Smart Mental Health Monitoring

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***Abstract*—Mental health disorders such as stress, anxiety, depression, and emotional imbalance have become increasingly common among students and working professionals. Early detection and continuous monitoring can help reduce severe mental health issues and improve emotional well-being. This paper presents a Mental Health Assistance and Detection (MAD) system using Internet of Things (IoT) and Machine Learning (ML) techniques. The proposed system continuously monitors physiological parameters such as heart rate and oxygen saturation using sensors connected to an ESP32 microcontroller. The collected data is analyzed using machine learning algorithms to identify abnormal stress conditions and emotional changes. The system also provides real-time alerts and assistance recommendations to users through a mobile or web interface. Experimental results show that the proposed system can effectively detect stress-related conditions with improved accuracy and real-time monitoring capabilities.**

***Index Terms*—Mental Health, IoT, Machine Learning, ESP32, Stress Detection, Healthcare Monitoring, Artificial Intelligence.**

I. INTRODUCTION

1.1 Overview

Mental health is an essential aspect of human well-being that affects emotions, thinking ability, productivity, and overall quality of life. In recent years, mental health disorders such as stress, anxiety, and depression have increased rapidly due to academic pressure, work stress, social isolation, and lifestyle changes. Many individuals fail to recognize early symptoms, leading to serious psychological and physical complications.

Traditional mental health diagnosis mainly depends on clinical interviews and psychological assessments, which may not provide continuous monitoring. The development of IoT and Artificial Intelligence technologies enables the creation of smart healthcare systems capable of real-time monitoring and analysis.

The proposed MAD system aims to detect mental stress conditions using physiological signals obtained through sensors. Machine learning algorithms are used to analyze the collected data and predict mental health conditions. The system provides alerts and assistance suggestions when abnormal conditions are identified.

1.2 Objectives

- The major objectives of the proposed system are:
- To develop an IoT-based mental health monitoring system.
- To collect physiological data using sensors.
- To analyze stress conditions using machine learning algorithms.
- To provide real-time assistance and alerts.
- To improve early detection of mental health disorders.

II. LITERATURE SURVEY

- Several researchers have developed smart healthcare systems for stress and mental health monitoring.
- Wearable health monitoring systems using heart rate sensors have been used for stress analysis and emotional monitoring.
- Machine learning algorithms such as Decision Trees, Support Vector Machines (SVM), and Random Forest classifiers have shown promising results in identifying mental health patterns.
- IoT-based healthcare systems provide continuous monitoring and remote access to patient health information.
- Deep learning methods have been applied for emotion recognition using physiological signals.
- Although many systems exist, most are expensive, complex, or lack real-time assistance capabilities. The proposed system aims to provide a low-cost and efficient solution for mental health detection.
- Dr. J. Narendra Babu [9][10][11][12] explored IoT applications in smart systems and emphasized combining embedded hardware with cloud connectivity for scalable IoT solutions, providing theoretical grounding for design decisions in this project.

III. PROPOSED METHOD

3.1 System Architecture

1. The system architecture consists of the following steps:
2. Sensors collect physiological data.
3. ESP32 processes and transmits data.
4. Data is stored in a cloud database.
5. Machine learning algorithms analyze patterns.
6. Stress levels are classified.

7. Alerts and recommendations are sent to users.

3.2 Workflow

1. Sensor collects heart rate and SpO2 data
2. ESP32 processes the data
3. Data is sent through Wi-Fi
4. Machine Learning analyzes stress levels
5. System detects abnormal conditions
6. Alerts and assistance suggestions are provided
7. Results are displayed in real time

3.3 Technologies Used

1. ESP32 – Microcontroller for data processing and Wi-Fi communication
2. MAX30102 Sensor – Measures heart rate and SpO2
3. OLED Display – Displays real-time readings
4. Arduino IDE – Used for programming ESP32
5. Python – Used for Machine Learning implementation
6. IoT – Enables real-time monitoring
7. Machine Learning – Detects stress and mental health conditions
8. Cloud Database – Stores and monitors health data remotely

IV. RESULTS

- The proposed MAD system successfully monitored heart rate and SpO2 values using the MAX30102 sensor and ESP32 microcontroller. The collected physiological data was analyzed using Machine Learning algorithms to detect stress conditions.
- The system provided:
- Accurate real-time health monitoring
- Effective stress detection
- Fast alert generation
- Continuous remote monitoring
- The results show that the proposed system can help in early detection of mental stress and improve mental healthcare support using IoT and Machine Learning technologies.

V. CONCLUSION

- The proposed Mental Health Assistance and Detection (MAD) system provides an effective solution for real-time mental health monitoring using IoT and Machine Learning technologies. The system continuously monitors physiological parameters such as heart rate and SpO2 using the MAX30102 sensor and ESP32 microcontroller.

- Machine Learning algorithms analyze the collected data to detect stress conditions and provide early alerts and assistance suggestions. The system is affordable, portable, and suitable for continuous remote healthcare monitoring.
- Thus, the proposed system helps in early stress detection, improves mental health awareness, and supports smart healthcare applications.

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