOFTWARE REQUIREMENTS

- Microsoft Windows XP or later / Ubuntu 12.0 LTS or later /MAC OS 10.1 or later.
- Python Interpreter (3.6).
- TensorFlow framework, Keras API.
- PyQt5, Tkinter module.
- Python OpenCV2, scipy, qimage2ndarray, winGuiAuto, pypiwin32, sys, keyboard, pytsx3, pillow libraries.

2.2 SYSTEM FEATURES

- User-friendly based GUI built using industrial standard PyQt5.
- Real time American standard character detection based on gesture made by user.
- Customized gesture generation.
- Forming a stream of sentences based on the gesture made after a certain interval of time.

CHAPTER 3

SYSTEM DESIGN

3.1 SYSTEM ARCHITECTURE

Group Code : - 04 Sign Language Recognition Using Hand Gestures

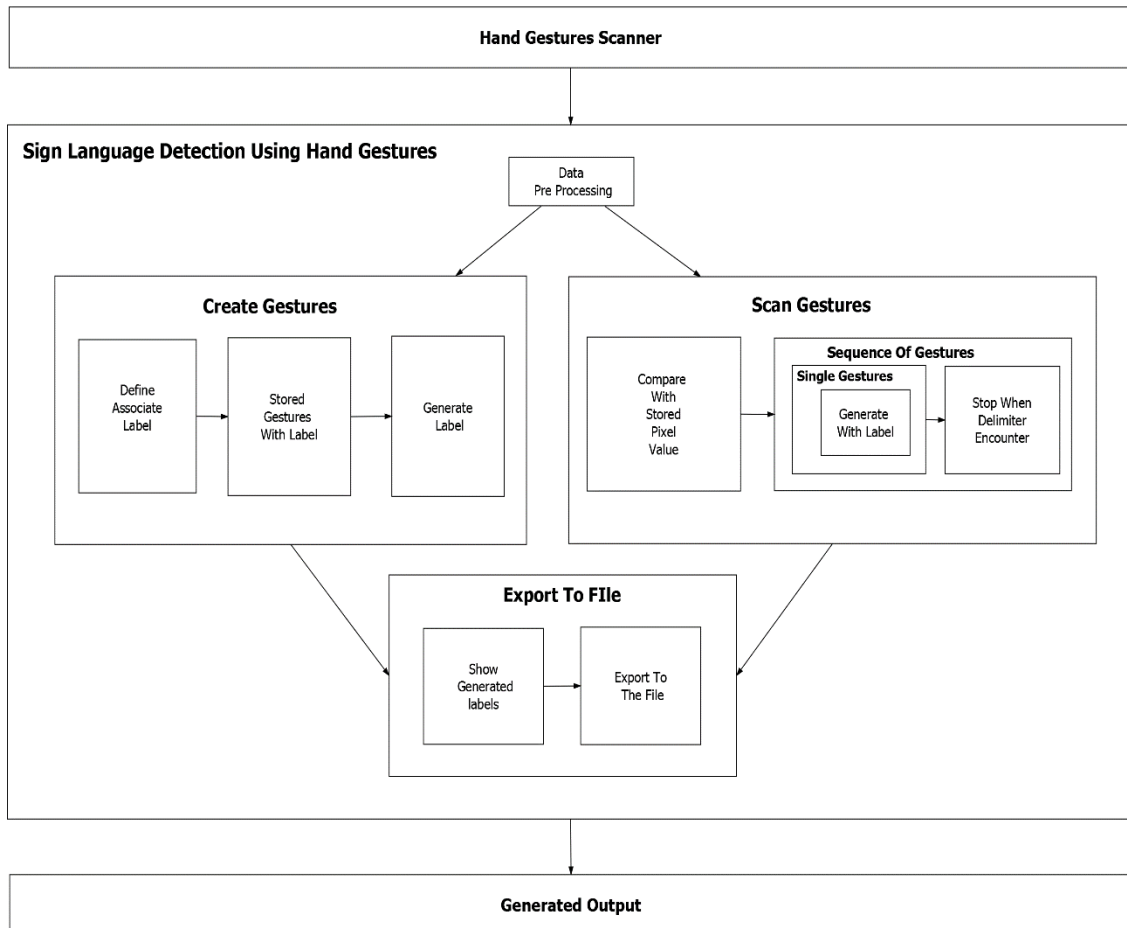


Fig 1: System Architecture for Sign Language Recognition Using Hand Gestures.

3.2 MODULES IN THE SYSTEM

- **Data Pre-Processing** – In this module, based on the object detected in front of the camera its binary images is being populated. Meaning the object will be filled with solid white and background will be filled with solid black. Based on the pixel's regions, their numerical value in range of either 0 or 1 is being given to next process for modules.

- **Scan Single Gesture** – A gesture scanner will be available in front of the end user where the user will have to do a hand gesture. Based on Pre-Processed module output, a user shall be able to see associated label assigned for each hand gestures, based on the predefined American Sign Language (ASL) standard inside the output window screen.
- **Create gesture** –A user will give a desired hand gesture as an input to the system with the text box available at the bottom of the screen where the user needs to type whatever he/she desires to associate that gesture with. This customize gesture will then be stored for future purposes and will be detected in the upcoming time.
- **Formation of a sentence** – A user will be able to select a delimiter and until that delimiter is encountered every scanned gesture character will be appended with the previous results forming a stream of meaning-full words and sentences.
- **Exporting** – A user would be able to export the results of the scanned character into an ASCII standard textual file format.

3.3 USE CASE DIAGRAM

Group Code: -4 Sign Language Recognition Using Hand Gestures

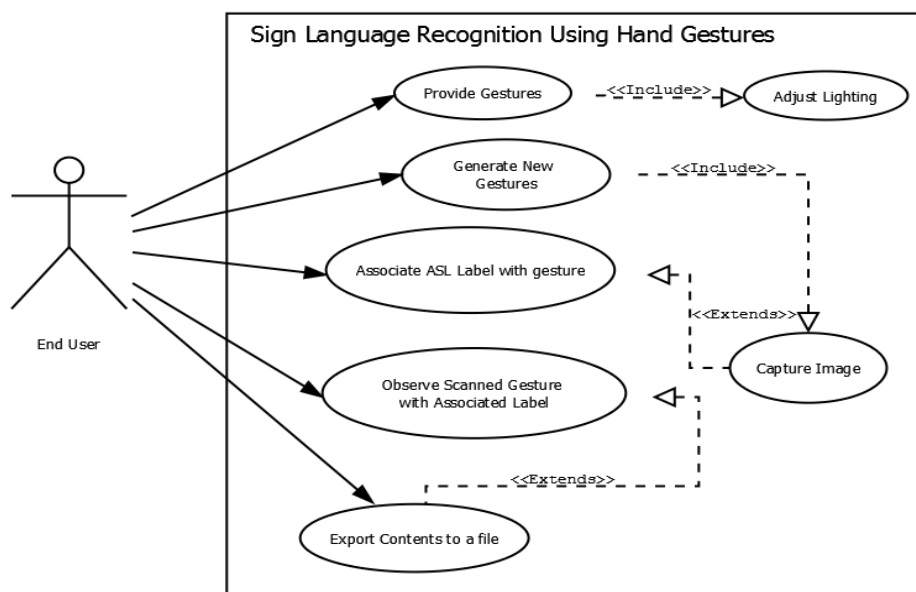


Fig 2: Use Case Diagram for Sign Language Recognition Using Hand Gestures.

3.4 ACTIVITY DIAGRAM

Group Code : -04 Sign Language Recognition Using Hand Gestures

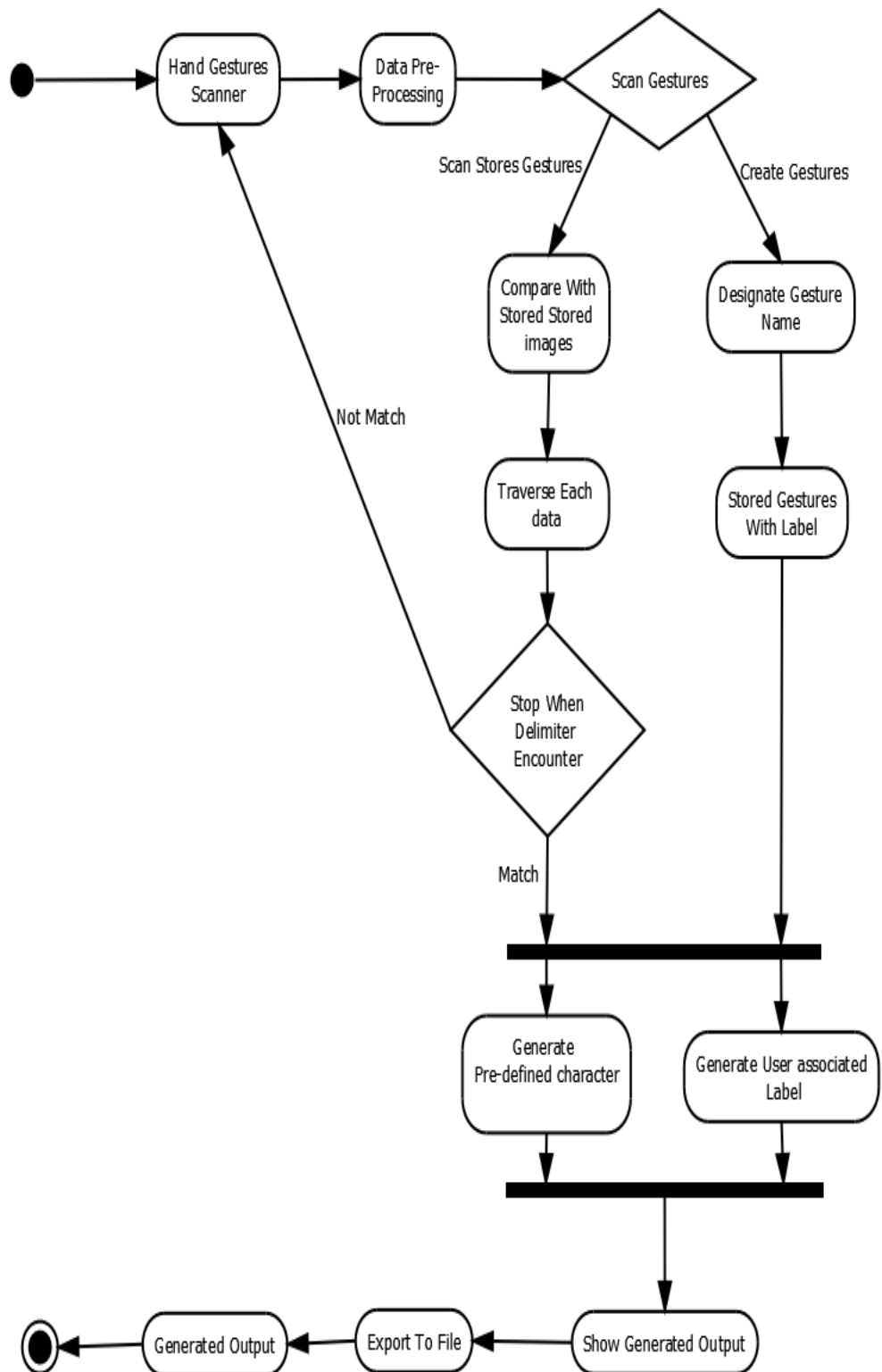


Fig 3: Activity Diagram for Sign Language Recognition Using Hand Gestures.

CHAPTER 4

IMPLEMENTATION

4.1 CODE SNIPPETS

Dashboard.py

```
__author__ = 'Shadab Shaikh, Obaid Kazi, Ansari Mohd Adnan'

from PyQt5 import QtWidgets, uic
from PyQt5.QtWidgets import QMessageBox
from PyQt5.QtCore import QUrl
from PyQt5.QtGui import QImage
from PyQt5.QtGui import QPixmap
from PyQt5 import QtCore
from scipy.ndimage import imread
from PyQt5.QtCore import QTimer, Qt
from PyQt5 import QtGui
from tkinter import filedialog
from tkinter import *
import tkinter as tk
from matplotlib import pyplot as plt
from matplotlib.widgets import Button
import sys
import os
import cv2
import numpy as np
import qimage2ndarray
import win32api
import winGuiAuto
import win32gui
import win32co
import keyboard
import pyttsx3
import shutil
index = 0
engine = pyttsx3.init()

#importing pyqt5 libraries
#will help in reading the images

#for file export module

#for gesture viewer

#for pyqt
#for removal of files
#for the camera operations
#proceesing on images
#convers images into matrix

#for removing title cv2 window and always on top
#for pressing keys
#for tts assistance
#for removal of directories
#index used for gesture viewer
#engine initialization for audio tts assistance

def nothing(x):
    pass

image_x, image_y = 64,64

#image resolution

from keras.models import load_model
classifier = load_model('ASLModel.h5')

#loading the model

def fileSearch():
    """Searches each file ending with .png in SampleGestures dirrectory so that
    custom gesture could be passed to predictor() function"""
    fileEntry=[]
    for file in os.listdir("SampleGestures"):
        if file.endswith(".png"):
            fileEntry.append(file)
    return fileEntry

def load_images_from_folder(folder):
    """Searches each images in a specified directory"""
    images = []
    for filename in os.listdir(folder):
        img = cv2.imread(os.path.join(folder,filename))
        if img is not None:
            images.append(img)
    return images

def toggle_imagesfwd(event):
    """displays next images act as a gesutre viewer"""
    img=load_images_from_folder('TempGest/')
    global index

    index += 1

    try:
        if index < len(img):
            plt.axes()
            plt.imshow(img[index])
            plt.draw()
```

```

        except:
            pass

def toggle_imagesrev(event):
    """displays previous images act as a gesture viewer"""
    img=load_images_from_folder('TempGest/')
    global index

    index -= 1

    try:
        if index < len(img) and index>=0:
            plt.axes()
            plt.imshow(img[index])
            plt.draw()
    except:
        pass

def openimg():
    """displays predefined gesture images at right most window"""
    cv2.namedWindow("Image", cv2.WINDOW_NORMAL )
    image = cv2.imread('template.png')
    cv2.imshow("Image",image)
    cv2.setWindowProperty("Image",cv2.WND_PROP_FULLSCREEN,cv2.WINDOW_FULLSCREEN)
    cv2.resizeWindow("Image",298,430)
    cv2.moveWindow("Image", 1052,214)

def removeFile():
    """Removes the temp.txt and tempgest directory if any stop button is pressed oor
    application is closed"""
    try:
        os.remove("temp.txt")
    except:
        pass
    try:
        shutil.rmtree("TempGest")
    except:
        pass

def clearfunc(cam):
    """shut downs the opened camera and calls removeFile() Func"""
    cam.release()
    cv2.destroyAllWindows()
    removeFile()

def clearfunc2(cam):
    """shut downs the opened camera"""
    cam.release()
    cv2.destroyAllWindows()

def saveBuff(self,cam,finalBuffer):
    """Save the file as temp.txt if save button is pressed in sentence formation
    through gui"""
    cam.release()
    cv2.destroyAllWindows()
    if(len(finalBuffer)>=1):
        f=open("temp.txt","w")
        for i in finalBuffer:
            f.write(i)
        f.close()

def capture_images(self,cam,saveimg,mask):
    """Saves the images for custom gestures if button is pressed in custom gesture
    generationn through gui"""
    cam.release()
    cv2.destroyAllWindows()
    if not os.path.exists('./SampleGestures'):
        os.mkdir('./SampleGestures')

    gesname=saveimg[-1]
    if(len(gesname)>=1):
        img_name = "./SampleGestures/"+str(gesname).format(str(gesname))
        save_img = cv2.resize(mask, (image_x, image_y))
        cv2.imwrite(img_name, save_img)

```



```

def controlTimer(self):
    # if timer is stopped
    self.timer.isActive()
    # create video capture
    self.cam = cv2.VideoCapture(0)
    # start timer
    self.timer.start(20)

def predictor():
    """ Depending on model loaded and customgesture saved prediction is made by
    checking array or through SiFt algo"""
    import numpy as np
    from keras.preprocessing import image
    test_image = image.load_img('1.png', target_size=(64, 64))
    test_image = image.img_to_array(test_image)
    test_image = np.expand_dims(test_image, axis = 0)
    result = classifier.predict(test_image)
    gesname=''
    fileEntry=fileSearch()
    for i in range(len(fileEntry)):
        image_to_compare = cv2.imread("./SampleGestures/"+fileEntry[i])
        original = cv2.imread("1.png")
        sift = cv2.xfeatures2d.SIFT_create()
        kp_1, desc_1 = sift.detectAndCompute(original, None)
        kp_2, desc_2 = sift.detectAndCompute(image_to_compare, None)

        index_params = dict(algorithm=0, trees=5)
        search_params = dict()
        flann = cv2.FlannBasedMatcher(index_params, search_params)

        matches = flann.knnMatch(desc_1, desc_2, k=2)

        good_points = []
        ratio = 0.6
        for m, n in matches:
            if m.distance < ratio*n.distance:
                good_points.append(m)
        if(abs(len(good_points)+len(matches))>20):
            #goodpoints and matcches sum from 1.png and customgestureimages
            #is grater than 20
            gesname=fileEntry[i]
            gesname=gesname.replace('.png','')
            if(gesname=='sp'):
                #sp is replaced with <space>
                gesname=' '
            return gesname

    if result[0][0] == 1:
        return 'A'
    elif result[0][1] == 1:
        return 'B'
    elif result[0][2] == 1:
        return 'C'
    elif result[0][3] == 1:
        return 'D'
    elif result[0][4] == 1:
        return 'E'
    elif result[0][5] == 1:
        return 'F'
    elif result[0][6] == 1:
        return 'G'
    elif result[0][7] == 1:
        return 'H'
    elif result[0][8] == 1:
        return 'I'
    elif result[0][9] == 1:
        return 'J'
    elif result[0][10] == 1:
        return 'K'
    elif result[0][11] == 1:
        return 'L'
    elif result[0][12] == 1:
        return 'M'
    elif result[0][13] == 1:
        return 'N'

```

```

elif result[0][14] == 1:
    return 'O'
elif result[0][15] == 1:
    return 'P'
elif result[0][16] == 1:
    return 'Q'
elif result[0][17] == 1:
    return 'R'
elif result[0][18] == 1:
    return 'S'
elif result[0][19] == 1:
    return 'T'
elif result[0][20] == 1:
    return 'U'
elif result[0][21] == 1:
    return 'V'
elif result[0][22] == 1:
    return 'W'
elif result[0][23] == 1:
    return 'X'
elif result[0][24] == 1:
    return 'Y'
elif result[0][25] == 1:
    return 'Z'

def checkFile():
    """retrieve the content of temp.txt for export module """
    checkfile=os.path.isfile('temp.txt')
    if(checkfile==True):
        fr=open("temp.txt","r")
        content=fr.read()
        fr.close()
    else:
        content="No Content Available"
    return content

class Dashboard(QtWidgets.QMainWindow):

    def __init__(self):
        super(Dashboard, self).__init__()
        self.setWindowFlags(QtCore.Qt.WindowCloseButtonHint |
QtCore.Qt.WindowMinimizeButtonHint | QtCore.Qt.FramelessWindowHint)
        cap = cv2.VideoCapture('gestfinal2.min.mp4')

        # Read until video is completed
        while(cap.isOpened()):
            ret, frame = cap.read()
            if ret == True:
                # Capture frame-by-frame
                ret, frame = cap.read()
                cv2.namedWindow("mask", cv2.WINDOW_NORMAL)
                cv2.imshow("mask", frame)

                cv2.setWindowProperty("mask",cv2.WND_PROP_FULLSCREEN,cv2.W
INDOW_FULLSCREEN)
                cv2.resizeWindow("mask",720,400)
                cv2.moveWindow("mask", 320,220)

                if cv2.waitKey(25) & 0xFF == ord('q'):
                    break

            else:
                break

        # When everything done, release
        cap.release()

        # Closes all the frames
        cv2.destroyAllWindows()
        self.setWindowIcon(QtGui.QIcon('icons/windowLogo.png'))
        self.title = 'Sign language Recognition'
        uic.loadUi('UI_Files/dash.ui', self)
        self.setWindowTitle(self.title)
        self.timer = QTimer()
        self.create.clicked.connect(self.createGest)

```

```

self.exp2.clicked.connect(self.exportFile)
self.scan_sen.clicked.connect(self.scanSent)
if(self.scan_sinlge.clicked.connect(self.scanSingle)==True):
    self.timer.timeout.connect(self.scanSingle)
self.create.setCursor(QtGui.QCursor(QtCore.Qt.PointingHandCursor))
self.scan_sen.setCursor(QtGui.QCursor(QtCore.Qt.PointingHandCursor))
self.scan_sinlge.setCursor(QtGui.QCursor(QtCore.Qt.PointingHandCursor))
self.exp2.setCursor(QtGui.QCursor(QtCore.Qt.PointingHandCursor))
self.exit_button.clicked.connect(self.quitApplication)
self._layout = self.layout()
self.label_3 = QtWidgets.QLabel()
movie = QtGui.QMovie("icons/dashAnimation.gif")
self.label_3.setMovie(movie)
self.label_3.setGeometry(0,160,780,441)
movie.start()
self._layout.addWidget(self.label_3)
self.setObjectName('Message_Window')

def quitApplication(self):

    """shutdown the GUI window along with removal of files"""
    userReply = QMessageBox.question(self, 'Quit Application', "Are you sure
    you want to quit this app?", QMessageBox.Yes | QMessageBox.No,
    QMessageBox.No)
    if userReply == QMessageBox.Yes:
        removeFile()
        keyboard.press_and_release('alt+F4')

def createGest(self):

    """ Custom gesture generation module"""
    try:
        clearfunc(self.cam)
    except:
        pass
    gesname=""
    uic.loadUi('UI_Files/create_gest.ui', self)
    self.setWindowTitle(self.title)
    self.create.clicked.connect(self.createGest)
    self.exp2.clicked.connect(self.exportFile)
    if(self.scan_sen.clicked.connect(self.scanSent)):
        controlTimer(self)
    self.scan_sinlge.clicked.connect(self.scanSingle)
    self.linkButton.clicked.connect(openimg)
    self.create.setCursor(QtGui.QCursor(QtCore.Qt.PointingHandCursor))
    self.scan_sen.setCursor(QtGui.QCursor(QtCore.Qt.PointingHandCursor))
    self.scan_sinlge.setCursor(QtGui.QCursor(QtCore.Qt.PointingHandCursor))
    self.exp2.setCursor(QtGui.QCursor(QtCore.Qt.PointingHandCursor))
    self.pushButton_2.clicked.connect(lambda:clearfunc(self.cam))
    try:
        self.exit_button.clicked.connect(lambda:clearfunc(self.cam))
    except:
        pass
    self.exit_button.clicked.connect(self.quitApplication)
    self.plainTextEdit.setPlaceholderText("Enter Gesture Name Here")
    img_text = ''
    saveimg=[]
    while True:
        ret, frame = self.cam.read()
        frame = cv2.flip(frame,1)
        try:
            frame=cv2.resize(frame, (321,270))
            frame = cv2.cvtColor(frame, cv2.COLOR_BGR2RGB)
            img2 = cv2.rectangle(frame, (150,50),(300,200), (0,255,0),
            thickness=2, lineType=8, shift=0)
        except:
            keyboard.press_and_release('esc')

        height2, width2, channel2 = img2.shape
        step2 = channel2 * width2
        # create QImage from image
        qImg2 = QImage(img2.data, width2, height2, step2,
        QImage.Format_RGB888)
        # show image in img_label
        try:

```

```

        self.label_3.setPixmap(QPixmap.fromImage(qImg2))
        slider2=self.trackbar.value()
    except:
        pass

    lower_blue = np.array([0, 0, 0])
    upper_blue = np.array([179, 255, slider2])
    imcrop = img2[52:198, 152:298]
    hsv = cv2.cvtColor(imcrop, cv2.COLOR_BGR2HSV)
    mask = cv2.inRange(hsv, lower_blue, upper_blue)

    cv2.namedWindow("mask", cv2.WINDOW_NORMAL )
    cv2.imshow("mask", mask)

    cv2.setWindowProperty("mask",cv2.WND_PROP_FULLSCREEN,cv2.WINDOW_FULLSCREEN)
    cv2.resizeWindow("mask",170,160)
    cv2.moveWindow("mask", 766,271)

    hwnd = winGuiAuto.findTopWindow("mask")
    win32gui.SetWindowPos(hwnd, win32con.HWND_TOP,
    0,0,0,0,win32con.SWP_NOMOVE | win32con.SWP_NOSIZE |
    win32con.SWP_NOACTIVATE)

    try:
        ges_name = self.plainTextEdit.toPlainText()
    except:
        pass
    if(len(ges_name)>=1):
        saveimg.append(ges_name)
    else:
        saveimg.append(ges_name)
        ges_name=''

    try:
        self.pushButton.clicked.connect(lambda:capture_images(self
        ,self.cam,saveimg,mask))
    except:
        pass

    gesname=saveimg[-1]

    if keyboard.is_pressed('shift+s'):
        if not os.path.exists('./SampleGestures'):
            os.mkdir('./SampleGestures')
        if(len(gesname)>=1):
            img_name =
            "./SampleGestures/"+str(gesname)+".png".format(str(gesname))
            save_img = cv2.resize(mask, (image_x, image_y))
            cv2.imwrite(img_name, save_img)
        break

    if cv2.waitKey(1) == 27:
        break

    self.cam.release()
    cv2.destroyAllWindows()

    if os.path.exists("./SampleGestures/"+str(gesname)+".png"):
        QtWidgets.QMessageBox.about(self, "Success", "Gesture Saved
        Successfully!")

def exportFile(self):

    """export file module with tts assistance and gesturre viewer"""
    try:
        clearfunc2(self.cam)
    except:
        pass
    uic.loadUi('UI_Files/export.ui', self)
    self.setWindowTitle(self.title)
    self.create.clicked.connect(self.createGest)
    self.exp2.clicked.connect(self.exportFile)
    self.scan_sen.clicked.connect(self.scanSent)
    self.scan_singlge.clicked.connect(self.scanSingle)
    self.create.setCursor(QtGui.QCursor(QtCore.Qt.PointingHandCursor))

```

```

self.scan_sen.setCursor(QtGui.QCursor(QtCore.Qt.PointingHandCursor))
self.scan_singlge.setCursor(QtGui.QCursor(QtCore.Qt.PointingHandCursor))
self.exp2.setCursor(QtGui.QCursor(QtCore.Qt.PointingHandCursor))
self.exit_button.clicked.connect(self.quitApplication)
content=checkFile()
self.textBrowser_98.setText(" "+content)
engine.say(str(content).lower())
try:
    engine.runAndWait()
except:
    pass
if(content=="File Not Found"):
    self.pushButton_2.setEnabled(False)
    self.pushButton_3.setEnabled(False)
else:
    self.pushButton_2.clicked.connect(self.on_click)
    try:
        self.pushButton_3.clicked.connect(self.gestureViewer)
    except:
        pass

def on_click(self):

    """Opens tkinter window to save file at desired location """
    content=checkFile()
    root=Tk()
    root.withdraw()
    root.filename = filedialog.asksaveasfilename(initialdir = "/",title =
    "Select file",filetypes = (("Text files","*.txt"),("all files","*.*")))
    name=root.filename
    #fr.close()
    fw=open(name+".txt","w")
    if(content=='No Content Available'):
        content=" "
    fw.write(content)
    try:
        os.remove("temp.txt")
        shutil.rmtree("TempGest")
    except:
        QtWidgets.QMessageBox.about(self, "Information", "Nothing to
        export")
    fw.close()
    root.destroy()

    if not os.path.exists('temp.txt'):
        if os.path.exists('.txt'):
            os.remove('.txt')
        else:
            QtWidgets.QMessageBox.about(self, "Information", "File
            saved successfully!")
            self.textBrowser_98.setText(" ")

def gestureViewer(self):

    """gesture viewer through matplotlib """
    try:
        img=load_images_from_folder('TempGest/')
        plt.imshow(img[index])
    except:
        plt.text(0.5, 0.5, 'No new Gesture Available',
        horizontalalignment='center',verticalalignment='center')
        axcut = plt.axes([0.9, 0.0, 0.1, 0.075])
        axcut1 = plt.axes([0.0, 0.0, 0.1, 0.075])
        bcut = Button(axcut, 'Next', color='dodgerblue', hovercolor='lightgreen')
        bcut1 = Button(axcut1, 'Previous', color='dodgerblue',
        hovercolor='lightgreen')

        #plt.connect('button_press_event', toggle_imagesfwd)
        bcut.on_clicked(toggle_imagesfwd)
        bcut1.on_clicked(toggle_imagesrev)
        plt.show()
        axcut._button = bcut #creating a reference for that element
        axcut1._button1 = bcut1

```

```

def scanSent(self):

    """sentence formation module """
    try:
        clearfunc(self.cam)
    except:
        pass
    uic.loadUi('UI_Files/scan_sent.ui', self)
    self.setWindowTitle(self.title)
    self.create.clicked.connect(self.createGest)
    self.exp2.clicked.connect(self.exportFile)
    if(self.scan_sen.clicked.connect(self.scanSent)):
        controlTimer(self)
    self.scan_sinlge.clicked.connect(self.scanSingle)
    try:
        self.pushButton_2.clicked.connect(lambda:clearfunc(self.cam))
    except:
        pass
    self.linkButton.clicked.connect(openimg)
    self.create.setCursor(QtGui.QCursor(QtCore.Qt.PointingHandCursor))
    self.scan_sen.setCursor(QtGui.QCursor(QtCore.Qt.PointingHandCursor))
    self.scan_sinlge.setCursor(QtGui.QCursor(QtCore.Qt.PointingHandCursor))
    self.exp2.setCursor(QtGui.QCursor(QtCore.Qt.PointingHandCursor))
    try:
        self.exit_button.clicked.connect(lambda:clearfunc(self.cam))
    except:
        pass
    self.exit_button.clicked.connect(self.quitApplication)
    img_text = ''
    append_text=''
    new_text=''
    finalBuffer=[]
    counts=0
    while True:
        ret, frame =self.cam.read()
        frame = cv2.flip(frame,1)
        try:
            frame=cv2.resize(frame, (331,310))

            frame = cv2.cvtColor(frame, cv2.COLOR_BGR2RGB)
            img = cv2.rectangle(frame, (150,50), (300,200), (0,255,0),
            thickness=2, lineType=8, shift=0)

        except:
            keyboard.press_and_release('esc')
            keyboard.press_and_release('esc')

        height, width, channel = img.shape
        step = channel * width
        # create QImage from image
        qImg = QImage(img.data, width, height, step,
        QImage.Format_RGB888)
        # show image in img_label
        try:
            self.label_3.setPixmap(QPixmap.fromImage(qImg))
            slider=self.trackbar.value()
        except:
            pass

        lower_blue = np.array([0, 0, 0])
        upper_blue = np.array([179, 255, slider])
        imcrop = img[52:198, 152:298]
        hsv = cv2.cvtColor(imcrop, cv2.COLOR_BGR2HSV)
        mask1 = cv2.inRange(hsv, lower_blue, upper_blue)

        cv2.namedWindow("mask", cv2.WINDOW_NORMAL )
        cv2.imshow("mask", mask1)

        cv2.setWindowProperty("mask",cv2.WND_PROP_FULLSCREEN,cv2.WINDOW_F
        ULLSCREEN)
        cv2.resizeWindow("mask",118,108)
        cv2.moveWindow("mask", 905,271)

        hwnid = winGuiAuto.findTopWindow("mask")

```

```

win32gui.SetWindowPos(hwnd, win32con.HWND_TOP,
0,0,0,0,win32con.SWP_NOMOVE | win32con.SWP_NOSIZE |
win32con.SWP_NOACTIVATE)

try:
    self.textBrowser.setText("\n          "+str(img_text))
except:
    pass
img_name = "1.png"
save_img = cv2.resize(mask1, (image_x, image_y))
cv2.imwrite(img_name, save_img)
img_text=predictor()
if cv2.waitKey(1) == ord('c'):
    try:
        counts+=1
        append_text+=img_text
        new_text+=img_text
        if not os.path.exists('./TempGest'):
            os.mkdir('./TempGest')
        img_names =
        ".\\TempGest\\"+"{}{}.png".format(str(counts)
        ,str(img_text))
        save_imgs = cv2.resize(mask1, (image_x,
        image_y))
        cv2.imwrite(img_names, save_imgs)
        self.textBrowser_4.setText(new_text)
    except:
        append_text+=' '

        if(len(append_text)>1):
            finalBuffer.append(append_text)
            append_text=''
        else:
            finalBuffer.append(append_text)
            append_text=''

try:
    self.pushButton.clicked.connect(lambda:saveBuff(self,self.
cam,finalBuffer))
except:
    pass
if cv2.waitKey(1) == 27:
    break

if keyboard.is_pressed('shift+s'):
    if(len(finalBuffer)>=1):
        f=open("temp.txt","w")
        for i in finalBuffer:
            f.write(i)
        f.close()
    break

self.cam.release()
cv2.destroyAllWindows()

if os.path.exists('temp.txt'):
    QtWidgets.QMessageBox.about(self, "Information", "File is
temporarily saved ... you can now proceed to export")
try:
    self.textBrowser.setText("          ")
except:
    pass

def scanSingle(self):

    """Single gesture scanner """
    try:
        clearfunc(self.cam)
    except:
        pass
    uic.loadUi('UI_Files/scan_single.ui', self)
    self.setWindowTitle(self.title)
    self.create.clicked.connect(self.createGest)
    self.exp2.clicked.connect(self.exportFile)
    self.scan_sen.clicked.connect(self.scanSent)

```

```

        if(self.scan_singlge.clicked.connect(self.scanSingle)):
            controlTimer(self)
        self.pushButton_2.clicked.connect(lambda:clearfunc(self.cam))
        self.linkButton.clicked.connect(openimg)
        self.create.setCursor(QtGui.QCursor(QtCore.Qt.PointingHandCursor))
        self.scan_sen.setCursor(QtGui.QCursor(QtCore.Qt.PointingHandCursor))
        self.scan_singlge.setCursor(QtGui.QCursor(QtCore.Qt.PointingHandCursor))
        self.exp2.setCursor(QtGui.QCursor(QtCore.Qt.PointingHandCursor))
        try:
            self.exit_button.clicked.connect(lambda:clearfunc(self.cam))
        except:
            pass
        self.exit_button.clicked.connect(self.quitApplication)
        img_text = ''
        while True:
            ret, frame = self.cam.read()
            frame = cv2.flip(frame,1)
            try:
                frame=cv2.resize(frame, (321,270))
                frame = cv2.cvtColor(frame, cv2.COLOR_BGR2RGB)
                img1 = cv2.rectangle(frame, (150,50),(300,200), (0,255,0),
                thickness=2, lineType=8, shift=0)
            except:
                keyboard.press_and_release('esc')

            height1, width1, channel1 = img1.shape
            step1 = channel1 * width1
            # create QImage from image
            qImg1 = QImage(img1.data, width1, height1, step1,
            QImage.Format_RGB888)
            # show image in img_label
            try:
                self.label_3.setPixmap(QPixmap.fromImage(qImg1))
                slider1=self.trackbar.value()
            except:
                pass

            lower_blue = np.array([0, 0, 0])
            upper_blue = np.array([179, 255, slider1])

            imcrop = img1[52:198, 152:298]
            hsv = cv2.cvtColor(imcrop, cv2.COLOR_BGR2HSV)
            mask = cv2.inRange(hsv, lower_blue, upper_blue)

            cv2.namedWindow("mask", cv2.WINDOW_NORMAL )
            cv2.imshow("mask", mask)

            cv2.setWindowProperty("mask",cv2.WND_PROP_FULLSCREEN,cv2.WINDOW_F
            ULLSCREEN)
            cv2.resizeWindow("mask",118,108)
            cv2.moveWindow("mask", 894,271)

            hwnd = winGuiAuto.findTopWindow("mask")
            win32gui.SetWindowPos(hwnd, win32con.HWND_TOP,
            0,0,0,0,win32con.SWP_NOMOVE | win32con.SWP_NOSIZE |
            win32con.SWP_NOACTIVATE)

            try:
                self.textBrowser.setText("\n\n\t"+str(img_text))
            except:
                pass

            img_name = "1.png"
            save_img = cv2.resize(mask, (image_x, image_y))
            cv2.imwrite(img_name, save_img)
            img_text = predictor()

            if cv2.waitKey(1) == 27:
                break

        self.cam.release()
        cv2.destroyAllWindows()

app = QtWidgets.QApplication([])
win = Dashboard()
win.show()
sys.exit(app.exec())

```


4.2 SCREENSHOTS

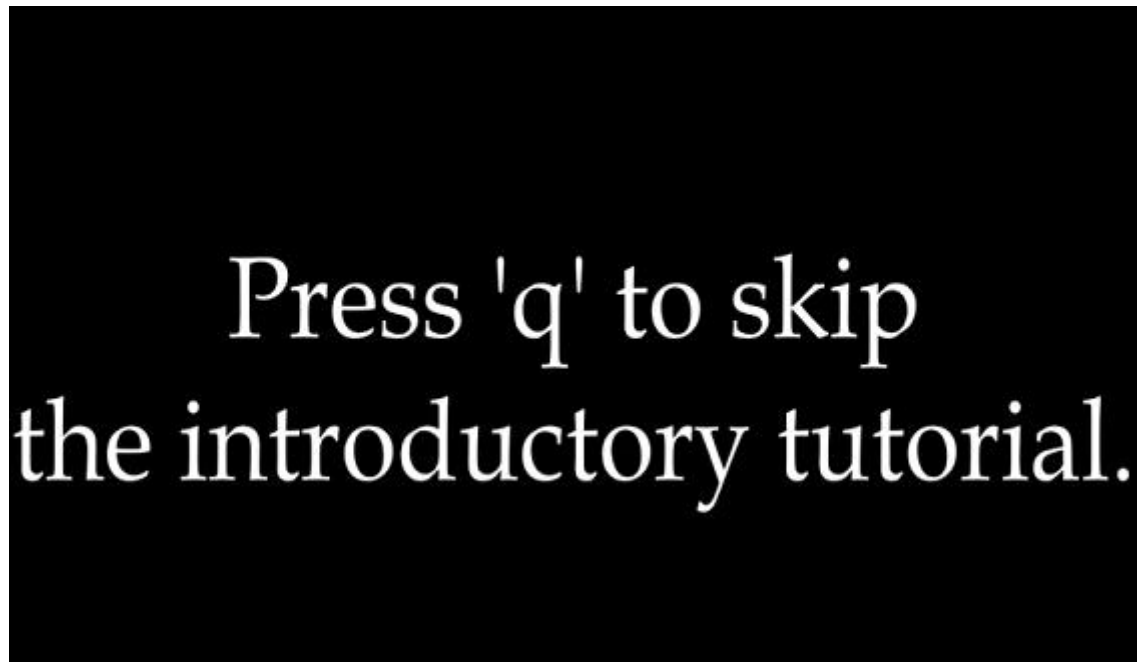


Fig 4.2.1: Skip Video.



Fig 4.2.2: Dashboard with Sample Gesture Animation.



Fig 4.2.3: Single Gesture.



Fig 4.2.4: Adjusting Camera Light as Needed.

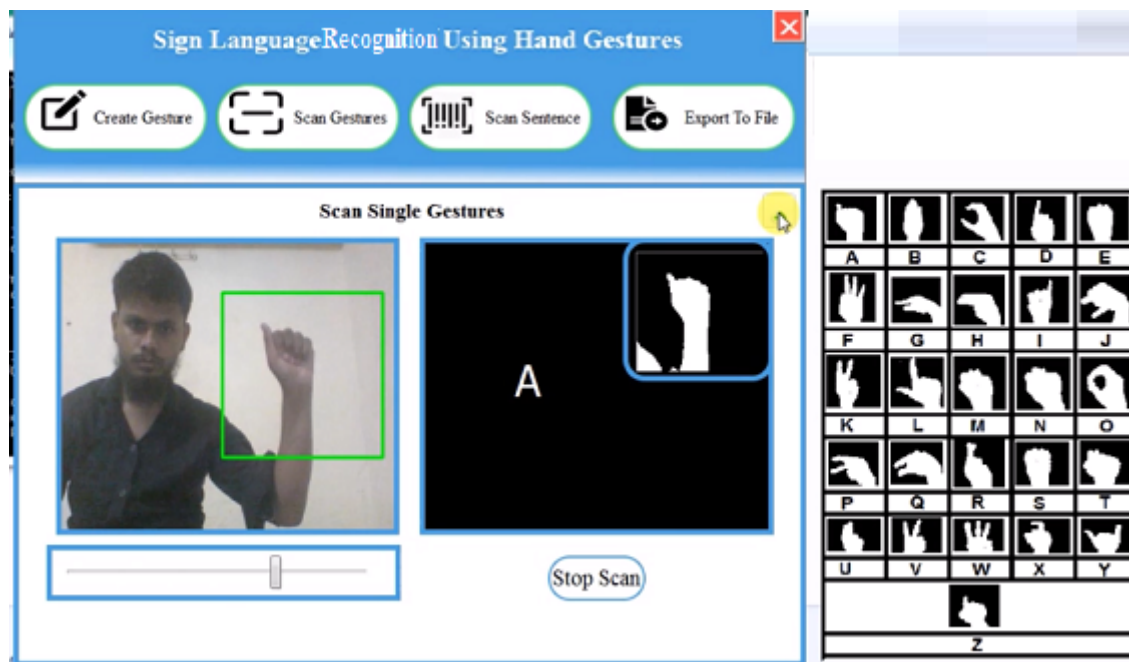


Fig 4.2.5: Placing Hand Inside Rectangle Box.

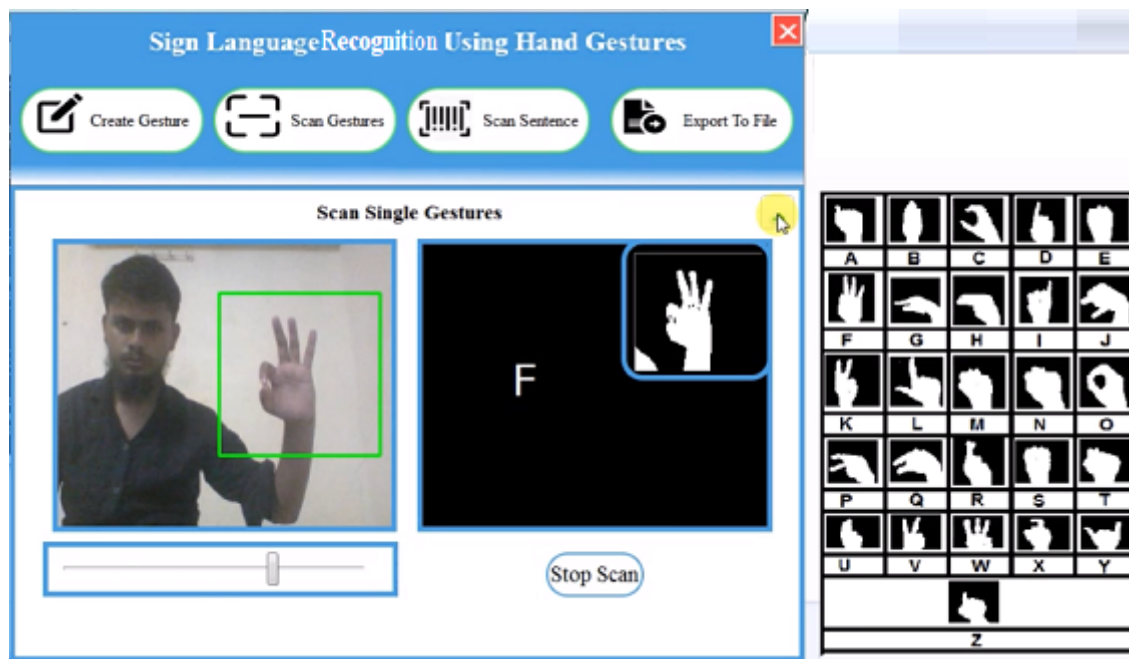


Fig 4.2.6: Single Gesture Output.

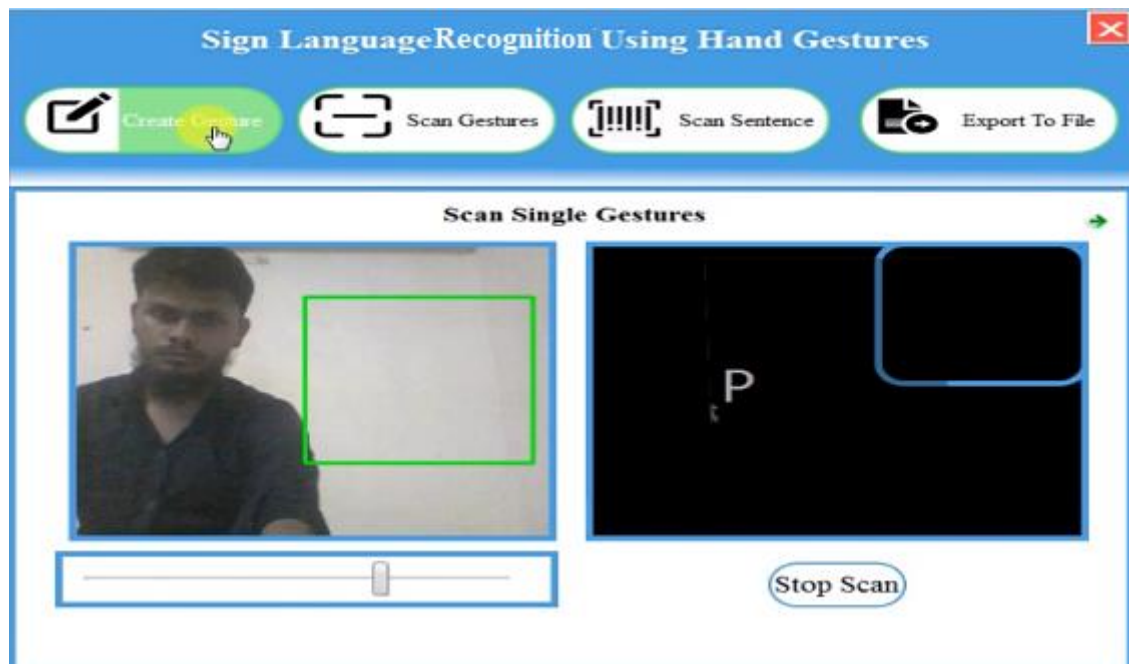


Fig 4.2.7: Custom Gesture Generation.



Fig 4.2.8: Assigning Label to Gesture.



Fig 4.2.9: Gesture Saved Successfully.

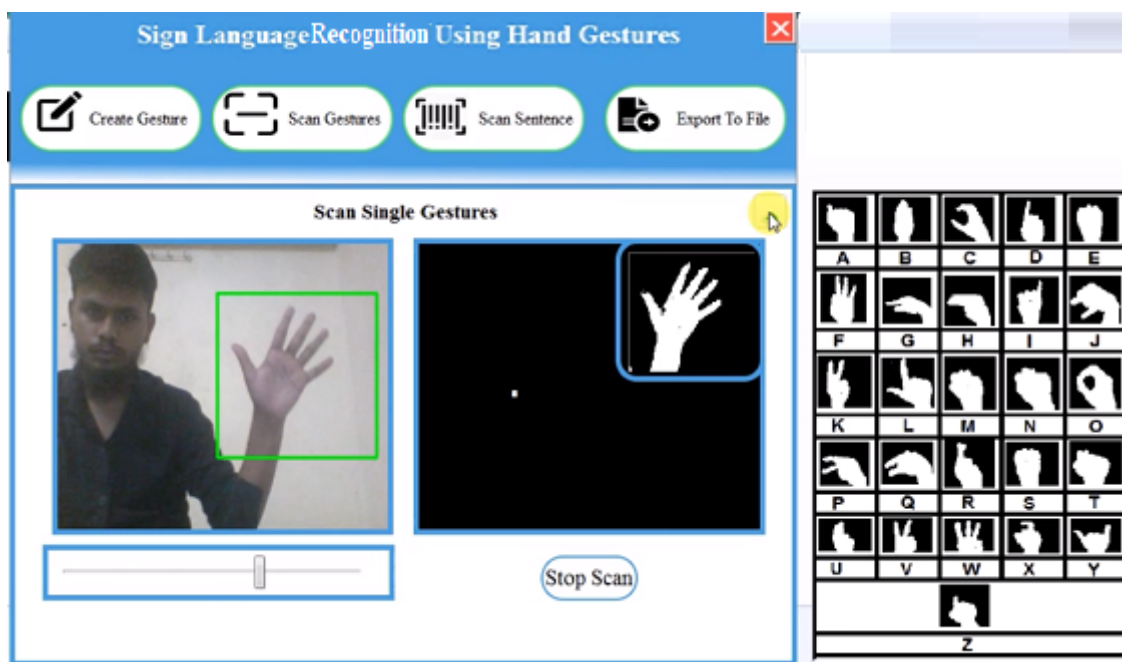


Fig 4.2.10: Scanning & Testing Newly Generated Gesture.

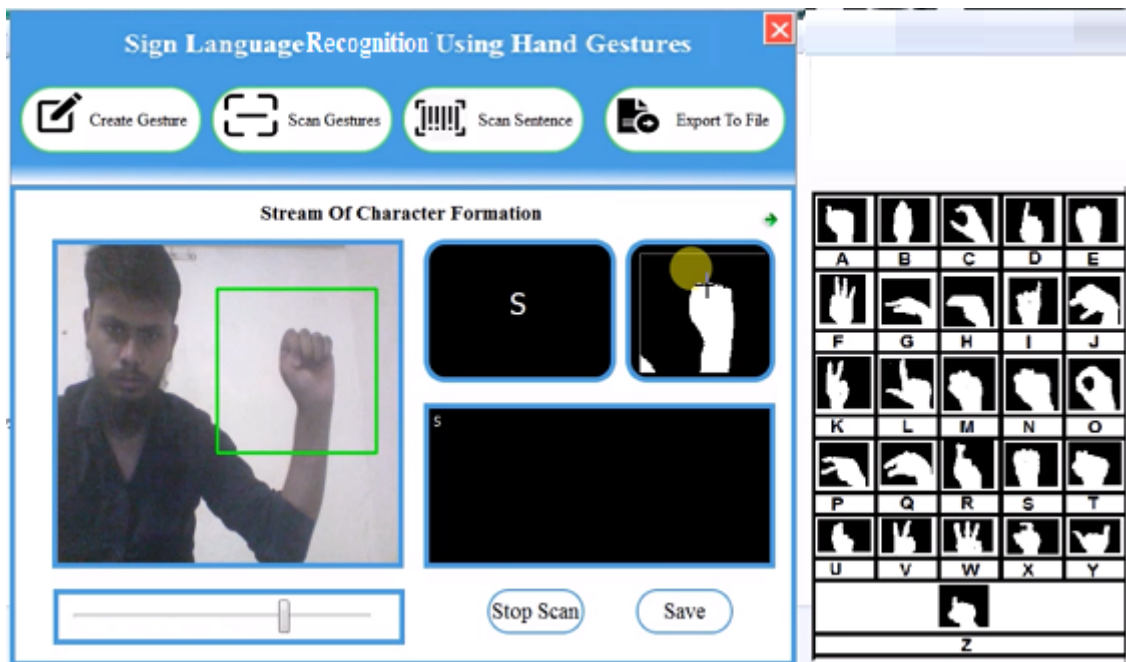


Fig 4.2.11: Sentence Formation, Focusing on The Top Right Window Pressing C to Form Sentence.

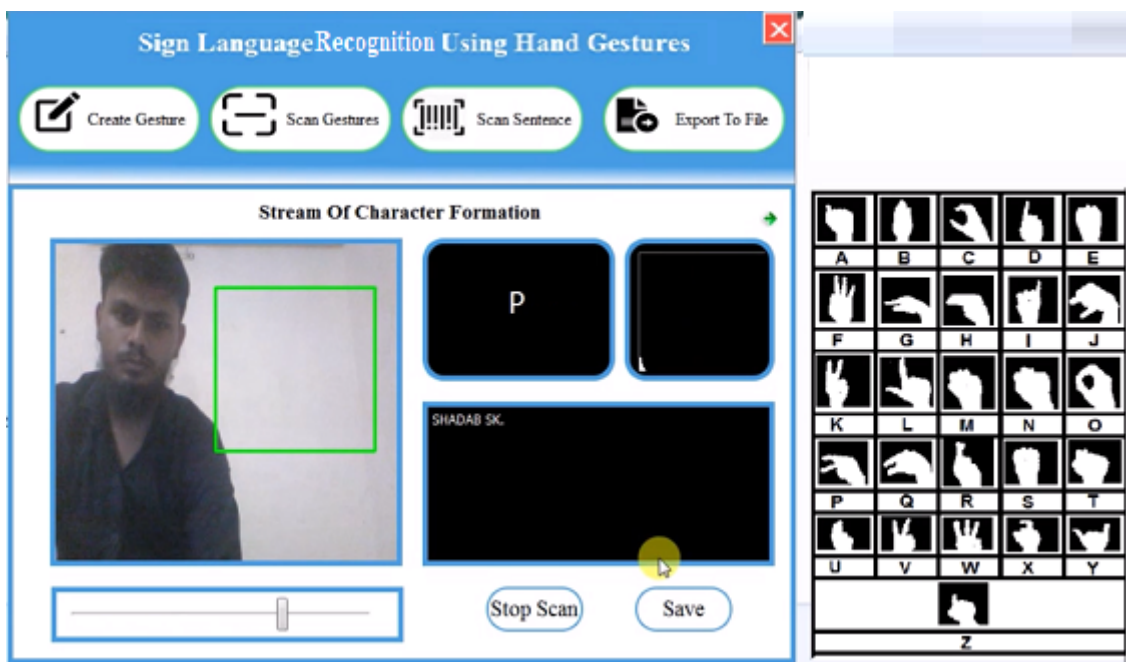


Fig 4.2.12: Sentence Formed.



Fig 4.2.13: Sentence Saved Temporarily.

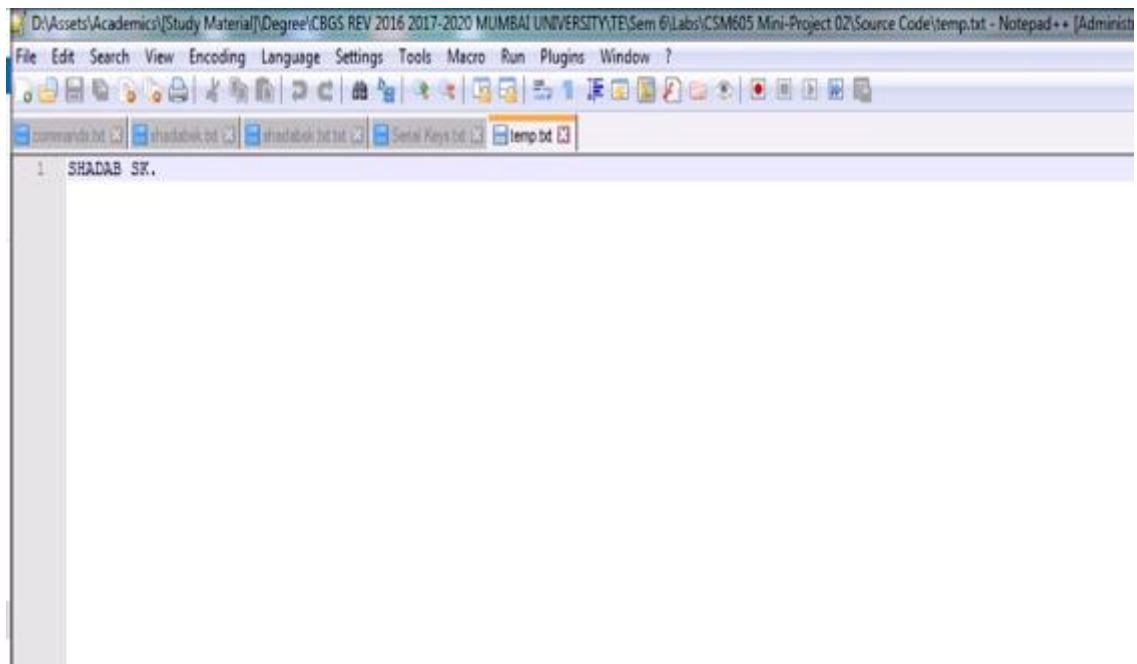


Fig 4.2.14: Content of Newly Generated temp.txt.

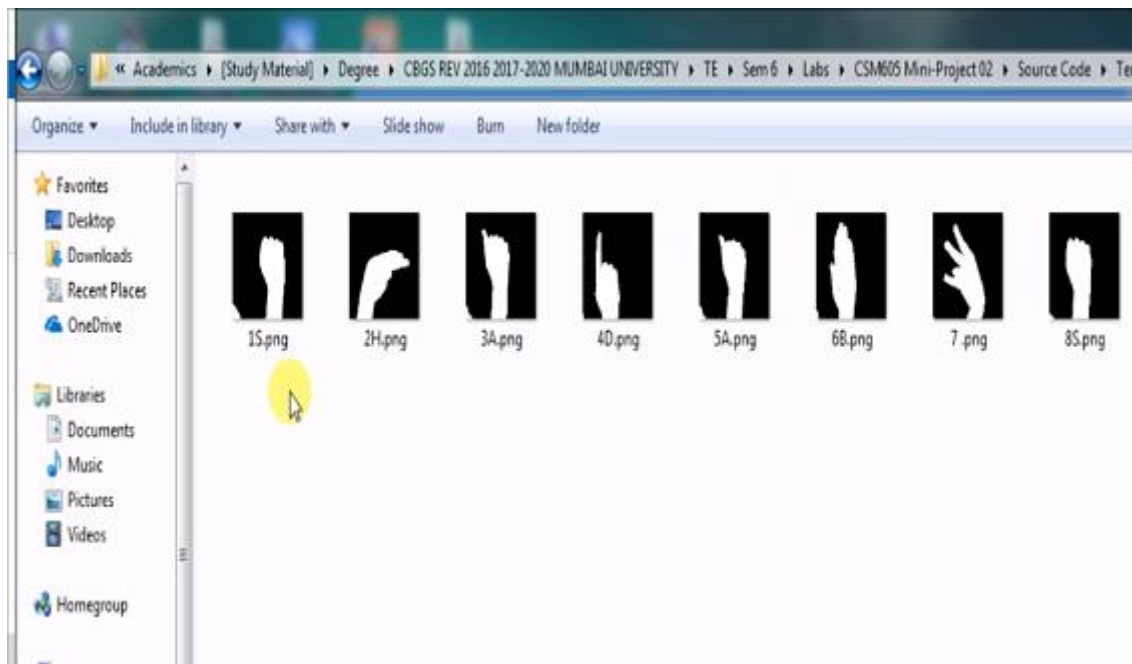


Fig 4.2.15: Content of Newly Generated TempGest Directory.



Fig 4.2.16: Export with TTS Assistance and Gesture Viewer.

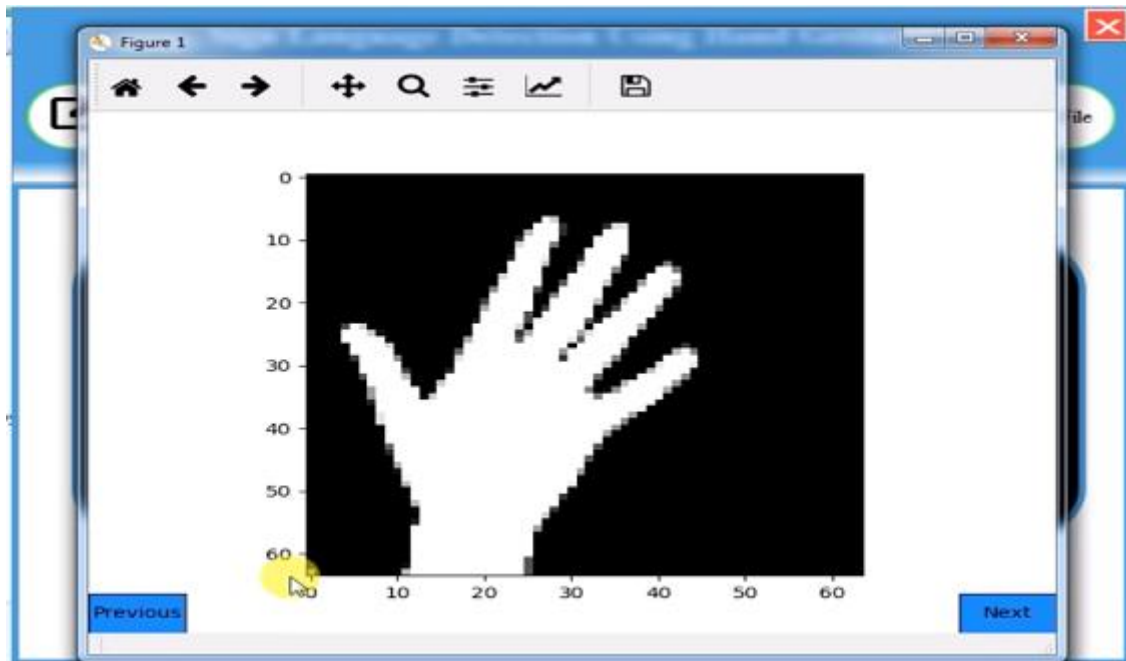


Fig 4.2.17: Gesture Viewer Sample.

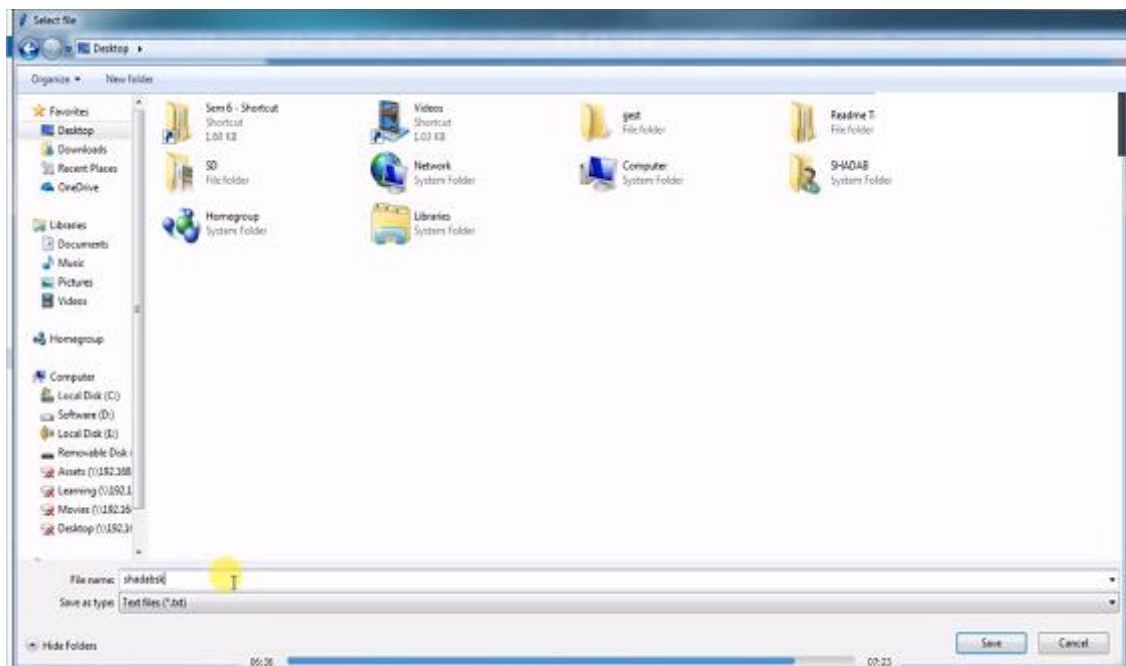


Fig 4.2.18: Exporting the File at Desired Location.



Fig 4.2.19: File Saved Successfully.

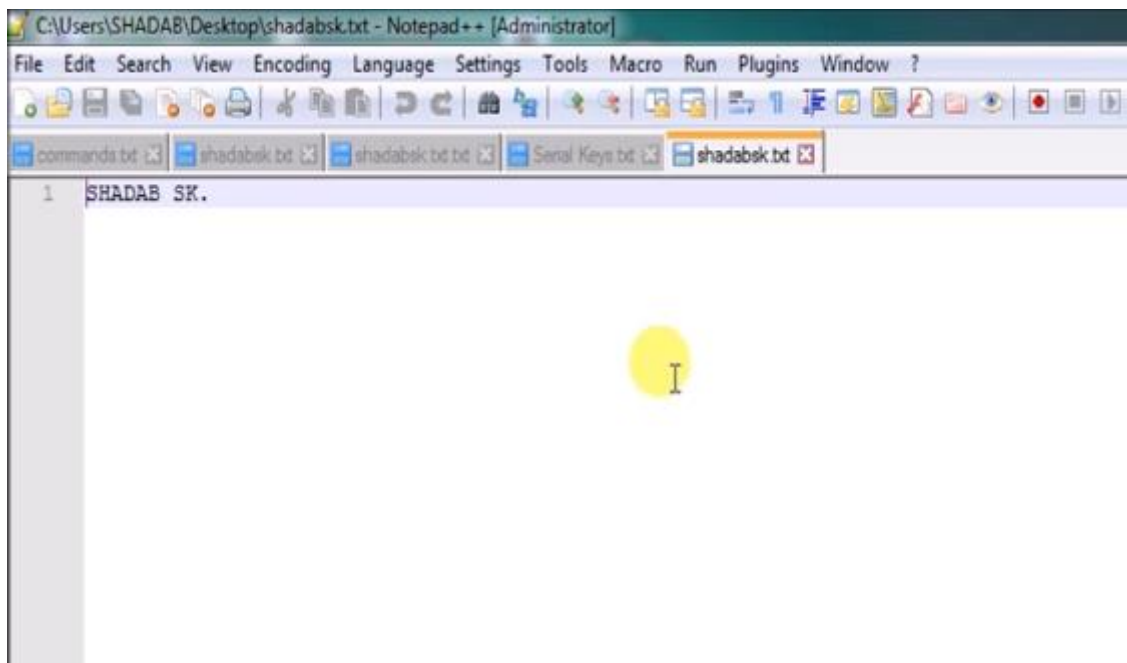


Fig 4.2.20: Content of Newly Saved File.

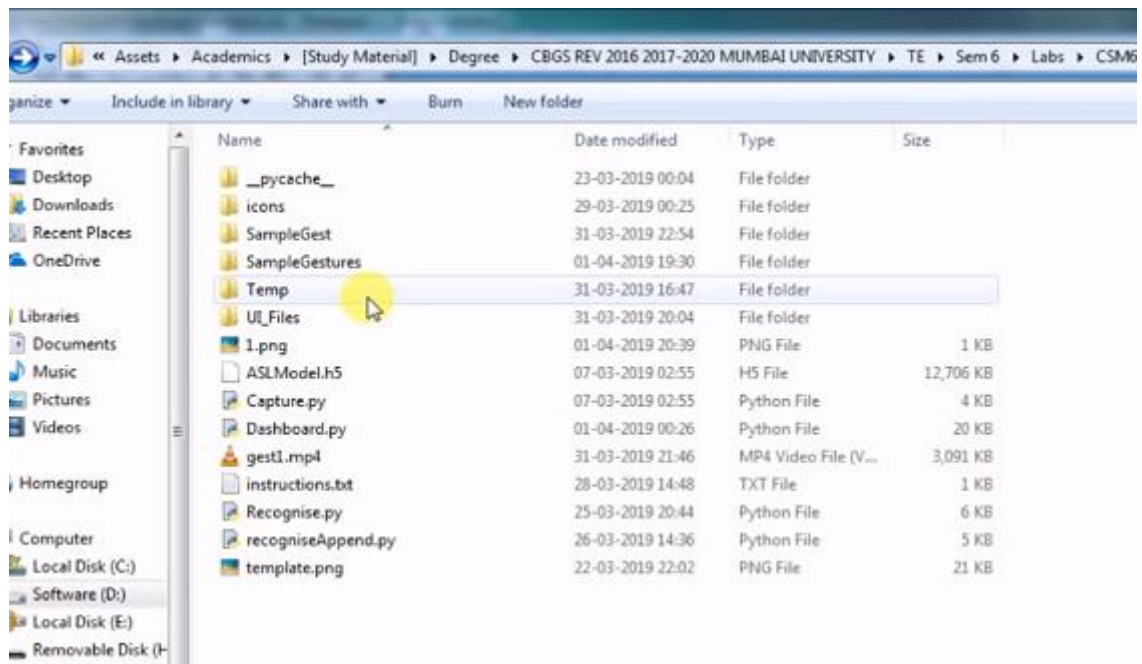


Fig 4.2.21: Temporary Files Deleted.



Fig 4.2.22: No Content Available.



Fig 4.2.23: Quitting the Application.

CHAPTER 5

CONCLUSION

5.1 CONCLUSION

From this project/application we have tried to overshadow some of the major problems faced by the disabled persons in terms of talking. We found out the root cause of why they can't express more freely. The result that we got was the other side of the audience are not able to interpret what these persons are trying to say or what is the message that they want to convey.

Thereby this application serves the person who wants to learn and talk in sign languages. With this application a person will quickly adapt various gestures and their meaning as per ASL standards. They can quickly learn what alphabet is assigned to which gesture. Add-on to this custom gesture facility is also provided along with sentence formation. A user need not be a literate person if they know the action of the gesture, they can quickly form the gesture and appropriate assigned character will be shown onto the screen.

Concerning to the implementation, we have used TensorFlow framework, with keras API. And for the user feasibility complete front-end is designed using PyQt5. Appropriate user-friendly messages are prompted as per the user actions along with what gesture means which character window. Additionally, an export to file module is also provided with TTS(Text-To-Speech) assistance meaning whatever the sentence was formed a user will be able to listen to it and then quickly export along with observing what gesture he/she made during the sentence formation.

5.2 FUTURE SCOPE

- It can be integrated with various search engines and texting application such as google, WhatsApp. So that even the illiterate people could be able to chat with other persons, or query something from web just with the help of gesture.
- This project is working on image currently, further development can lead to detecting the motion of video sequence and assigning it to a meaningful sentence with TTS assistance.

REFERENCES

REFERENCES

- [1] What-are-some-problems-faced-by-deaf-and-dumb-people-while-using-todays-common-tech-like-phones-and-PCs; Shobhit Agarwal, <http://bigdata-madesimple.com/14-useful-applications-of-data>, [Accessed April 06, 2019].
- [2] american-sign-language; NIDCD, <https://www.nidcd.nih.gov/health/american-sign-language> [Accessed April 06, 2019].
- [3] Sign_Language_Recognition_Application_Systems_for_Deaf-Mute_People_A_Review_Based_on_Input-Process-Output; Suharjito MT, https://www.academia.edu/35314119/Sign_Language_Recognition_Application_Systems_for_Deaf-Mute_People_A_Review_Based_on_Input-Process-Output [Accessed April 06, 2019].
- [4] Sign Language Translation via Image Processing; M. Ibrahim, <https://www.kics.edu.pk/project/startup/203> [Accessed April 06, 2019].
- [5] american-sign-language/community-and-culture-frequently-asked-questions/; nad, <https://www.nad.org/resources/american-sign-language/community-and-culture-frequently-asked-questions/> [Accessed April 06, 2019].
- [6] Indian Sign Language Character Recognition; Sanil Jain; K.V.Sameer Raja, https://cse.iitk.ac.in/users/cs365/2015/_submissions/vinsam/report.pdf [Accessed April 06, 2019].

APPENDICES

APPENDIX A: MANAGING VERSIONS OF THE APP USING GITHUB SCM TOOL.

Repository URL - <https://github.com/shadabsk/Sign-Language-Recognition-Using-Hand-Gestures-Keras-PyQT5-OpenCV>

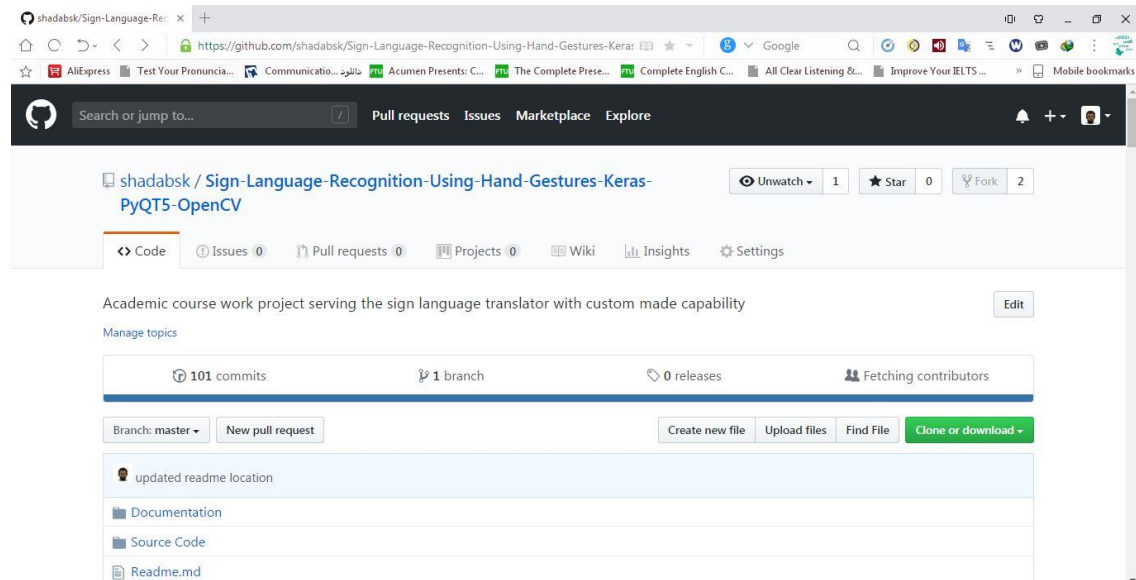


Fig 5.1: Repository overview.

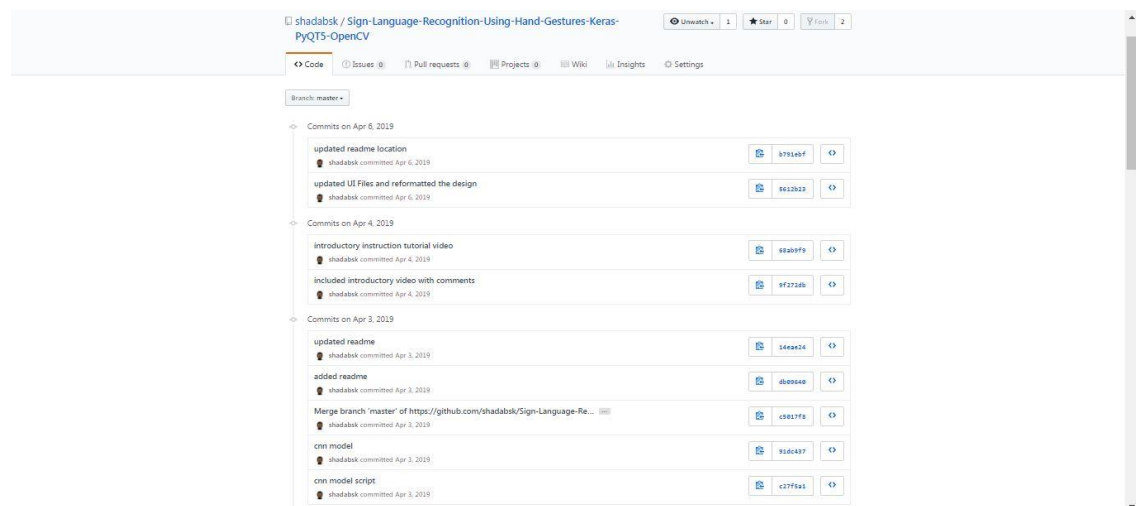


Fig 5.2: Master branch commit history.

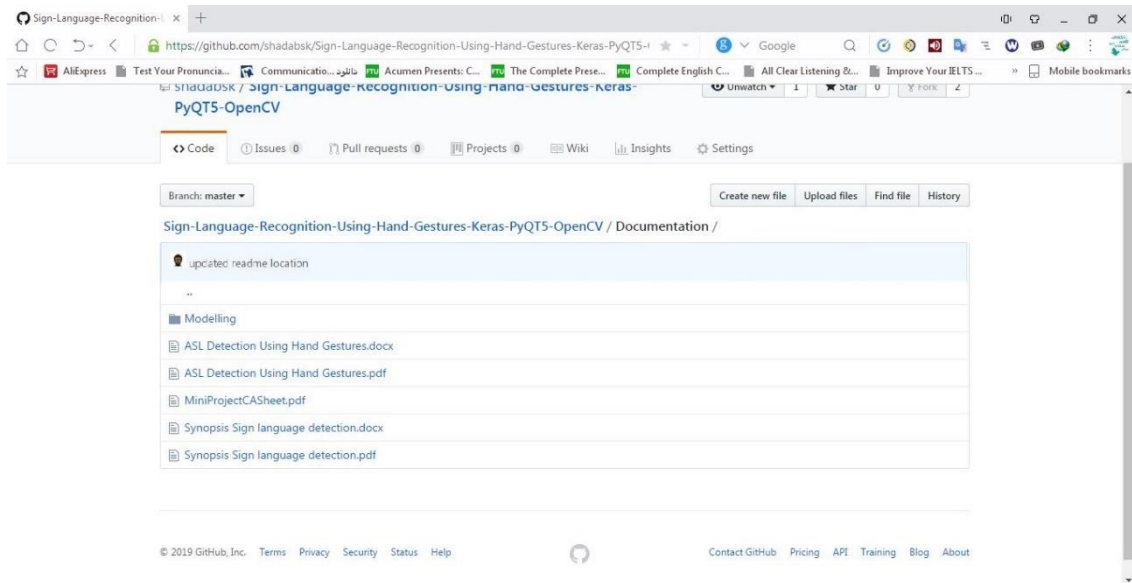


Fig 5.3: Documentation section.

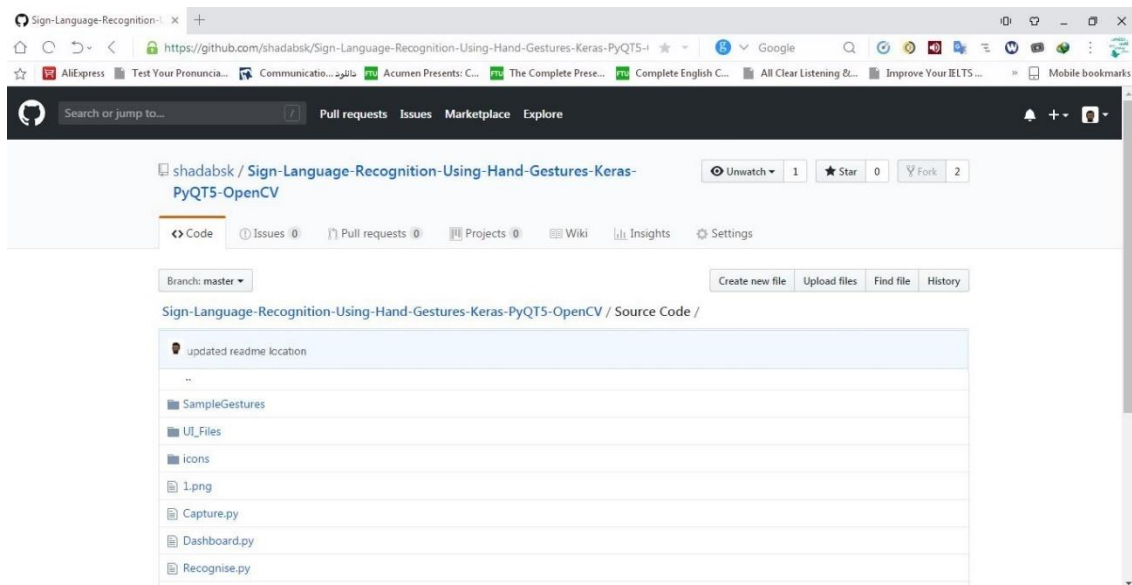


Fig 5.4: Source code section.

APPENDIX B: SCHEDULING THE PROJECT USING AGILE SCRUM METHODOLOGY WITH ONLINE TRELLO PLATFORM

Board URL - <https://trello.com/b/Ch19Fm8W/sign-language-detection-using-hand-gestures>

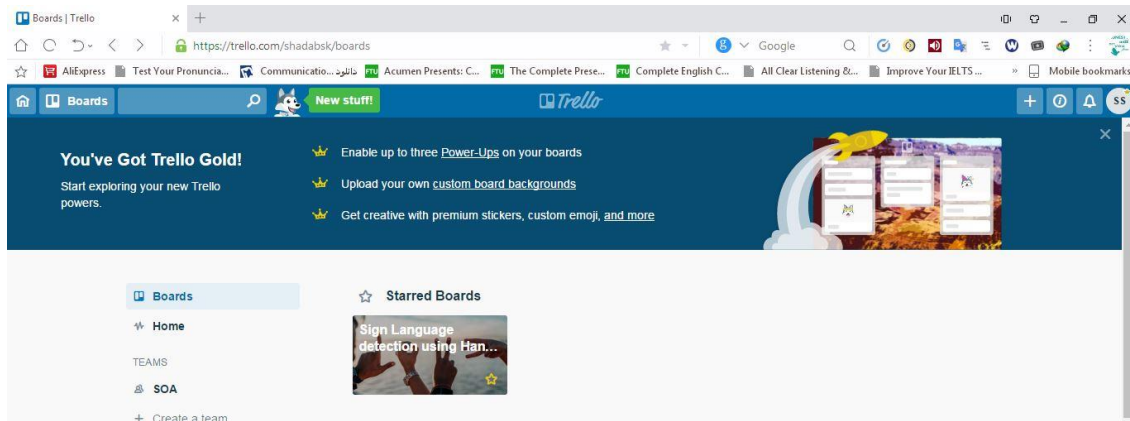


Fig 6.1: Billboard view.

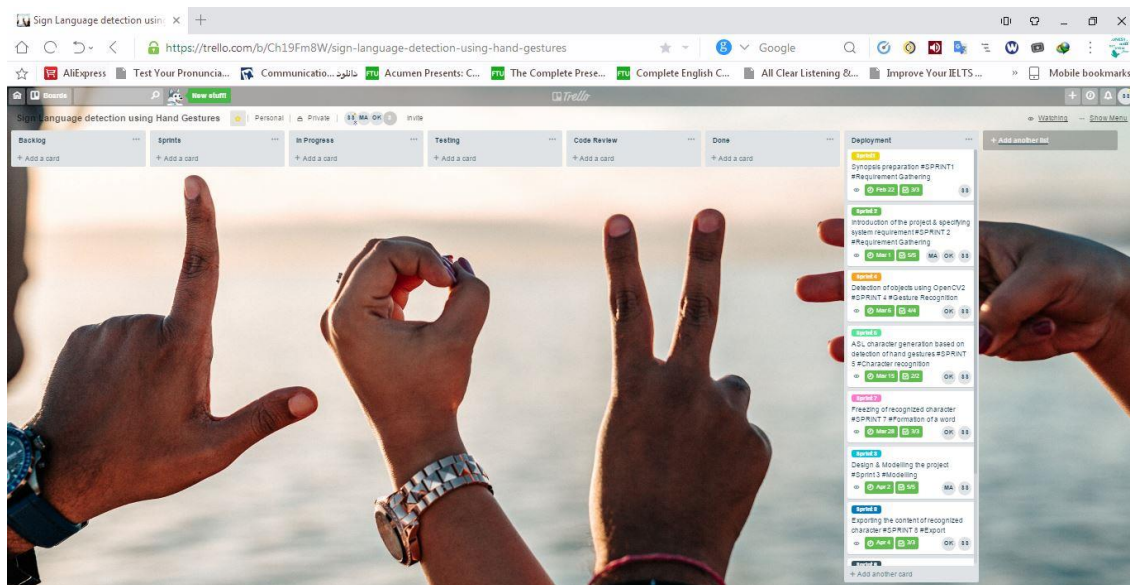


Fig 6.2: Inside view along with each phases of app.

Synopsis preparation #SPRINT1 #Requirement Gathering

in list [Deployment](#)

MEMBERS

SS +

LABELS

Sprint1 +

DUE DATE

Feb 22 at 12:00 PM

ADD TO CARD

Members

Labels

Checklist

Due Date

Attachment

Description

Add a more detailed description...

Works to be done for this sprint

Hide completed items

Delete

100%

Basic Idea about the project

Work to be carried out between the project

additional work to be done for the already existing system

Add an item

POWER-UPS

Get Power-Ups

ACTIONS

Move

Copy

Watch

Add Comment

Fig 6.3: schedule and task of sprint 1 “synopsis preparation” with assigned members

Introduction of the project & specifying system requirement #SPRINT 2 #Requirement Gathering

in list [Deployment](#)

MEMBERS

MA OK SS +

LABELS

Sprint 2 +

DUE DATE

Mar 1 at 12:00 PM

ADD TO CARD

Members

Labels

Checklist

Due Date

Attachment

Description

Add a more detailed description...

Works to be done for this sprint

Hide completed items

Delete

100%

Giving a brief intro about the project

Defining the scope of the project

Specifying the problem statement and the target audience

Specify system requirements (Both hardware and software)

Addressing the system features

POWER-UPS

Get Power-Ups

ACTIONS

Move

Copy

Watch

Fig 6.4: schedule and task of sprint 2 “requirement specification” with assigned members

ASL character generation based on detection of hand gestures

#SPRINT 5 #Character recognition

in list [Deployment](#)

MEMBERS

OK SS +

LABELS

Sprint 5 +

DUE DATE

Mar 15 at 12:00 PM

ADD TO CARD

Members

Labels

Checklist

Due Date

Attachment

Description

Add a more detailed description...

Activity for character recognition

Hide completed items

Delete

100%

Image should be considered from the designated pixel regions

Based on the gesture recognition , corresponding alphabet character as per american standard should be displayed on screen

Add an item

POWER-UPS

Get Power-Ups

ACTIONS

Move

Copy

Watch

Add Comment

Fig 6.5: schedule and task of sprint 4 “ASL char generation” along with assigned members

Detection of objects using OpenCV2 #SPRINT 4 #Gesture Recognition

in list [Deployment](#)

MEMBERS

OK SS +

LABELS

Sprint 4 +

DUE DATE

Mar 6 at 8:00 PM

ADD TO CARD

Members

Labels

Checklist

Due Date

Attachment

Description

Add a more detailed description...

Gesture Recognition Activity

Hide completed items

Delete

100%

System camera must pop-up using python script

Background should be captured and colored as black

The object in front should be invert of background color

The object shape should be a clear image

Add an item

POWER-UPS

Get Power-Ups

ACTIONS

Move

Copy

Watch

Fig 6.6: schedule and task of sprint 5 “Gesture recognition” along with assigned members

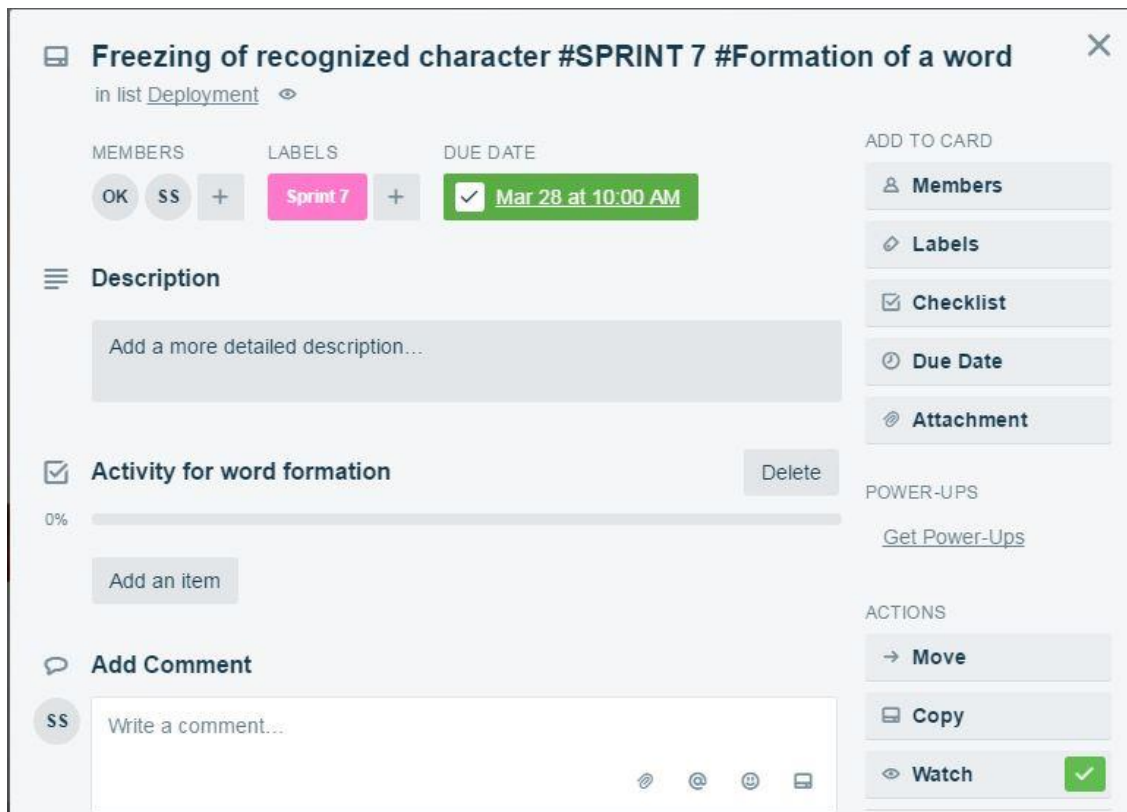


Fig 6.7: schedule of sprint 7 “Freezing of recognized character” along with assigned members

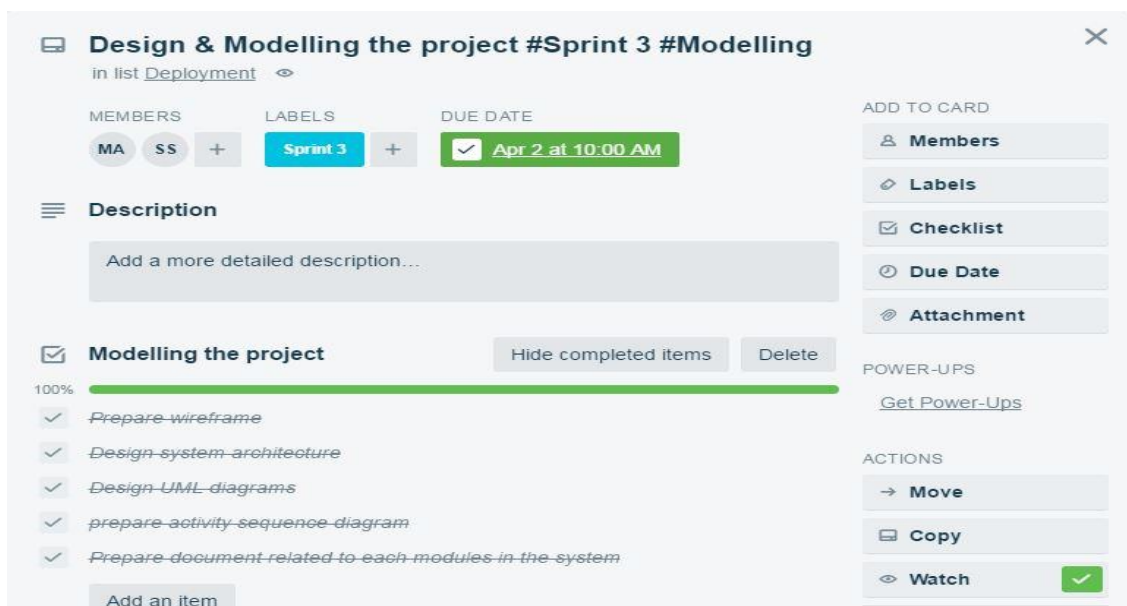


Fig 6.8: schedule and task of sprint 3 “Design & Modelling the project” along with assigned members

Exporting the content of recognized character #SPRINT 8 #Export

in list [Deployment](#)

MEMBERS

OK SS +

LABELS

Sprint 8 +

DUE DATE

✓ Apr 4 at 10:00 AM

ADD TO CARD

Members

Labels

Checklist

Due Date

Attachment

Description

Add a more detailed description...

✓ Activity for the export

Hide completed items

Delete

100%

✓ The content must be fetched from the recognized character

✓ Export facility must be available for the end user

✓ The character recognized should be exported in ASCII format with .txt extension

Add an item

POWER-UPS

[Get Power-Ups](#)

ACTIONS

→ Move

Copy

Watch ✓

Fig 6.9: schedule and task of sprint 8 “Exporting the content” along with assigned members

Custom gesture generation #SPRINT 6 #Customized gesture

in list [Deployment](#)

MEMBERS

SS +

LABELS

Sprint 6 +

DUE DATE

✓ tomorrow at 12:00 PM

ADD TO CARD

Members

Labels

Checklist

Due Date

Attachment

Description

Add a more detailed description...

✓ Activity for Customized gesture

Hide completed items

Delete

100%

✓ Image should be considered from the designated pixel regions

✓ Based on the gesture user has made, facility should be provided for the end user to save his gesture with appropriate label

Add an item

POWER-UPS

[Get Power-Ups](#)

ACTIONS

→ Move

Copy

Watch ✓

Add Comment

Fig 6.10: schedule and task of sprint 6 “Custom gesture generation” along with assigned members

