



**SRM INSTITUTE OF SCIENCE AND TECHNOLOGY
RAMAPURAM
FACULTY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF INFORMATION TECHNOLOGY
18CSP107L-Minor Project**

Final Review

**Smart Living with DigiReflect: An IoT Platform for
Efficient Task Management**

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ABSTRACT

- DigiReflect: An IoT Platform for Efficient Task Management integrates various productivity tools, including real-time date and time display, a calendar, customizable affirmations, and a note-taking system.
- Built with Python's Tkinter for the GUI and TensorFlow for sign language recognition, it provides an accessible interface for users. The dashboard opens with essential features prominently displayed, allowing easy interaction.
- A key functionality is the integrated sign language detection, which operates in a separate thread, enabling gesture recognition while keeping other features active.
- This application promotes organization and accessibility, catering particularly to individuals who communicate through sign language.
- The seamless interaction between components enhances the user experience, making it a comprehensive tool for daily activities. Overall, it combines productivity and advanced technology to create a user-friendly environment.

PROBLEM IDENTIFICATION

PROBLEM STATEMENT:

The application seeks to create a personal dashboard with real-time sign language detection, note management, and motivational affirmations. It must accurately interpret gestures, allow seamless note editing, and offer an easy-to-navigate interface.

SOLUTION:

A Tkinter-based dashboard integrates a trained TensorFlow model for real-time sign language detection, a note-taking module, and motivational affirmations. Webcam frames are preprocessed for compatibility with the model, while threading ensures responsiveness. The application allows easy note editing, displays a calendar, and updates time and date automatically, providing an accessible, interactive personal dashboard.

DISADVANTAGES

- **Limited Sign Detection Scope:** Recognizes only a specific set of signs, which may not cover all communication needs in sign language.
- **High Resource Usage:** Continuous video processing and machine learning can be resource-intensive, potentially slowing down system performance on lower-spec devices.
- **Dependency on Camera Quality:** Accurate detection requires a good-quality camera and consistent lighting, limiting functionality in low-light conditions or with lower-resolution cameras.
- **Privacy Concerns:** Requires camera access, which could raise privacy issues for some users who may be uncomfortable with continuous video monitoring.
- **Model Accuracy and Generalization:** The model may struggle to accurately interpret varied user gestures, especially with differences in hand positioning or lighting, potentially leading to errors.

MOTIVATION OF THE PROJECT

The motivation behind this project stems from the need to enhance inclusivity, organization, and daily motivation through technology. Sign language detection supports accessibility, making it easier for individuals with hearing or speech impairments to communicate in various environments. Additionally, integrating note-taking, real-time calendar updates, and affirmations within a single dashboard encourages productivity, positivity, and self-reflection. The goal is to build a smart, personal assistant that empowers users to manage daily tasks and stay motivated while embracing the transformative power of artificial intelligence and computer vision for a more inclusive future.

PROPOSED SYSTEM

- **Integrated Dashboard:** Combines sign language recognition, note management, calendar, and affirmations in one interface.
- **Real-Time Sign Language Recognition:** Uses a custom-trained model to detect and classify specific sign language gestures for non-verbal communication.
- **Enhanced Note Module:** Allows users to add, edit, and display notes easily, enabling better task and thought management.
- **Calendar Feature:** Supports event scheduling and tracking for streamlined time management.
- **Affirmations Display:** Centralized, positive affirmations designed to promote well-being and motivation throughout the day.
- **Inclusive Design:** Aims to support a broader range of users, including those needing non-verbal, gesture-based interaction.

ADVANTAGES

- **Enhanced Accessibility:** Facilitates non-verbal communication for users with speech or hearing impairments through real-time sign language detection.
- **Multi-Functionality:** Combines multiple features (notes, calendar, affirmations) in a single dashboard, reducing the need for multiple apps.
- **Improved Productivity:** Allows users to manage tasks, notes, and schedules conveniently, fostering better organization.
- **Positive Reinforcement:** Displays motivational affirmations to support a positive mindset throughout the day.
- **User-Friendly:** Simple, intuitive design with easy-to-navigate features, catering to diverse user needs.
- **Real-Time Interaction:** Instantaneous gesture recognition ensures prompt response, making the system feel responsive and reliable.

SYSTEM REQUIREMENTS

SOFTWARE REQUIREMENTS:

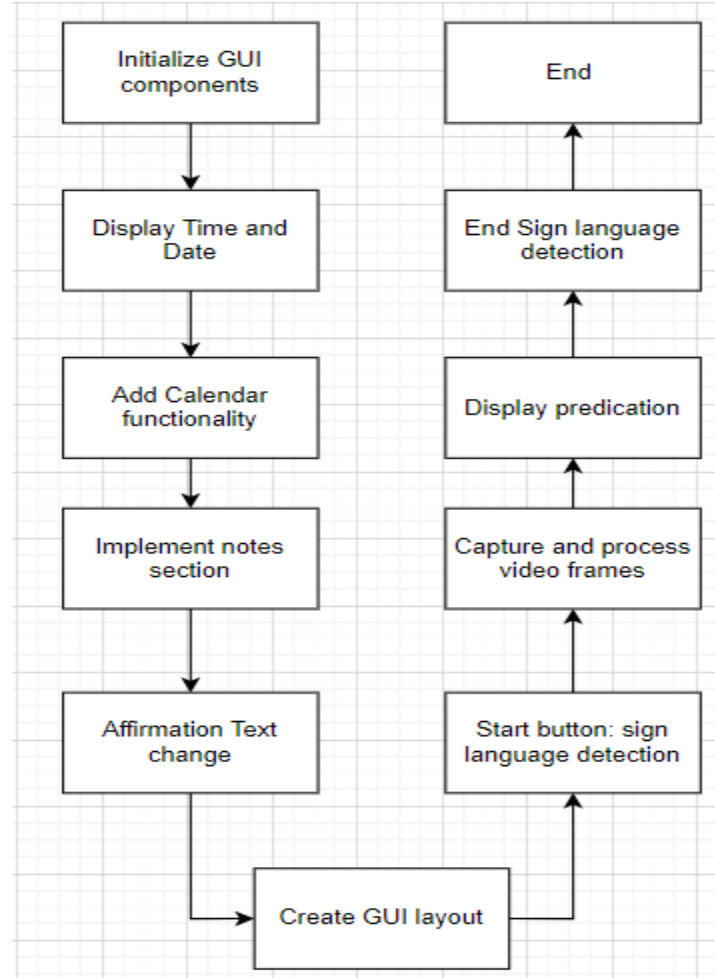
- **Programming Language:** Python 3.x
- **Libraries:**
 - OpenCV
 - Tkcalendar
 - Tkinter
 - TensorFlow
 - Matplotlib
 - NumPy
- **Operating System:**
 - Windows 10 or higher
 - Raspberry pi OS
- **Integrated Development Environment (IDE):**
 - Thonny
 - Visual Studio Code (VS Code)

SYSTEM REQUIREMENTS

HARDWARE REQUIREMENTS:

- **Web cam:** least 720p resolution for clear image capture.
- **Computer Specifications:** **Processor-** Intel i3 or above (or equivalent AMD), **RAM-** Minimum 4 GB (8 GB or higher recommended for TensorFlow and OpenCV tasks), **Storage-** At least 500 MB of free space for the project files, libraries, and trained model.
- **Microcontroller:** Raspberry pi pico

SYSTEM ARCHITECTURE



Full Modules presentation with algorithms

Dashboard Module:

- Displays the date, time, affirmations, a note-taking section, and allows users to view a calendar.
- It also integrates the sign language detection functionality, controlled via buttons.

Algorithm:

- **Initialize GUI:** Create a *Tkinter* window and set its properties (title, size, background).
- **Display Current Time:** Use *datetime* to fetch and update the current time every second.
- **Show Calendar:** Implement a calendar using *tkcalendar*, allowing users to select dates.
- **Affirmations:** Create a list of affirmations and cycle through them when clicked.
- **Notes Section:** Allow users to add, edit, and display notes in a text area.

Full Modules presentation with algorithms

Sign language detector module:

- **Initialize Webcam:** Use *OpenCV* to access the webcam.
- **Frame Capture:** Capture video frames continuously.
- **Preprocess Frames:** Convert frames to grayscale.
- **Resize images** to fit the model input.
- **Load Trained Model:** Use *TensorFlow* to load the pre-trained sign language detection model.
- **Make Predictions:** Predict the sign language gesture from the processed frame and display the result on the frame.

SAMPLE CODE

```
Thonny - C:\Users\durgas\OneDrive\Documents\sign_language_detection.py @ 169 : 1
File Edit View Run Tools Help
sign_language_detection.py x
1 import os
2 import tkinter as tk
3 from tkinter import simpledialog
4 from tkcalendar import Calendar
5 from datetime import datetime
6 import cv2
7 import numpy as np
8 from tensorflow.keras.models import load_model
9 from tensorflow.keras.preprocessing.image import img_to_array
10 from sklearn.preprocessing import LabelEncoder
11 import threading
12
13 # Main window setup for Smart Mirror
14 root = tk.Tk()
15 root.title("Smart Mirror")
16 root.geometry("800x600")
17 root.configure(bg='black')
18 root.attributes("-fullscreen", True) # Start in full screen mode
19
20 # Font settings
21 large_font = ("Helvetica", 40, "bold")
22 medium_font = ("Helvetica", 20)
23 small_font = ("Helvetica", 12)
24
25 # Global list to store notes
26 notes = []
27
28 # Load the trained model and LabelEncoder for sign language detection
29
Shell x
1/1 ----- 0s 25ms/step
1/1 ----- 0s 21ms/step
1/1 ----- 0s 31ms/step
1/1 ----- 0s 31ms/step
1/1 ----- 0s 31ms/step
1/1 ----- 0s 25ms/step
1/1 ----- 0s 25ms/step
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SAMPLE CODE

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sign_language_detection.py x

```
27
28 # Load the trained model and LabelEncoder for sign language detection
29 model = load_model('gesture_model.keras')
30 gestures = ['yes', 'please', 'help']
31 label_encoder = LabelEncoder()
32 label_encoder.fit(gestures)
33
34 # Function to update time and date
35 def update_time_date():
36     now = datetime.now()
37     current_time = now.strftime("%H:%M:%S")
38     current_date = now.strftime("%B %d, %Y")
39     current_day = now.strftime("%A")
40
41     time_label.config(text=current_time)
42     date_label.config(text=current_date)
43     day_label.config(text=current_day)
44
45     root.after(1000, update_time_date) # Update every second
46
47 # Function to toggle calendar visibility
48 def show_calendar():
49     cal_win = tk.Toplevel(root)
50     cal_win.title("Calendar")
51     cal_win.geometry("300x300")
52     cal = Calendar(cal_win, selectmode="day")
53     cal.pack(pady=20)
54
```

Shell x

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1/1 ----- 0s 25ms/step
1/1 ----- 0s 21ms/step
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SAMPLE CODE

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sign_language_detection.py

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55 # Function to add a new note
56 def add_note():
57     note = simpledialog.askstring("New Note", "Enter your note:")
58     if note:
59         notes.append(note)
60         update_notes_display()
61
62 # Function to update the note display area
63 def update_notes_display():
64     notes_display.delete("1.0", tk.END)
65     for i, note in enumerate(notes, 1):
66         notes_display.insert(tk.END, f"{i}. {note}\n")
67
68 # Function to change affirmation text on click
69 def change_affirmation():
70     affirmations = ["You are amazing!", "Stay positive!", "Believe in yourself!", "Keep going!", "You got this!"]
71     current_affirmation = affirmation_label.cget("text")
72     new_affirmation = affirmations[(affirmations.index(current_affirmation) + 1) % len(affirmations)]
73     affirmation_label.config(text=new_affirmation)
74
75 # Webcam control functions for gesture recognition
76 cap = None # Webcam video capture object
77
78 def preprocess_frame(frame, target_size=(64, 64)):
79     # Resize the frame to match the input size of the model
80     frame_resized = cv2.resize(frame, target_size)
81     # Normalize and convert to array
82     frame_array = frame_resized.astype('float32') / 255.0
```

Shell

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1/1 ----- 0s 25ms/step
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SAMPLE CODE

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sign_language_detection.py x
83 # Expand dimensions to make it compatible with the model input shape
84 frame_array = np.expand_dims(frame_array, axis=0)
85 return frame_array
86
87 def start_webcam():
88     global cap
89     cap = cv2.VideoCapture(0) # Open the webcam
90
91 def detect_gestures():
92     while cap.isOpened():
93         ret, frame = cap.read()
94         if not ret:
95             break
96         # Preprocess the frame for prediction
97         preprocessed_frame = preprocess_frame(frame)
98         # Make a prediction on the preprocessed frame
99         predictions = model.predict(preprocessed_frame)
100        predicted_index = np.argmax(predictions, axis=1)[0]
101        predicted_gesture = label_encoder.inverse_transform([predicted_index])[0]
102        # Display the predicted gesture on the frame
103        cv2.putText(frame, f"Gesture: {predicted_gesture}", (10, 30),
104                    cv2.FONT_HERSHEY_SIMPLEX, 1, (0, 255, 0), 2)
105        # Show the frame with the predicted gesture
106        cv2.imshow('Real-time Gesture Prediction', frame)
107        if cv2.waitKey(1) & 0xFF == ord('q'):
108            break
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SAMPLE CODE

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File Edit View Run Tools Help



sign_language_detection.py x

```
110         cap.release()
111         cv2.destroyAllWindows()
112
113         # Start gesture recognition in a separate thread to avoid blocking the UI
114         threading.Thread(target=detect_gestures, daemon=True).start()
115
116     def stop_webcam():
117         global cap
118         if cap and cap.isOpened():
119             cap.release()
120             cv2.destroyAllWindows()
121
122     # UI Elements
123     # Time, Date, and Day Labels (Top left)
124     time_label = tk.Label(root, text="", font=large_font, fg="white", bg="black")
125     time_label.grid(row=0, column=0, sticky="nw", padx=20, pady=10)
126
127     date_label = tk.Label(root, text="", font=medium_font, fg="white", bg="black")
128     date_label.grid(row=1, column=0, sticky="nw", padx=20)
129
130     day_label = tk.Label(root, text="", font=medium_font, fg="white", bg="black")
131     day_label.grid(row=2, column=0, sticky="nw", padx=20)
132
133     # Calendar Button (Below Date and Day)
134     calendar_icon = tk.Button(root, text="📅", font=large_font, command=show_calendar, bg="black", fg="white", bd=0)
135     calendar_icon.grid(row=3, column=0, sticky="nw", padx=20, pady=20)
136
```

Shell x

```
1/1 ----- 0s 25ms/step
1/1 ----- 0s 21ms/step
1/1 ----- 0s 31ms/step
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>>>

SAMPLE CODE

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Thonny - C:\Users\durgas\OneDrive\Documents\sign_language_detection.py @ 163 : 1
File Edit View Run Tools Help

sign_language_detection.py *
138 affirmation_label.grid(row=4, column=1, sticky="n", pady=20)
139 affirmation_label.bind("<Button-1>", lambda e: change_affirmation()) # Change affirmation on click
140
141 notes_label = tk.Label(root, text="Notes", font=medium_font, fg="white", bg="black")
142 notes_label.grid(row=5, column=2, sticky="ne", padx=20, pady=10)
143
144 notes_display = tk.Text(root, height=6, width=30, font=small_font, bg="black", fg="white", bd=0)
145 notes_display.grid(row=6, column=2, sticky="ne", padx=20)
146
147 add_note_button = tk.Button(root, text="Add Note", command=add_note, font=small_font, bg="white", fg="black")
148 add_note_button.grid(row=7, column=2, sticky="ne", padx=20)
149
150 start_button = tk.Button(root, text="Start Gesture Detection", font=small_font, bg="green", fg="white", command=start_webcam)
151 start_button.grid(row=8, column=1, pady=20)
152
153 stop_button = tk.Button(root, text="Stop Gesture Detection", font=small_font, bg="red", fg="white", command=stop_webcam)
154 stop_button.grid(row=9, column=1, pady=20)
155
156 root.grid_rowconfigure(4, weight=1)
157 root.grid_columnconfigure(1, weight=1)
158
159
160 update_time_date()
161
162 root.mainloop()
163 |
164 root.mainloop()
165

Shell x
1/1 ----- 0s 25ms/step
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DASHBOARD INTERFACE

08:29:34

November 08, 2024
Friday



You are amazing!

Notes

Add Note

Start Gesture Detection

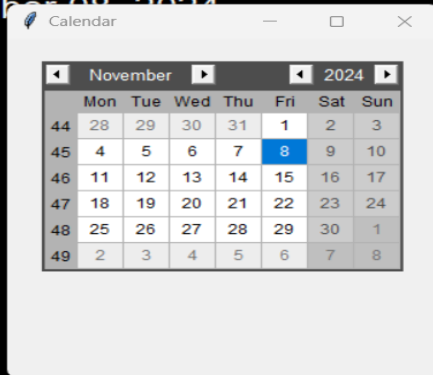
Stop Gesture Detection

CALENDAR POP UP

08:30:43

November 08, 2024

Friday



You are amazing!

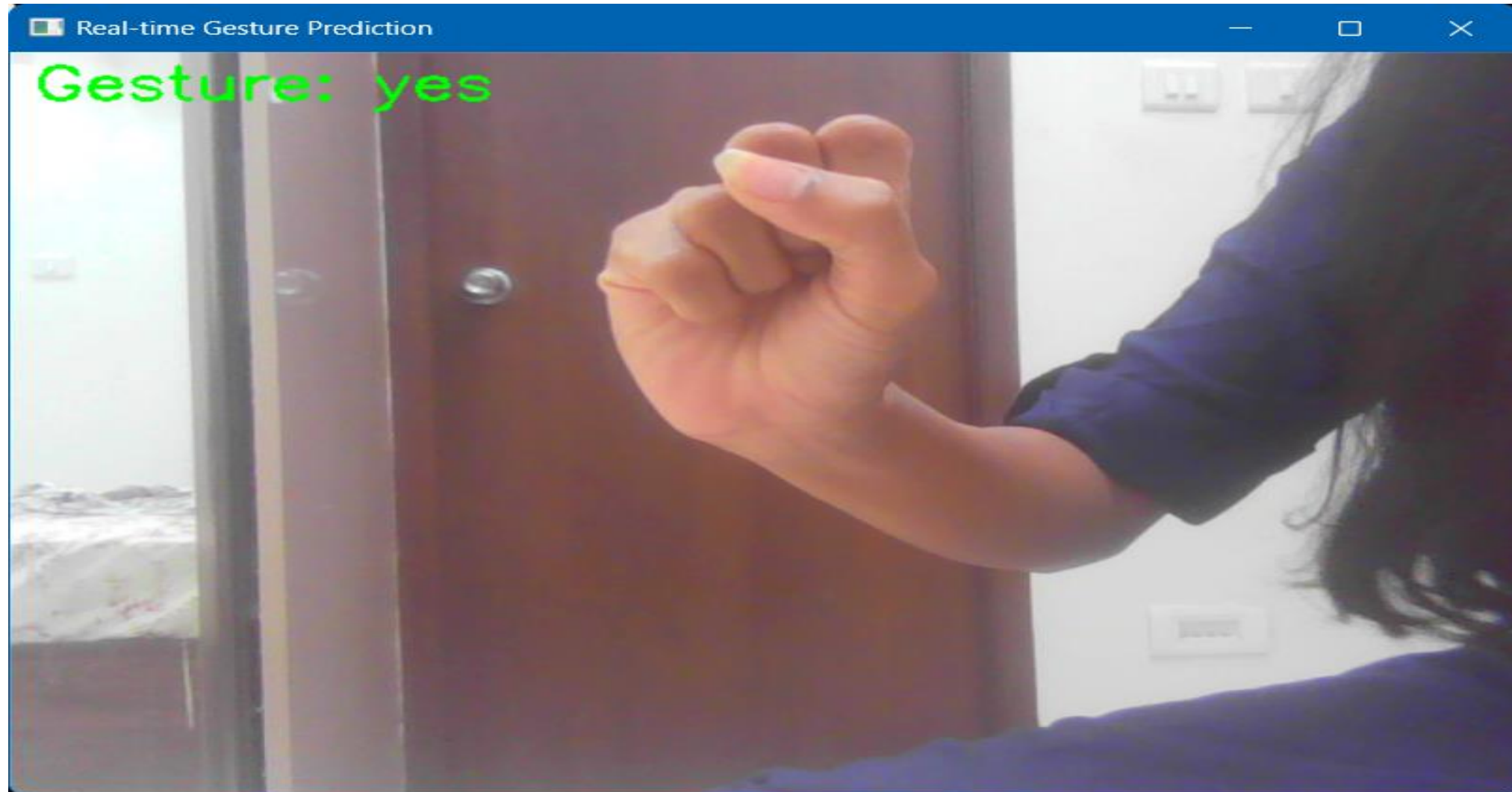
Notes

Add Note

Start Gesture Detection

Stop Gesture Detection

SMART MIRROR DISPLAY



SMART MIRROR DISPLAY



CONCLUSION

In conclusion, the application successfully integrates multiple productivity tools to enhance user experience. The real-time display of date and time, interactive calendar, affirmations, and note-taking functionality offers users a comprehensive platform for managing daily tasks.

The inclusion of sign language detection enables better communication for users who rely on gestures, making the application more inclusive.

Overall, this project not only demonstrates the practical application of Python and machine learning technologies but also addresses the importance of accessibility in everyday tools.

FUTURE ENHANCEMENT

To improve the functionality and usability of the application, the following enhancements are recommended:

- **Enhanced Sign Language Detection:** Expand the model to recognize more gestures and improve accuracy by incorporating a larger dataset.
- **User Profiles:** Allow users to create profiles to save personalized settings, notes, and affirmations.
- **Data Export:** Implement functionality to export notes and affirmations to a file for backup.
- **Mobile Application:** Develop a mobile version of the dashboard for easier access on various devices.
- **Integration with Other APIs:** Integrate with external APIs (e.g., weather, task management) to provide more comprehensive information.

THANK YOU