EmoJourn: A Smart Emotion Tracking and Analysis System

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ABSTRACT
Automated facial expression recognition is a growing field used in various applications like emotion-based photo labeling and video surveillance. Ekman proposed six distinct emotions covered by most datasets and cutting-edge techniques: anger, disgust, fear, happiness, sorrow, and surprise. These emotions are universal, shared by all people regardless of culture. Ekman later added more emotions like excitement and embarrassment. Researchers also study micro-expressions lasting less than half a second. Mirrors help individuals regulate feelings and communicate with themselves and others, benefiting those with social anxiety. Smart mirrors with added AI and face recognition can offer personalized features. [1]The proposed project adapts existing smart mirror technology to help stoics monitor their emotions. IoT and smart environments are increasingly incorporating automatic human emotion identification, enhancing interactions with virtual assistants like Siri and Google Assistant. Relatives and specialists can monitor a stoic's mental health through the project, aided by Google Assistant's capabilities to provide support and information. Google Assistant, with its natural language processing and machine learning algorithms, can assist stoics when they need someone to talk to, making it a valuable addition to the project. Many studies explore integrating Google Assistant with smart mirrors for enhanced functionality and support[2].

Keywords
Smart, Emotional disorder, Facial Expression, Virtual Assistant, Smart, Monitoring, Emotion Journal, Stoics, Tracking Analysis.

1. INTRODUCTION
Many people experience mental health challenges, which can affect both their own lives and those around them. These issues may lead to difficulties in daily functioning and an increased risk of self-harm. Depression, for example, is more than just feeling sad; it involves a range of symptoms such as sadness, loss of enjoyment, and thoughts of death. It can impact a person's ability to concentrate, feel hopeful, and interact with others, potentially causing distress to those close to them. Some individuals, known as stoics, may hide their emotions, preferring to deal with problems internally. However, it's essential to help them recognize and address their emotions to prevent negative outcomes. Facial expression is a powerful way to convey emotions, and technology like real-time emotion recognition systems can aid in this process. By integrating such technology into everyday objects like smart mirrors, it becomes easier to monitor and respond to emotional cues in real-time. In a proposed project, a smart mirror captures facial expressions and uses image processing to determine emotions. Depending on the detected emotion, the system provides appropriate reinforcement or support, such as motivational quotes or a virtual assistant for conversation. Additionally, a mobile application records and analyzes historical emotion data, offering insights for self-reflection or professional intervention as needed.

2. RELATED LITERATURE
Researches related to this Study were gathered data and serves as basis for the study. [2] Mental health problems can happen when people have had tough times, like bad family situations or other hard experiences. Feeling sad or lonely sometimes is okay, especially when things aren't going well. But if those sad feelings stick around for a long time and make it hard to enjoy life, it might be a sign that someone needs to see a specialist for help. [3]Mental health issues like depression, anxiety, and mood problems are common worldwide, including in the Philippines. In the Philippines, mental illness ranks as the third most prevalent disability. Studies conducted by the WHO in 2020 revealed that millions of Filipinos suffer from various mental health conditions, with depression and anxiety affecting a significant portion of the population. The Philippines has been identified as having one of the highest rates of mental health problems in the Western Pacific Region. Many of those affected in the country tend to hide their emotions or problems, often referred to as being stoic. Many individuals grapple with mental disorders, impacting their daily lives and relationships. The expression of emotions, whether positive or negative, significantly affects those around them. These mental health challenges can lead to psychosocial impairments, functional disabilities, and even pose a risk of self-harm (ICD-11, 2019). Facial expressions are a key aspect of nonverbal communication, reflecting emotions and aiding in understanding individuals' feelings. Facial expression recognition involves classifying emotions based on facial features, using patterns to determine emotional states [4]. This recognition is crucial for applications like diagnosing sadness,

identifying mental disorders, and predicting health outcomes. A study utilized deep learning algorithms to classify facial expressions, including seven universal emotions[5]. These expressions were employed to identify stoic emotions, with neutral expressions added to represent typical demeanor.

The DSM-5 outlines criteria for diagnosing depression, including symptoms like persistent exhaustion, feelings of worthlessness or guilt, hopelessness, difficulty concentrating, sleep disturbances, changes in appetite or weight, and physical restlessness or sluggishness. Emotions play a crucial role in human life, impacting both physical and mental well-being. Long-term negative emotions can contribute to depression, and understanding emotions remains a challenge despite extensive research efforts. Facial expressions are a primary means of nonverbal communication, conveying emotions and intentions [6]. Recognizing facial expressions can aid in effective communication and understanding others' emotional states. Facial expression recognition, using deep learning algorithms, has applications in diagnosing sadness, identifying mental disorders, and predicting health outcomes. The study aims to classify facial expressions, including happiness, sadness, fear, anger, surprise, disgust, and neutral, to understand emotions in stoic individuals .

3. METHODOLOGY

The proponents conducted an interview and observation for the proposed project, entitled Smart Emotion Journal for the monitoring of the stoics, The Smart Emotion Journal is designed to support individuals with limited social interactions, aiming to prevent situations that may trigger negative emotional responses. It helps stoic individuals and their families stay informed about their mental health status and potential disorders. The application can provide notifications if the user requires attention or is struggling with communication. It also tracks the user's emotions over time, fostering self-awareness and potentially enhancing relationships. This project serves as a valuable reference for future researchers with similar objectives. During the project's functional requirement phase, the project's functional requirements were meticulously ascertained by closely examining the functionalities depicted in the schematic diagram of the Smart Emotion Journal.

The first formula [1] is used for the assessment of stoic, relatives or psychologist on the system. The second formula [2] is use to consolidate all the assessment of stakeholders on the efficiency of the system.

$$\boldsymbol{Percentage} = \frac{Total\ no.of\ "yes"\ got\ in\ the\ survey}{(Total\ no.of\ questions\ x\ No.of\ Respondents)}\ x\ 100 \quad (1)$$

$$\boldsymbol{Percentage} = \frac{Stoics + Relatives + Psychologist}{3} \quad (2)$$

4. PRESENTATION OF ANALYSIS OF ` DATA

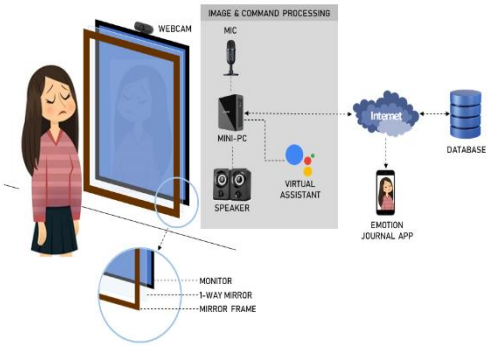

Figure 1. Operational Framework for the Proposed Project

To develop the proposed project, Smart Emotion Journal, based on the Operational Framework for the Proposed Project (see Figure 1) The proposed project incorporated several components, including a camera, mini-PC, monitor, microphone, speaker, mirror frame, and a one-way mirror. Its objective was to monitor the facial expressions of stoic individuals. The camera captured these expressions, while the mini-PC processed the images. Integration of a virtual assistant enabled communication, with the speaker facilitating the assistant's responses and the microphone serving as audio input during interactions. Integrated into the system were a high-quality one-way mirror, an LCD monitor, and a frame to support both components. This setup formed a wall-mounted mirror capable of displaying crucial information such as weather, time, date, temperature, and the stoic's emotional state, presented as a percentage.

- It can identify the registered user.
- It can recognize a stoic's emotion.
- It can identify/recognize the seven emotions (neutral, happy, angry, fear, surprise, sad, disgust).
- It can engage in conversational interactions.
- It can display the time, weather, date, and bible verse.
- It can say motivational quotes after the identification of three consecutive sad emotions.
- The mobile application can send a notification to the user when an emotion is scanned.
- It can send a warning notification when three sad emotions are identified.
- It can send critical notifications if it detects more instances of sadness within 14 days.
- The mobile journal application can allow registration with email verification login of users.
- The mobile journal application can display historical and recent emotions in a list and in a graph.

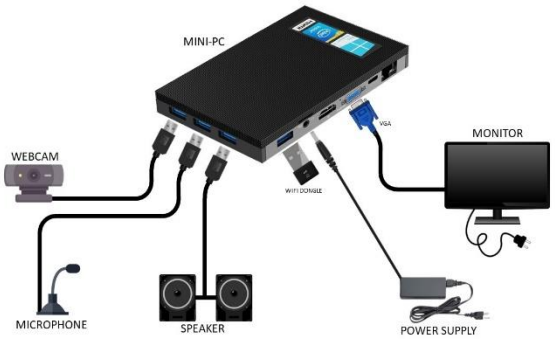

Figure 2. Schematic Diagram Smart Emotion Journal

The schematic diagram (see Figure 2) shows the connections between all the devices. the (Mini-PC) at its core. It analyzes facial expressions captured by the Webcam, while the microphone and speaker facilitate communication with the Virtual Assistant. Notably, upon detecting three consecutive emotions, the system voices motivational quotes through the speaker, offering comfort and inspiration. The monitor serves as the main display for the smart mirror, showing essential information like news and weather updates, and contributing to an immersive user experience. A 65W power supply ensures smooth operation, while the integration of a Wi-Fi dongle enables seamless wireless connectivity, reflecting the proponents' dedication to technological advancement and user convenience. The mobile application connects to Firebase via the internet, allowing the stoic's relatives and specialists to monitor them. The system is usable if the user has a mobile application and access to the internet.

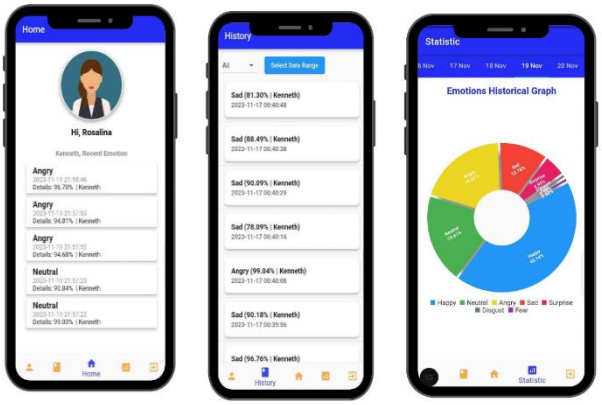

Figure 3. Mobile Application

The interface displays the stoic's most recent five emotions for quick monitoring, accompanied by their respective timestamps and dates. Each emotion is quantified with a percentage, providing a rapid and efficient overview of the Stoic's emotional states at a glance. This snapshot feature allows for swift and immediate insight into the recent emotional journey within a specific timeframe. The Smart Emotion Journal offers real-time emotional detection, with continuous updates appearing in the mobile application's history. Users can navigate the emotional journal using a search bar, enabling them to filter and review past emotional states based on various criteria like time, date, or specific emotions. This feature provides a comprehensive means for both the stoic and their guardians to monitor and comprehend emotional experiences over time. Additionally, the journal's history aids psychologists in accessing the emotional journey of their patients, facilitating effective assessment, evaluation, and provision of professional advice and psychological assessment. The application includes an Emotion Historical Graph that shows the most common emotions of the day. Each pie represents a different emotion, making it easy to see which ones were felt the most. The chart also displays the date, helping users quickly find and explore their emotions for specific days.

Figure 4. Connection of all devices in based on Schematic Diagrams

The proponents began the integration of devices into the prototype, systematically coding the system to meet all project requirements. They employed a suitable algorithm and utilized the language compatible with the Mini PC. Throughout this phase, they established a timeline for completing the incremental process and applied various project management techniques to monitor progress. Once the units were developed, the proponents conducted unit testing to ensure the proper functioning of each program component and to evaluate the system's readiness for the subsequent project phase. This phase was iterated until the system met the criteria outlined by the users. After connecting the components to the Mini PC, the proponents constructed a compartment at the rear of the mirror to accommodate all components and the microcontroller. The prototype was integrated with the mirror, with all components installed accordingly (refer to Figure 4).

Figure 5. Proponents testing the Emotion Detection

PyCharm served as the platform for uploading code and programs to the Mini PC to ensure the proper functioning of the devices, as illustrated in (see to Figure 5). This software facilitates writing, compiling, and uploading code to the Mini PC. The proponents selected PyCharm for its suitability to the project's needs and widespread usage. The code for emotion detection on the Mini PC was uploaded to verify its functionality. Subsequently, the webcam captured images after the code upload. Following emotion detection testing, the project's proponents connected the Emotion Detection

components to the Mini PC and included the necessary library for the Emotion Detection to operate effectively.

The proponents chose Visual Studio to develop the mobile app because of its user-friendly interface and tools for creating easy-to-use interfaces. The proponents found it helpful for coding because it includes features like auto-completion and color-coding for readability. Proponents used Flutter to connect the app to Firebase, which can send and store data. Flutter has built-in commands that adjust depending on the code's condition, making it easier to connect the app to a Mini PC for data transfer. All components were tested by the proponents, both hardware and software to ensure they worked properly. Before deployment, the proponents conducted a comprehensive system test to identify and fix any defects or errors. During testing, they encountered various issues such as faulty cables and software mistakes, but they swiftly addressed them to meet the project's goals. Additional testing was performed to ensure the prototype was built with minimal faults and met the project's standards. Regular testing and monitoring will help identify any future defects or errors and address them according to the project's requirements.

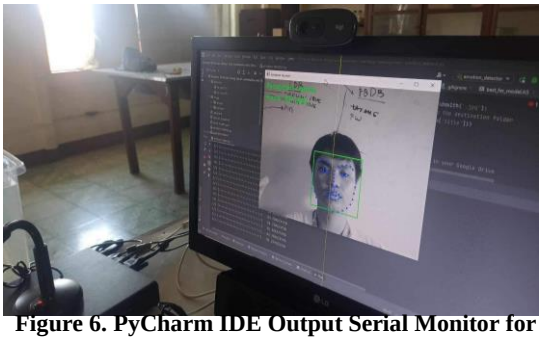

Figure 6. PyCharm IDE Output Serial Monitor for Identify Registered Face

Testing hardware and software is crucial to ensure the safety of a project for users. The project's developers conducted comprehensive testing of the entire system because identifying faults and issues before deployment is essential for ensuring system stability. Proponents executed programs to detect bugs and evaluate the accuracy of software execution (see Figure 6). The deployment phase commenced with a briefing of the project prototype to stakeholders, during which developers explained the project's functionalities to clients. Following the briefing, they proceeded to attach the prototype to the client and initialized the software for testing.

Figure 7. Prototype Testing by Stoics

The project team conducted thorough testing to ensure the functionality and reliability of both hardware and software components. Initial testing focused on facial detection to acquire key features accurately. Emotion detection was tested at a range of 1.2 meters, confirming consistent performance. The microphone's effectiveness was verified up to a signal strength of 1.4 meters. Testing then shifted to the virtual assistant, assessing its responsiveness and accuracy. Finally, the Smart Emotion Journal mobile application was extensively examined before deployment, demonstrating successful functionality and alignment with project objectives.

Figure 8. Proponents presenting the Mobile Application to Relatives

The proponents took the opportunity to provide a detailed demonstration of how the Mobile Application functioned to the relatives present. During the demonstration, they meticulously reviewed each feature of the Mobile Application, ensuring that the parents fully comprehended its operation and capabilities. This comprehensive overview aimed to equip them with a thorough understanding of how the application could benefit them and their children. (see Figure 8).

Figure 9. Proponents presenting the Mobile Application to Psychologist

During the testing of the Mobile application, facial expression detection and face recognition activate together with the

monitoring feature of the system. The user can register on the mobile application to track the stoic's emotions through historical graphs and recent emotions. The psychologist can monitor the stoic's emotions and modify the name of the stoic if there are many being monitored. The proponents also demonstrated other functionalities of the mobile app such as adding an modifying the name of the stoic and sending a critical notification if detects more than sadness within 14 days. By inputting the specific name of the stoic in the mobile app. (see Figure 9).

5. RESULT, CONCLUSIONS, AND RECOMMENDATIONS

Table 1. Stoics, Relatives, and Psychologist evaluation results.

Stoics	100 %
Relatives	100 %
Psychologist	100 %
Total	**100 %**

The survey was conducted and the proponents calculated the survey findings using the survey forms that each respondent had completed and returned. According to the calculated final survey results, the project's effectiveness level is high, at 100% (see Table 1). The survey's findings indicate that the project needs to be improved more in order to achieve greater effectiveness, including the integration of light to determine the face properly.

The Smart Emotion Journal aids stoics in avoiding triggers for adverse emotional reactions and allows relatives to monitor their emotions, fostering awareness throughout the day. Face recognition achieves a 95% recognition rate for registered stoics. However, it cannot accurately predict genuine feelings if emotions are hidden or feigned, operating solely on facial expressions. Multiple tests refined the system's accuracy, achieving rates between 85% and 99% in identifying emotions. The mobile app features historical emotion data and assists not only stoics but also relatives and psychologists, providing notifications and a virtual assistant for support. Additionally, it delivers motivational quotes for encouragement. The project acknowledges room for improvement to better assist stoics.

The project was evaluated by the stakeholders after testing and deployment, who gave it a 100% effectiveness rate. The project's supporters came to the conclusion that it has been successful in monitoring stoic's people in detecting emotions and identify the stoic's registered faces before the scanning of facial expressions. The project also succeed in integrating a virtual assistant that the person could talk to anytime. This way, the person could say what he/she felt, and the assistant could offer assistance or simply just a sense of having someone to talk to. The project's supporters came to the conclusion that there is still much work to be done before it can truly benefit the stakeholders.

The proponents recommended including a regular client to assess their potential for stoicism and to distinguish between stoic and non-stoic individuals. They also recommended enhancing mirror visibility by adding more light sources. A stable connection was crucial for ensuring smooth system operation and a reliable user experience, allowing seamless communication between system components. To minimize wait times, they proposed considering a premium account for ad-free music during virtual assistant interactions.

6. ACKNOWLEDGMENTS

We extend our heartfelt thanks to the experts who have contributed to the development of this template. Their invaluable insights, extensive knowledge, and unwavering dedication have been instrumental in shaping and refining the final product. The collaborative efforts and expertise of these professionals have ensured that the template meets the highest standards of quality and functionality.

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