



International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.699

Volume 14, Issue 4, April 2025

EMOSENSE: A Video Based Mental Health Assessment

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ABSTRACT: Mental health challenges are on the rise globally, yet access to timely and accurate assessment remains limited. EMOSENSE is an innovative, video-based mental health assessment tool that leverages computer vision and machine learning to evaluate emotional and psychological states through facial expressions, micro-expressions, and behavioral cues captured in short video recordings. By analyzing real-time visual data, EMOSENSE can detect patterns linked to common mental health conditions such as depression, anxiety, and stress. This non-invasive, scalable solution aims to supplement traditional clinical evaluations, offering early detection and continuous monitoring in remote or underserved areas. The system emphasizes user privacy and ethical AI practices while providing actionable insights for healthcare providers and individuals. EMOSENSE represents a step forward in making mental health care more accessible, objective, and data-driven.

KEYWORDS: Emosense, levarges, micro-expressions, non-invasive

I.INTRODUCTION

Mental health has become a critical component of overall well-being, with conditions such as depression, anxiety, and stress affecting millions of individuals worldwide. Traditional assessment methods often rely on self-reported data or in-person evaluations by mental health professionals, which can be time-consuming, subjective, and limited by accessibility. With advancements in artificial intelligence and computer vision, there is a growing opportunity to develop innovative, non-invasive tools that can complement existing diagnostic approaches.

EMOSENSE is a video-based mental health assessment system designed to detect and evaluate emotional states using facial expressions and behavioral cues. By capturing short video inputs from users and analyzing them with machine learning algorithms, EMOSENSE identifies patterns associated with various psychological conditions. This approach enables more objective, real-time assessments that can be conducted remotely, making mental health support more accessible, especially in underserved or remote areas.

The aim of EMOSENSE is not to replace clinical diagnosis but to provide a supplementary tool that enhances early detection, monitoring, and overall mental health awareness. Through this technology, EMOSENSE seeks to bridge the gap between need and access in mental healthcare while upholding ethical standards and ensuring user privacy.

II.SYSTEM MODEL AND ASSUMPTIONS

The EMOSENSE system is designed as a modular, video-based mental health assessment tool that functions through a series of interconnected components. It begins with a user interface module, where individuals can record short video clips using a webcam or smartphone. Once the video is captured, it is passed through a preprocessing stage that ensures facial visibility, aligns facial landmarks, and adjusts lighting for consistency. The core of the system lies in the facial expression analysis engine, which uses computer vision algorithms to detect subtle facial movements such as eyebrow positioning, eye blinking, and lip motion. These features are then analyzed by an emotion recognition module powered by machine learning or deep learning models, which classify the user's emotional states—such as happiness, sadness, anger, or neutrality—across video frames.

The system then transitions into the mental health assessment layer, where emotional patterns and behavioral trends are mapped to potential indicators of mental health conditions like depression, anxiety, or stress. The analysis results are visualized and presented through a feedback and reporting module, which may include charts, risk scores, or suggestions for professional follow-up. All user data is secured by a dedicated privacy and encryption layer, ensuring that sensitive

information remains confidential. Together, these components allow EMOSENSE to provide a non-invasive, data-driven, and accessible method for emotional monitoring and early mental health support.

The design and operation of EMOSENSE are based on several key assumptions to ensure its effectiveness and reliability. First, it is assumed that users provide clear, unobstructed facial input in a well-lit environment, allowing the system to accurately detect facial landmarks and expressions. The tool also presumes user cooperation during the recording session, including facing the camera and maintaining a stable position. EMOSENSE assumes that the emotional expressions captured align with commonly recognized patterns used to train the underlying machine learning models, which may not fully account for individual, cultural, or neurodiverse variations in expression. Furthermore, the system operates under the assumption that users give informed consent for data collection, and that their devices—such as smartphones or webcams—are capable of capturing video at sufficient resolution. Finally, EMOSENSE is intended as a supportive tool rather than a clinical diagnostic system; it is assumed that users and professionals will interpret the results as indicative insights and not definitive mental health diagnoses. To ensure accurate and reliable functioning, EMOSENSE makes the assumptions:

III.EFFICIENT COMMUNICATION

Effective communication plays a crucial role in the usability and impact of the EMOSENSE system. Since the tool is designed to assist users in understanding their emotional and mental health states, it must present insights in a clear, empathetic, and accessible manner. The system uses intuitive visualizations such as emotion timelines, color-coded risk indicators, and concise summaries to help users interpret their results without requiring technical expertise. Furthermore, EMOSENSE facilitates communication between users and mental health professionals by generating structured, shareable reports that translate raw emotional data into clinically relevant observations. The system also includes built-in prompts and guidance to ensure that users are informed about the purpose of each step, their rights, and the confidentiality of their data. By fostering transparency and clarity, EMOSENSE not only enhances user trust but also ensures that emotional assessments can lead to meaningful, supportive conversations between individuals and caregivers.

IV.SECURITY

Security is a foundational pillar of the EMOSENSE system, as it handles highly sensitive user data including facial videos and emotional assessments. To ensure user privacy and data protection, EMOSENSE employs robust security mechanisms at every stage of data handling. All video data is encrypted during both transmission and storage using advanced encryption standards (e.g., AES-256), preventing unauthorized access or interception. User consent is explicitly obtained before any recording or analysis takes place, and data is anonymized where possible to safeguard personal identity. Role-based access controls restrict system access to authorized personnel only, and secure authentication protocols protect user accounts. Additionally, regular security audits and compliance with data protection regulations such as GDPR or HIPAA (depending on the region) are maintained to uphold industry standards. These measures ensure that EMOSENSE remains a trustworthy and secure platform for mental health assessment.

Security in EMOSENSE is critical due to the personal and sensitive nature of the data it processes—user facial videos, emotional profiles, and inferred mental health indicators. To protect this data, EMOSENSE implements a **multi-layered security architecture** combining secure data acquisition, encrypted storage, access control, and regulatory compliance.

1. Data Encryption

All user video inputs and analysis results are encrypted end-to-end using industry-standard protocols like AES-256 for storage and TLS/SSL for data transmission. This ensures that even if data is intercepted or accessed without authorization, it remains unreadable.

2. User Consent and Data Control

Before capturing any video or performing analysis, EMOSENSE explicitly requests user consent through clear and concise forms. Users have full control over their data, including the ability to review, export, or delete their information at any time.

Role-based access control (RBAC) is used to restrict system access. Only authenticated and authorized personnel can interact with back-end systems, and their actions are logged for traceability. Multi Factor.

- **Variability in expression**
- **Lighting and video quality**
- **User cooperation**
- **Non-diagnostic nature**

Figure 6.2: Data visualization on sentiment analysis

Volume 14, Issue 4, April 2025**|DOI: 10.15680/IJIRSET.2025.1404256|****VI.CONCLUSION**

EMOSENSE presents a novel approach to mental health assessment by leveraging video-based emotion recognition and machine learning to identify potential psychological patterns. The system provides a non-invasive, accessible, and real-time solution for emotional monitoring, particularly useful in environments where traditional mental health support is limited. Through its modular design, EMOSENSE effectively captures facial expressions, processes emotional data, and delivers meaningful insights that can aid users in understanding their mental state.

While it is not a replacement for professional diagnosis, EMOSENSE serves as a valuable supplementary tool that promotes early detection, mental health awareness, and regular emotional check-ins. The promising results in emotion recognition accuracy and user feedback indicate the system's potential impact in both clinical and non-clinical settings. Moving forward, continued model refinement, personalization, and larger-scale testing will enhance its reliability and inclusivity. Ultimately, EMOSENSE contributes to bridging the gap between mental health needs and technological innovation, making emotional care more proactive and accessible.

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