



METHODIST
COLLEGE OF ENGINEERING & TECHNOLOGY
[Autonomous Institution]

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MINOR PROJECT

AUTISM SUPPORT SYSTEM

SYSTEM(ASS)

Submitted By:

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ABSTRACT

The Autism Support System aims to enhance the learning and emotional development of children diagnosed with autism through innovative technologies. The emotion recognition module detects and classifies emotions from facial expressions, providing audio feedback and maintaining logs of detected emotions. In cases of frequent distress detection, an emergency SMS is sent to parents. The hand gesture recognition module enables children to play songs based on their facial expressions, fostering a multimodal interaction experience. The emotion gaming module engages children in interactive games that promote the recognition and understanding of emotions. This paper presents the system's architecture, design, implementation, and testing, along with the results and potential future improvements. The study demonstrates the potential of leveraging advanced technologies to support the emotional and social development of children with autism, offering a promising tool for therapists, educators, and caregivers. By integrating facial recognition, gesture recognition, and emotion-based gaming, the system provides a comprehensive platform for emotion detection and interaction.. This review aims to not only become a reference for future research on emotion recognition, but also to provide an overview of the work done in this topic for potential readers.

INTRODUCTION

The Autism Support System is an innovative project aimed at providing comprehensive assistance to individuals with autism. This system leverages advanced technologies to create a supportive environment that caters to the unique needs of autistic individuals. By integrating emotion recognition, personalized feedback, and real-time notifications, this system seeks to enhance the quality of life for users and their caregivers.

Objective:

- **Timely Intervention:** To provide early and appropriate emotional support which can significantly improve the quality of life for individuals with ASD.
- **Enhanced Social Skills:** To help in developing better social and communication skills.
- **Improved Mental Health:** To provide psychological support and coping strategies that can reduce anxiety and improve overall mental well-being.
- **Independence:** to provide tools and technologies that assist in emotion recognition and can foster greater independence and self awareness.
- **Personalized Support:** To provide tailored feedback and suggestions to meet individual needs and preferences.

Scope: The "Autism Support System" project aims to provide a comprehensive support framework for individuals with autism. The system integrates multiple advanced technologies to offer personalized and effective assistance.

LITERATURE SURVEY

Paper Name	Dataset	Methodology	Advantages	Disadvantages
Talaat, Fatma M., et al. "Real-time facial emotion recognition convolutional neural network for autism children." Soft Computing (2024)	Visual clues (movies, games)	Teaching emotions to autistic children using visual clues	Demonstrated effectiveness of visual clues in teaching emotions	Focused on visual clues only
Wei, J., Hu, G., Yang, X., Luu, A.T. and Dong, Y., 2024.	Video datasets with facial and body gestures	Combining facial expression and body gesture visual information	Comprehensive emotion recognition by considering both facial and body gestures	Complex integration of facial and body gesture data

SYSTEM ANALYSIS

Existing System: The current systems aimed at supporting individuals with autism often include traditional methods such as therapy sessions, specialized education programs, and manual monitoring by caregivers. Some technological interventions exist but are typically isolated, lacking comprehensive integration and real-time responsiveness.

- **Limited Automation:** Existing systems largely rely on manual intervention, which can be time-consuming and less efficient.
- **Lack of Real-Time Support:** Many current solutions do not offer real-time emotional and gesture recognition, which is critical for immediate support.
- **Fragmented Solutions:** Available technologies often address individual aspects such as visual games or emotion recognition but do not provide a holistic support system.
- **Accessibility Issues:** High costs and limited accessibility can prevent many individuals from benefiting from existing advanced support technologies.
- **Data Utilization:** Insufficient use of data analytics for personalized feedback and improvements in care strategies

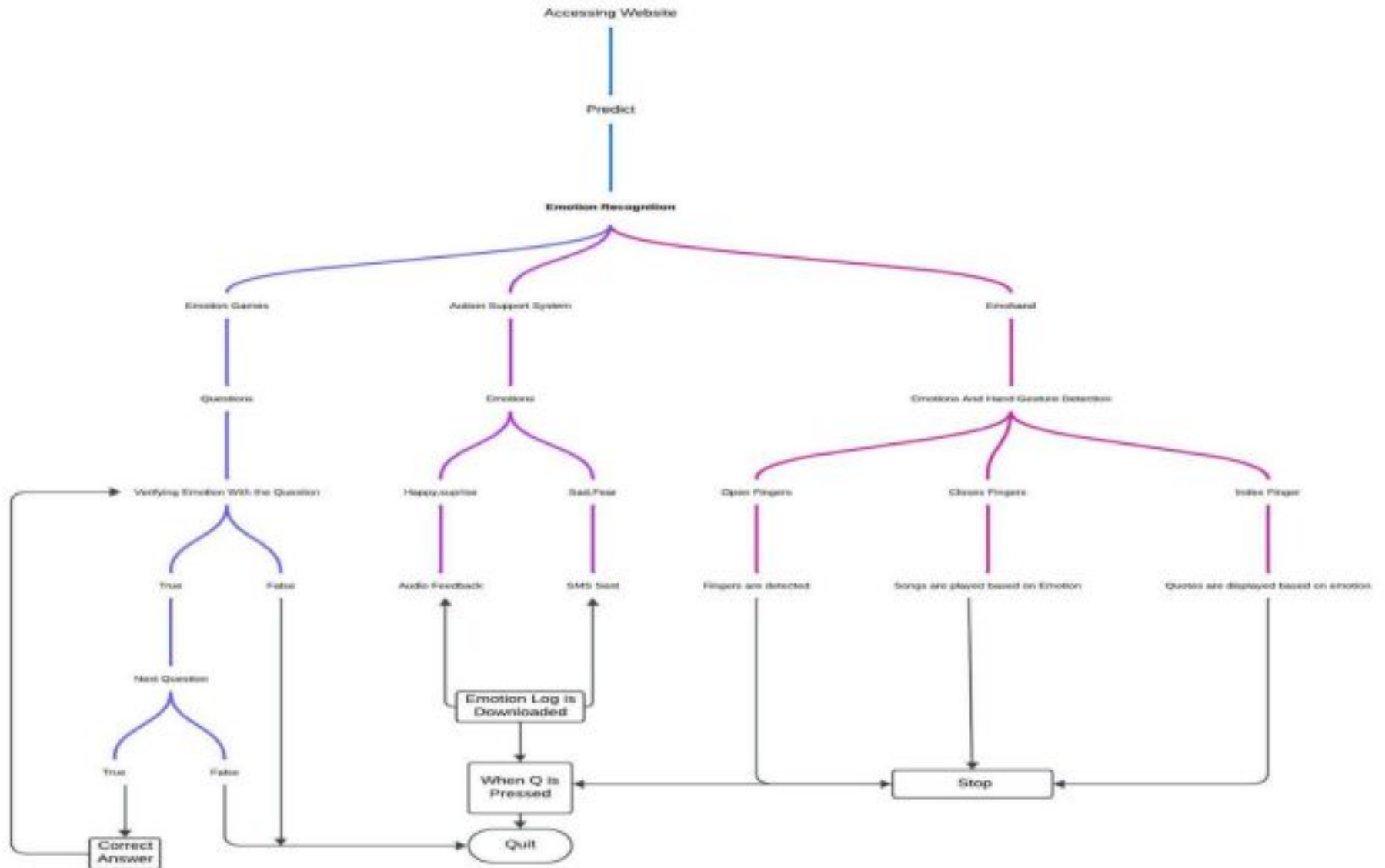
Proposed System :Proposed System Overview: The Autism Support System integrates emotion recognition, gesture recognition, visual games, and personalized feedback to provide comprehensive and real-time support for individuals with autism. The system uses advanced technologies to enhance the effectiveness and accessibility of support services.

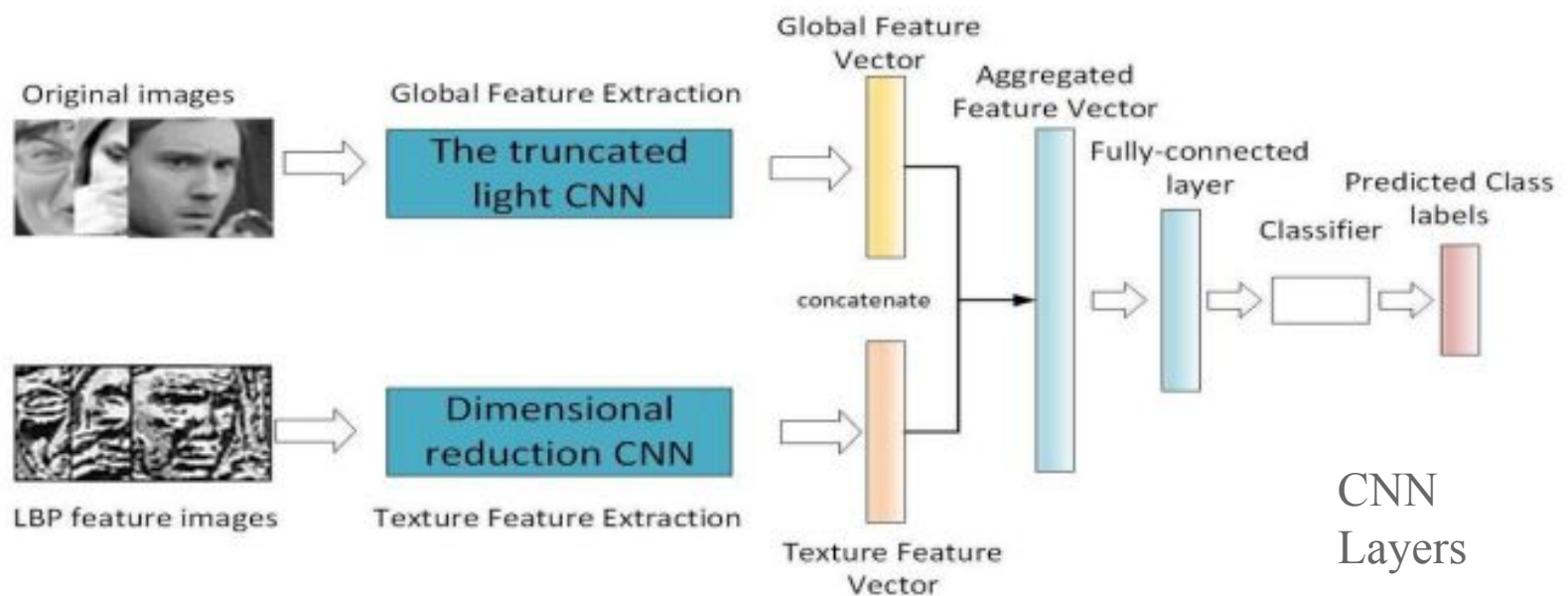
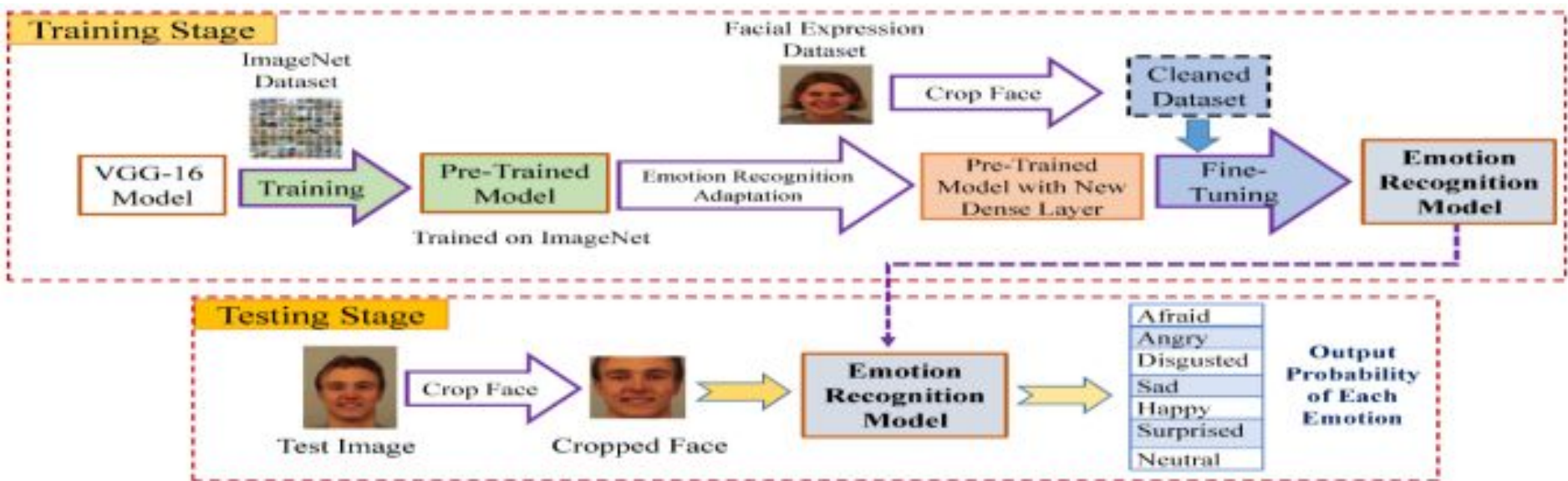
- Real-Time Emotion and Gesture Recognition:**Immediate identification and interpretation of emotions and gestures facilitate timely support.
- Integrated Support:** Combines multiple functionalities such as emotion recognition, visual games, and emergency notifications into a single cohesive system.
- Personalized Feedback:** Utilizes logged data to provide tailored feedback and suggestions, enhancing individual support.
- Automated Monitoring:** Reduces the need for constant manual oversight, freeing up time for caregivers while ensuring continuous support.
- Accessibility and Cost-Effectiveness:** Leverages common hardware (webcams, computers) and open-source software to make advanced support more accessible and affordable.

Advantages of Proposed system:

- **Enhanced Real-Time Recognition and Immediate Intervention:**Provides prompt responses by identifying emotions and gestures in real-time, improving communication and support effectiveness for individuals with autism.
- **Comprehensive Integrated Functionality:**Combines multiple support tools (emotion recognition, visual games, emergency notifications) into a single, cohesive system, reducing complexity and enhancing user experience.
- **Personalized Feedback and Adaptive Support:**Utilizes logged data to offer tailored feedback and suggestions, ensuring individualized care and continuously adapting to the user's needs and progress.
- **Automated Monitoring and Reduced Caregiver Burden:**Automates the monitoring process, allowing caregivers to focus on direct interaction and quality care, while ensuring continuous support without constant manual oversight.
- **Accessibility, Cost-Effectiveness, and Data-Driven Insights:**Leverages common hardware and open-source software to make advanced support more affordable and accessible, while providing data-driven insights for ongoing improvement and informed decision-making.

ARCHITECTURE





CONCLUSION

- **Objectives:**

Streamline administrative tasks, Ensure data security , Provide a user-friendly interface

- **Achievements :**

1.Successfully implemented key modules such as administration, fees, staff, expenses, admissions, marks using views ,forms ,models

2. Met user requirements and improved efficiency

- **Challenges :**

Integration issues(connecting mysql with django) , data migration(moving the aggregated data between the html pages)

Future Enhancement

- **Advanced Emotion and Gesture Recognition:**Incorporate contextual data (voice tone, body language) and enable multi-facial analysis to improve emotion recognition.Implement 3D cameras and depth sensors for accurate gesture recognition and allow customization of gestures.
- **Integration with Wearable Devices and Mobile Accessibility:**Monitor physiological data (heart rate, skin conductance) through wearable devices to gain a comprehensive understanding of the user's emotional state.Develop mobile applications for real-time support and monitoring on the go.
- **Adaptive Learning and Multiplayer Options:**Use adaptive learning algorithms to tailor game difficulty and content based on the child's progress and needs.Introduce multiplayer games to encourage social interaction and teamwork.
- **Parental/Guardian Dashboard and Educational Modules:**Create a dashboard for parents or guardians to monitor progress and receive notifications and insights.Develop educational modules to assist with learning and cognitive development.
- **Continuous Learning and Advanced AI Techniques:**Implement continuous learning capabilities to improve system accuracy and effectiveness over time.Utilize advanced AI techniques such as deep learning and reinforcement learning to enhance performance.

IMPLEMENTATION

Dataset Description:

The data consists of 48x48 pixel grayscale images of faces. The faces have been automatically registered so that the face is more or less centred and occupies about the same amount of space in each image. The task is to categorize each face based on the emotion shown in the facial expression into one of seven categories (0=Angry, 1=Disgust, 2=Fear, 3=Happy, 4=Sad, 5=Surprise, 6=Neutral). The training set consists of 28,709 examples and the public test set consists of 3,589 examples.

Functional Requirements:

- Emotion Recognition: The system must capture video input, detect faces, and accurately recognize and log emotions in real time.
- Gesture Recognition: The system should detect and interpret predefined gestures to aid communication.
- Visual Games: Interactive games must be included to support cognitive and motor skills development.
- Emergency Notifications: The system must send SMS notifications to predefined contacts when distress is detected frequently.
- Data Logging: Emotions and timestamps must be logged for further analysis and personalized feedback.

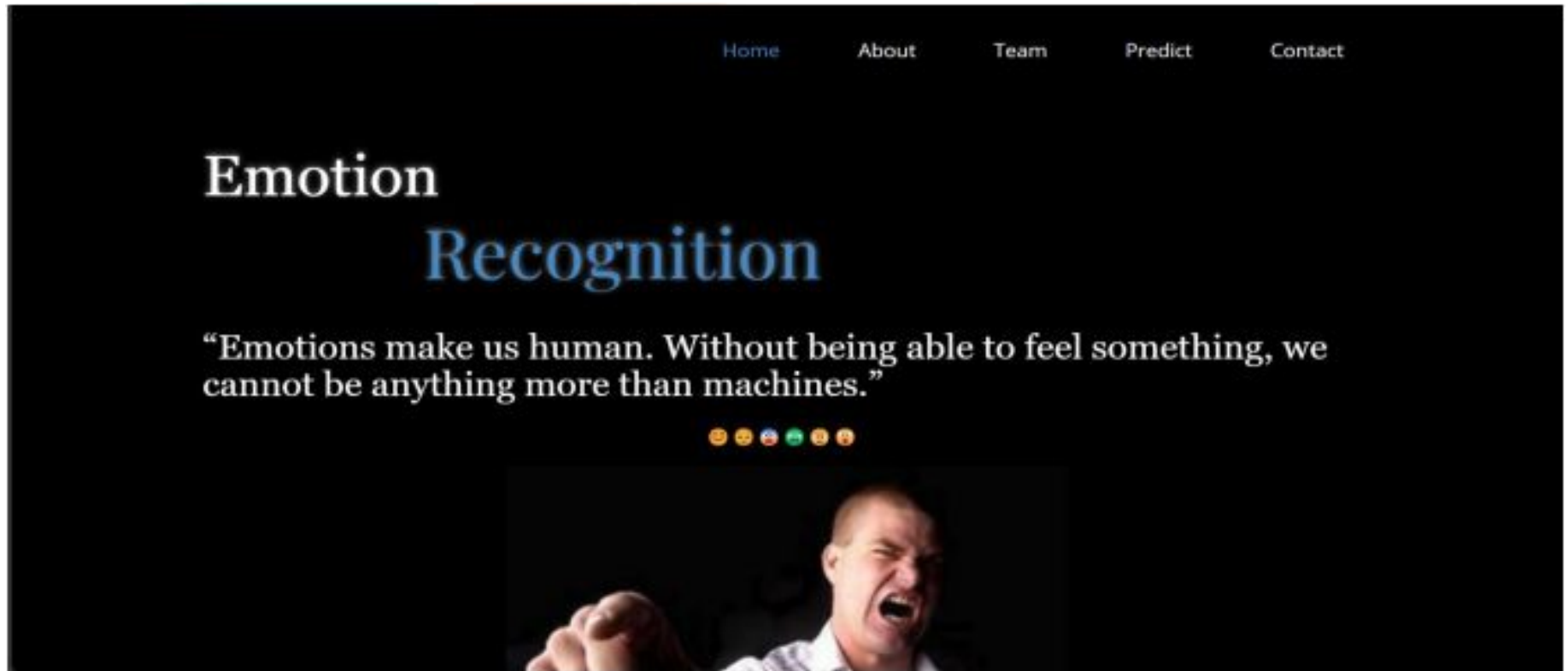
Non-Functional Requirements:

- Performance:** The system should process video input and provide feedback in real time with minimal latency.
- Usability:** The interface should be user-friendly and accessible, with clear instructions and easy navigation.
- Reliability:** The system must be robust, with minimal downtime and reliable operation.
- Scalability:** The architecture should support future enhancements and additional functionalities.
- Security:** User data, especially sensitive information, must be securely handled and protected from unauthorized access.

Software Requirements:

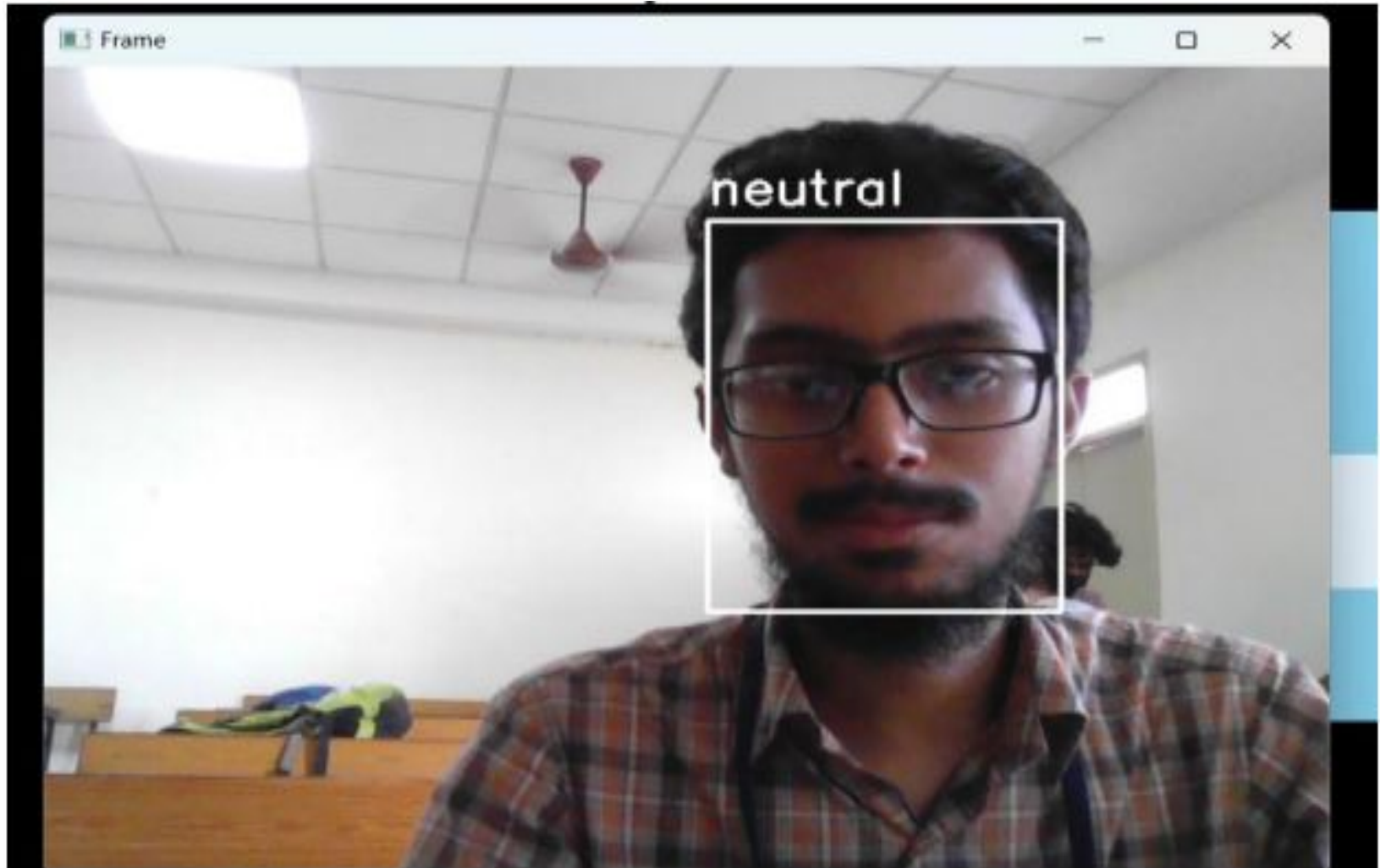
- Operating System:** Windows, macOS, or Linux
- Programming Language:** Python 3.x
- Libraries and Frameworks:** OpenCV, TensorFlow/Keras, pytsx3, Twilio, NumPy
- Development Environment:** Visual Studio Code, Jupyter Notebook
- Version Control:** Git/GitHub

User Interface

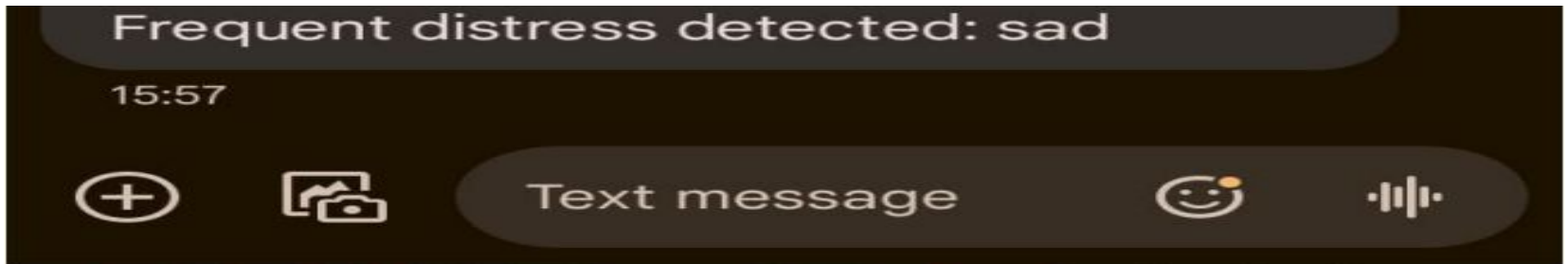


The model firstly displays the UI above. Upon clicking the PREDICT menu, one can find the 3 modules - EmoRecognition, EmoHand, and EmoGame

EmoRecognition

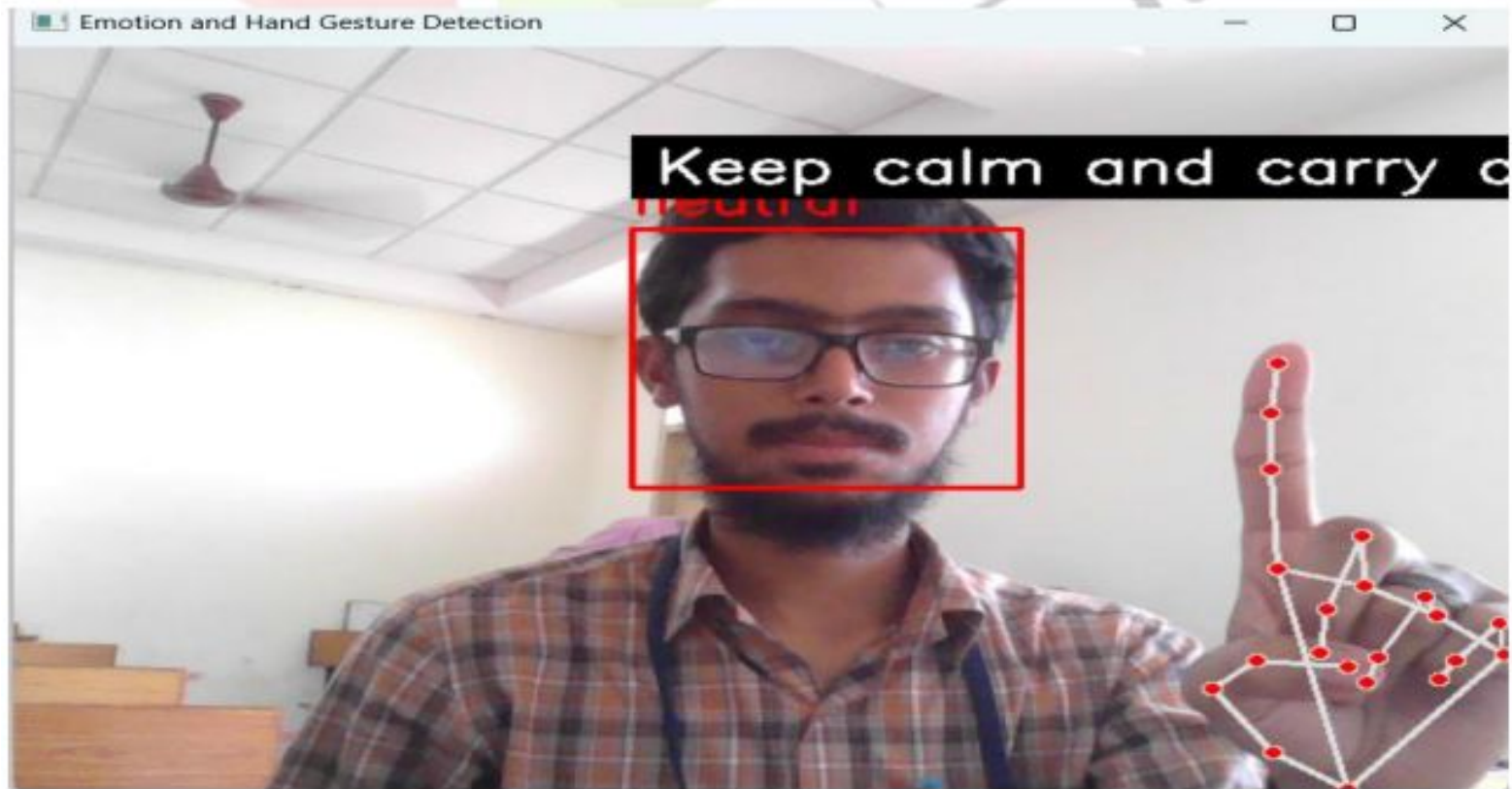


Log For User Monitoring

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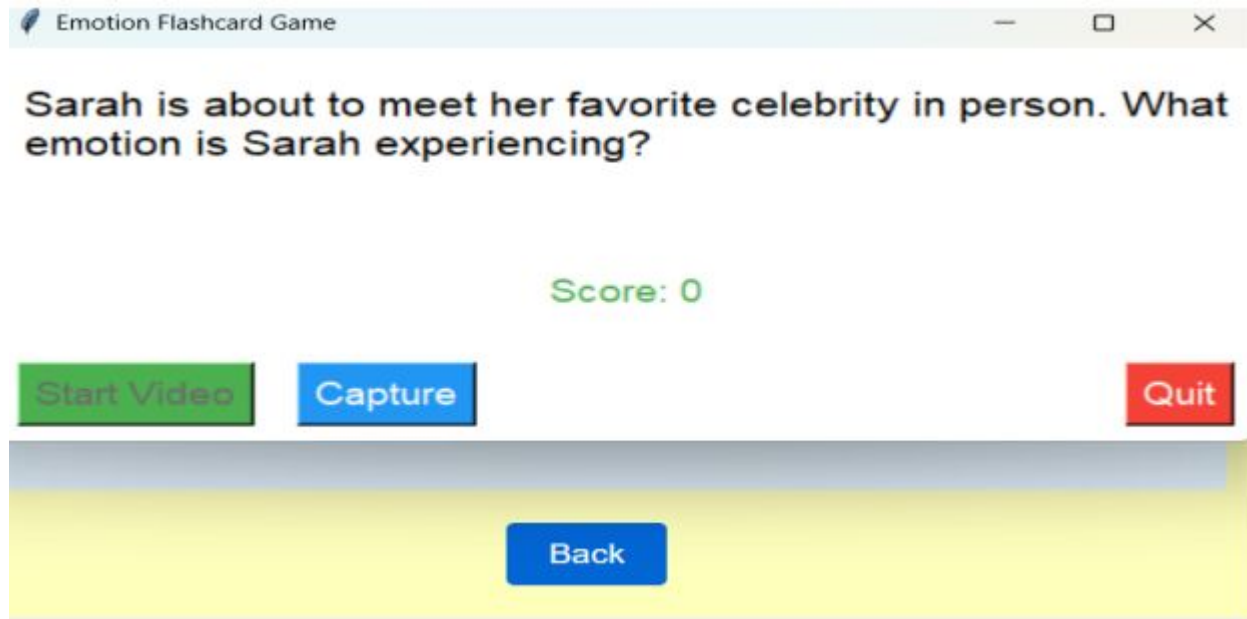
Distress Message

Gesture Recognition



Gesture Recognition with personalized feedback and emotion detection with customized songs

EmoGame



Test Case Templates

Test Case	Expected Result	Actual Result	Observation	Analysis	Output
Emotion Recognition: Happy	System recognizes "Happy"	System recognizes "Neutral"	Failed	Criteria for each emotion needs to be updated	Colour of bounding box changes + audio feedback received
Emotion Recognition: Surprised	System recognizes "Surprised"	System recognizes "Surprised"	Performed as expected	Successful	Color of bounding box changes + audio feedback received
Emotion Recognition: Sad	System recognizes "Sad"	System recognizes "Sad"	Performed as expected	Successful	Color of bounding box changes + audio feedback received + Emergency SMS received

Personalized Feedback: Happy	System recognizes "Index Finger"	System recognizes "Index Finger"	Performed as expected	Successful	None
Session Logging: Save Log	Session log saved successfully	Session log saved successfully	Performed as expected	Successful	None
Notification: Distress Alert	Sends alert for distress	Sends alert for distress	Performed as expected	Successful	None
Notification: Happy State	No alert for happy state	No alert for happy state	Performed as expected	Successful	None

REFERENCES

- Paper Name: [1] Talaat, Fatma M., et al. "Real-time facial emotion recognition model based on kernel autoencoder and convolutional neural network for autism children." *Soft Computing* (2024): 1-14.
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- Paper Name:[4] Agung, Erlangga Satrio, Achmad Pratama Rifai, and Titis Wijayanto. "Image-based facial emotion recognition using convolutional neural network on emognition dataset." *Scientific Reports* 14.1 (2024): 14429.