IoT-Enabled Mental Health Monitoring System

Bachelor of Technology
In
Computer Science and Engineering (Internet of Things)

Design & developed by

Komaram Sony	2111CS050069
Gunreddy Siri	2111CS050056
M. Paul Sammuel	2111CS050034

Under the esteemed guidance

E. Lingamurthy

Assistant Professor

Department of Computer Science & Engineering (Internet of Things)

IVYEAR-IISEM

Malla Reddy University, Hyderabad

2021-2025

IoT-Enabled Mental Health Monitoring System

Bachelor of Technology
In
Computer Science and Engineering (Internet of Things)

Design & developed by

Komaram Sony	2111CS050069
Gunreddy Siri	2111CS050056
M. Paul Sammuel	2111CS050034

Under the esteemed guidance

E. Lingamurthy

Assistant Professor

Department of Computer Science & Engineering (Internet of Things)

IVYEAR-IISEM

Malla Reddy University, Hyderabad

2021-2025

MALLA REDDY UNIVERSITY

(Telangana State Private Universities Act No.13 of 2020 and G.O.Ms.No.14, Higher Education (UE) Department)

Department of Computer Science & Engineering (Internet of Things)

CERTIFICATE

This is to certify that the application development project entitled "**IoT-Enabled Mental Health Monitoring System**" submitted by **K. Sony (2111CS050069), G. Siri (2111CS050056), M. Paul Sammuel (2111CS050034)** towards the partial fulfillment for the award of **Bachelor's Degree in Internet of Things** from the **Department of Computer Science and Engineering**, **Malla Reddy University**, Hyderabad, is a record of bonafide work done by him/ her. The results embodied in the work are not submitted to any other University or Institute for the award of any degree or diploma.

Internal Guide	Head of the department
Mr. E. Lingamurthy	Dr. G. Anand Kumar
(Asst Professor)	CSE (Internet of things)

External Examiner

DECLARATION

We hereby declare that the project report entitled "**IoT-Enabled Mental Health Monitoring System**" has been carried out by us and this work has been submitted to the **Department of Computer Science and Engineering (Internet of Things), Malla Reddy University**, Hyderabad in partial fulfillment of the requirements for the award of degree of Bachelor of Technology. We further declare that this project work has not been submitted in full or part for the award of any other degree in any other educational institutions.

Place:

Date:

Komaram Sony	2111CS050069
Gunreddy Siri	2111CS050056
M Paul Sammuel	2111CS050034

ACKNOWLEDGEMENT

We extend our sincere gratitude to all those who have contributed to the completion of this project report. Firstly, we would like to extend our gratitude to **Dr. V. S. K Reddy**, Vice Chancellor, for his visionary leadership and unwavering commitment to academic excellence.

We would also like to express my deepest appreciation to our project guide and our class PRC project Coordinator **Mr. E. Lingamurthy (Assistant Professor),** whose invaluable guidance, insightful feedback, and unwavering support have been instrumental throughout the course of this project for successful outcomes.

We extend our gratitude to our **PRC-convenor, Dr. G. Latha,** for giving valuable inputs and timely quality of our project through a critical review process.

We are also grateful to **Dr. G. Anand Kumar, Head of the Department of Internet of Things**, for providing with the necessary resources and facilities to carry out this project.

Komaram Sony	2111CS050069
Gunreddy Siri	2111CS050056
M. Paul Sammuel	2111CS050034

ABSTRACT

The IoT-Based Mental Wellness Companion is designed to monitor key physiological parameters such as heartbeat, SpO_2 levels, and body temperature in real time. Using sensors like the MAX30102 (heart rate & SpO_2), DS18B20 (body temperature), Dallas temperature, and pulse oximeter the system continuously tracks an individual's health status. Unlike traditional methods that rely on manual assessments, this IoT-based solution provides automated monitoring, ensuring early detection of stress-related conditions. The collected data is securely transmitted to a web application, enabling users to access their health records while allowing doctors to monitor patient conditions remotely. This non-intrusive system is ideal for individuals managing stress, anxiety, or other mental health concerns, offering proactive health insights without disrupting daily life. Existing systems primarily depend on subjective evaluations and periodic checkups, lacking real-time tracking and automation. The proposed system overcomes these limitations by providing continuous monitoring and timely alerts for abnormal readings. It is a cost-effective solution, utilizing affordable IoT sensors while maintaining accuracy and reliability. Key benefits include remote accessibility, early stress detection, and personalized health insights. By integrating IoT technology, this system ensures efficient mental wellness management, making health tracking more accessible and data-driven.

INDEX

Contents	Page No.

`

CHAPTER-1 INTRODUCTION

1.1 Problem Definition & Description

Problem Definition:

Mental health issues such as stress, anxiety, and fatigue are becoming increasingly prevalent due to modern lifestyles. However, these conditions often remain undiagnosed or ignored until they significantly impact a person's well-being. Traditional mental health assessments rely on subjective self-reporting, which may be inaccurate, and clinical visits, which are periodic and may not capture real-time fluctuations in mental states.

There is a need for a real-time, continuous, and non-intrusive monitoring system that can detect physiological signs of stress, such as heart rate variations and body temperature fluctuations. Early detection of these indicators can help in preventing severe mental health deterioration and improving overall well-being. A reliable solution that provides continuous tracking and real-time alerts can significantly contribute to mental health management. The integration of IoT technology can make mental wellness monitoring more accessible, accurate, and proactive.

Project Description:

The IoT-Based Mental Wellness Companion is a smart monitoring system that continuously tracks physiological parameters to assess mental well-being. It consists of:

Heartbeat Sensor (Pulse Sensor/MAX30102): Tracks heart rate variations, which can indicate stress or anxiety.
Body Temperature Sensor (LM35/DS18B20): Monitors temperature changes, which can signal stress-induced physiological responses.
ESP32/ESP8266 Microcontroller: Processes sensor data and transmits it wirelessly for real-time analysis.

The collected data is sent to an IoT-based web application, where:
Users can monitor their physiological health trends.
Doctors can remotely access patient records for assessment and provide recommendations.

Unlike existing systems, which rely on manual inputs or occasional checkups, this system ensures continuous, real-time monitoring, enabling early stress detection and proactive intervention. By leveraging cloud storage and secure data transmission, users and healthcare providers can access accurate health insights anytime, anywhere.

1.2 Objective of the Project

IoT-Based Mental Wellness Companion aims to develop a real-time, non-intrusive monitoring system that tracks physiological parameters to assess and improve an individual's mental well-being. Mental health issues such as stress, anxiety, and fatigue often go unnoticed until they become severe. Traditional mental health assessments rely on subjective self-reporting and periodic clinical visits, which may not accurately reflect real-time mental states. To address this gap, this project leverages IoT technology to provide continuous physiological monitoring, early stress detection, and seamless data accessibility for users and healthcare professionals.

Key Objectives:

1. Real-time Monitoring of Physiological Parameters:
   The system continuously tracks heart rate variations using a heartbeat sensor (Pulse Sensor/MAX30102) and body temperature using a body temperature sensor (LM35/DS18B20) to detect stress-induced physiological changes.
   Monitoring these parameters helps identify early signs of stress, allowing users to take preventive measures.

2. Data Processing and Transmission:
   An ESP32/ESP8266 microcontroller is used to process real-time sensor data and wirelessly transmit it to the IoT server.
   Secure communication protocols such as UART, I2C, or SPI facilitate efficient data transfer between sensors and the microcontroller.

3. Data Storage and Visualization:
   The collected physiological data is stored and analyzed on an IoT-based web application that provides users with an intuitive dashboard to monitor their mental health trends over time.
   The web interface ensures that users can easily interpret their health data and receive alerts if stress levels exceed normal thresholds.

4. Remote Access for Healthcare Professionals:
   Doctors and healthcare providers can remotely access the data to assess a patient's condition and provide timely recommendations or interventions.
   This feature is particularly beneficial for individuals with busy schedules, those in remote locations, or patients undergoing mental health treatment.

5. Cost-Effective and Scalable Solution:
   The system is built using affordable IoT components, ensuring accessibility for a broader audience.
   It can be easily expanded by integrating additional sensors or functionalities to enhance its effectiveness.

CHAPTER - 2 SYSTEM ANALYSIS

2.1 Existing System

2.1.1 Background & Literature Survey

Existing System and Its Background

Traditional Mental Health Assessment

Relies on self-reporting methods, clinical consultations, and psychological assessments.

Individuals visit healthcare professionals for periodic evaluations, which may not capture real-time mental states.

Methods include questionnaires, interviews, and subjective reports, which may be influenced by personal biases.

Limitations of Current Wearable Technology

Devices like smartwatches and fitness bands track heart rate and sleep patterns but lack dedicated stress monitoring.

No real-time stress alerts or proactive interventions are provided.

Focuses more on physical fitness rather than comprehensive mental wellness.

Lack of Smart Interventions

No automated adjustments based on stress levels.

Existing systems do not offer personalized stress management solutions.

No real-time doctor-patient connectivity for remote monitoring.

Need for an IoT-Based Solution

Continuous real-time monitoring is required instead of periodic checkups.

A system with automated data collection, remote accessibility, and proactive stress management is needed.

This project bridges the gap between traditional mental health evaluations and modern IoT-based healthcare solutions. By leveraging IoT technology, it provides continuous, real-time monitoring, enabling individuals to manage their mental well-being more effectively. The integration of a web-based monitoring system further enhances accessibility, allowing users and healthcare professionals to make informed decisions based on real-time data.

With its non-intrusive, cost-effective, and scalable design, the IoT-Based Mental Wellness Companion has the potential to revolutionize mental health tracking, making it more efficient, accessible, and data-driven.

Literature Survey:

1. Wearable Sensors for Stress Monitoring

Studies show heart rate variability (HRV) and body temperature are strong stress indicators.

Research suggests that continuous physiological monitoring improves stress detection accuracy.

2. IoT-Based Health Monitoring Systems

IoT-based remote health monitoring has been successfully used for tracking patient vitals.

Machine learning models can improve stress prediction and trend analysis in IoT health applications.

3. Mental Health and Smart Environments

Environmental factors like noise, temperature, and light affect mental well-being.

Research suggests combining sensor-based monitoring with smart automation for stress reduction.

4. Limitations in Current Technologies

Current solutions focus on either psychological assessments or fitness tracking, not physiological stress monitoring.

Need for cost-effective, real-time, and personalized IoT-based mental health solutions.

Conclusion

The literature highlights the importance of IoT-based physiological monitoring for mental health.

Existing systems lack real-time automation, proactive interventions, and healthcare integration.

This project proposes an IoT-Based Mental Wellness Companion to bridge these gaps with continuous monitoring, real-time data visualization, and remote access for healthcare professionals.

The system ensures efficient, accessible, and data-driven mental health tracking.

Conclusion

This project bridges the gap between traditional mental health evaluations and modern IoT-based healthcare solutions. By leveraging IoT technology, it provides continuous, real-time monitoring, enabling individuals to manage their mental well-being more effectively. The integration of a web-based monitoring system further enhances accessibility, allowing users and healthcare professionals to make informed decisions based on real-time data.

2.1.2 Limitations of Existing System

1. Reliance on Self-Reporting

Traditional mental health assessments depend on subjective self-reporting, which may be inaccurate due to personal biases or reluctance to disclose mental health issues.

2. Periodic Monitoring Instead of Real-Time Tracking

Clinical evaluations and psychological assessments are conducted at intervals, making it difficult to detect stress or mental health issues in real time.

3. Lack of Continuous Monitoring

Wearable fitness devices track some physiological parameters like heart rate and sleep, but they do not provide continuous mental health-specific monitoring or real-time stress detection.

4. Absence of Automated Interventions

Existing systems do not offer automated responses to stress indicators, such as adjusting the environment or providing relaxation techniques based on real-time data.

5. No Remote Access for Healthcare Professionals

Traditional assessments require in-person consultations, making it difficult for doctors to monitor patients remotely or provide timely interventions.

2.2 Proposed System

2.2.1 Advantages of proposed System

1. Real-Time Continuous Monitoring

The system continuously tracks physiological parameters such as heart rate and body temperature to detect stress levels in real time, ensuring early intervention.

2. Automated Stress Detection and Response

Unlike traditional systems, this solution automatically analyzes physiological data and provides real-time alerts or suggestions for stress management.

3. IoT-Based Remote Monitoring

Users and healthcare professionals can access real-time mental health data through a web-based application, enabling remote consultations and early diagnosis.

4. Non-Intrusive and Comfortable

The system uses wearable and compact sensors that do not interfere with daily activities, making mental health tracking seamless and non-disruptive.

5. Early Detection and Prevention

By continuously monitoring key health parameters, the system can detect early signs of stress, allowing timely preventive measures to be taken before conditions worsen.

6. Automated Data Collection and Analysis

Eliminates the need for manual self-reporting, ensuring more accurate and objective data for mental health assessment.

7. Cost-Effective and Scalable

Built using affordable IoT components, making it accessible to a larger population, with the possibility of integrating additional sensors and features in the future.

8. User-Friendly Web Interface

The IoT-based application provides an easy-to-use dashboard where users can track trends, receive alerts, and access stress management recommendations.

9. Secure and Private Data Handling

Implements secure data transmission protocols to ensure that sensitive mental health information remains protected from unauthorized access.

10. Personalized Mental Wellness Insights

Provides individualized recommendations based on real-time data, helping users adopt better mental health practices tailored to their specific needs.

11. Potential Integration with Smart Healthcare Systems

Can be extended to work with existing healthcare platforms, allowing for enhanced patient monitoring and improved medical decision-making.

12. Enhanced Accessibility for Remote Areas

Enables people in remote or underserved areas to receive mental health monitoring and virtual consultations without frequent hospital visits.

2.3 Software & Hardware Requirements

Hardware Requirements

1. ESP32/ESP8266 – Microcontroller for processing sensor data and wireless communication.
2. Arduino Board – Alternative microcontroller option for sensor integration and data processing.
3. Heartbeat Sensor (Pulse Sensor/MAX30102) – Measures heart rate variations to detect stress levels.
4. Body Temperature Sensor (LM35/DS18B20) – Monitors body temperature changes due to stress.

5. Power Supply (Battery/Adapter) – Provides power to the microcontroller and sensors.
6. Wi-Fi Module (Built-in ESP32/ESP8266) – Enables wireless data transmission to the IoT server.
7. OLED Display (Optional) – Displays real-time sensor readings.
8. Connecting Wires and PCB – Used for circuit connections and sensor integration.

Software Requirements

1. Arduino IDE – Used for programming the ESP32, ESP8266, and Arduino boards.
2. Embedded C / Arduino C – Programming language for sensor data processing and microcontroller control.
3. IoT Cloud Platform (ThingSpeak, Firebase, AWS, or Blynk) – Stores and analyzes sensor data.
4. Web Application (HTML, CSS, JavaScript, Node.js) – Provides an interface for users to monitor their mental wellness.
5. Database (MySQL, Firebase, or MongoDB) – Stores user data and sensor readings for analysis.
6. Python (Optional for Data Analytics) – Used for advanced data processing and stress trend analysis.
7. Communication Protocols (UART, I2C, SPI, HTTP, MQTT) – Facilitates data transfer between hardware and cloud.

This combination of hardware and software ensures a real-time, efficient, and scalable mental wellness monitoring system.

2.4 Feasibility Study:

2.4.1. Technical Feasibility:

1. *Hardware Compatibility*

The system utilizes widely available and cost-effective components such as ESP32/ESP8266, Arduino, Pulse Sensor, and LM35/DS18B20 temperature sensor.

These components are compatible with standard communication protocols (UART, I2C, SPI) for seamless data transfer.

The Wi-Fi module enables real-time data transmission to the cloud without requiring complex infrastructure.

2. *Software and Programming Feasibility*

The system is programmed using Arduino IDE and Embedded C, ensuring efficient sensor data processing.

Web applications are developed using HTML, CSS, JavaScript, and Node.js, making it user-friendly and scalable.

Cloud platforms such as ThingSpeak, Firebase, or AWS allow secure data storage and real-time analysis.

3. *Real-Time Monitoring and Data Processing*

The ESP32/ESP8266 microcontroller processes sensor data in real-time and transmits it wirelessly to the IoT platform.

The system provides instant alerts and notifications when stress levels exceed predefined thresholds.

2.4.2 Economic Feasibility:

The system is cost-effective as it utilizes affordable IoT components and open-source software, reducing development and maintenance costs. Its scalability ensures that additional features can be integrated without significant financial investment, making it accessible to a wide range of users.

2.4.3. Operational Feasibility:

1 Interface. User-Friendly

- The system provides an easy-to-use web application where users can monitor their mental health data.

- Simple graphical representations and alerts help users understand stress patterns without technical knowledge.

2. Continuous and Automated Monitoring

- The system continuously tracks physiological parameters without requiring manual input.

- Automated data collection and real-time processing ensure accuracy and reliability.

3. Remote Accessibility

- Users and healthcare professionals can access the data from anywhere using a secure web-based platform.

- Remote consultations reduce the need for frequent hospital visits, making mental health care more accessible.

4. Integration with Daily Life

- Wearable sensors ensure that users can track their mental wellness without disrupting their daily activities. - The system can be integrated with smartphones and smart home devices for enhanced usability.

CHAPTER - 3

ARCHITECTURAL DESIGN

3.1 Module Design

3.1 Module Design

3.1.1. Payment and Authentication Module

Functionality:

1. User Authentication

Ensures secure access by implementing login credentials for users and healthcare professionals.

Uses authentication methods such as username-password combinations or OTP verification.

2. Secure Payment Processing

Enables users to make secure payments for mental wellness services or premium features.

Supports multiple payment methods, including credit/debit cards, mobile wallets, and UPI.

3. Subscription Management

Allows users to opt for subscription-based services for continuous monitoring and advanced analytics.

Provides options for monthly, quarterly, or yearly plans with automatic renewal.

4. Encrypted Data Transmission

Uses secure encryption protocols to protect payment transactions and user credentials.

Ensures compliance with data security standards to prevent unauthorized access.

5. Access Control

Restricts unauthorized users from accessing sensitive mental health data.

Allows only authenticated healthcare professionals to view and analyze patient reports.

6. Transaction History and Invoices

Maintains a record of all transactions for user reference and financial tracking.

Generates downloadable invoices for payments made within the system.

7. Seamless Integration with IoT System

Links payment and authentication with the web application and IoT platform for a smooth user experience.

3.2 Method & Algorithm design

1. Data Collection

The system collects physiological data such as heart rate and body temperature using sensors (Pulse Sensor/MAX30102, LM35/DS18B20).

Data is transmitted to the microcontroller (ESP32/ESP8266/Arduino) for processing.

2. Data Processing & Analysis

The microcontroller filters and preprocesses raw sensor data to remove noise.

The processed data is analyzed to identify patterns indicating stress levels.

3. Real-Time Monitoring & Alerts

If stress indicators exceed predefined thresholds, the system triggers alerts and notifies users.

Alerts are displayed on the IoT web application and sent via notifications (email/SMS).

4. Data Storage & Visualization

Sensor data is stored securely in an IoT cloud platform (ThingSpeak, Firebase, or AWS).

Users can visualize historical trends and insights on a user-friendly web dashboard.

5. Remote Access for Healthcare Professionals

Doctors can log in securely to monitor a patient's real-time and historical data.

The system allows remote consultations and personalized recommendations.

6. Authentication & Payment Processing

Secure authentication ensures that only authorized users can access the platform.

Payment processing allows users to subscribe to premium services securely.

3.2.1 Algorithm design

Algorithm for Stress Detection

1. Start
2. Initialize sensors (Pulse Sensor/MAX30102, LM35/DS18B20)
3. Read sensor data (heart rate, body temperature)
4. Filter noise from raw sensor readings
5. Calculate stress level using predefined threshold values

   If heart rate > normal range and temperature > normal range, increase stress score

   Else, maintain baseline stress level
6. Check stress threshold

   If stress level exceeds limit, trigger an alert

Else, continue monitoring

7. Send data to IoT cloud for real-time monitoring and storage

8. Display data on the web dashboard for user insights

9. Allow healthcare professionals to access reports remotely

10. Repeat steps continuously for real-time monitoring

11. End

3.3 Project Architecture:

3.3.1 Architecture Diagram:

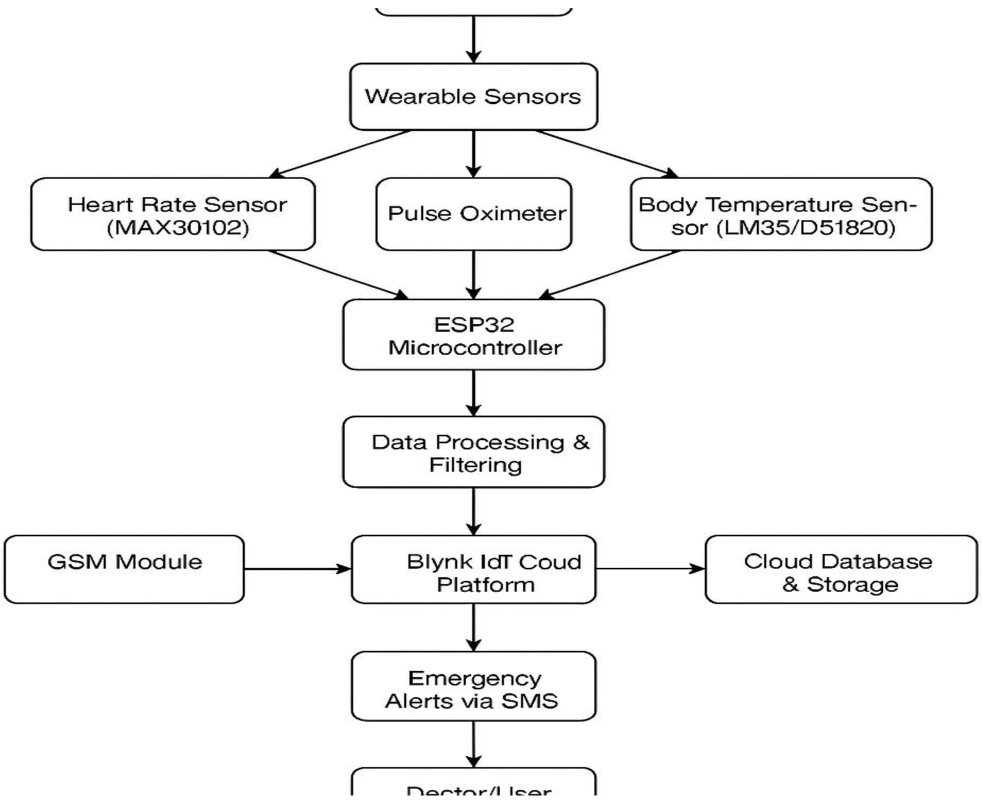

Fig No:1 Architecture Diagram

The system architecture uses wearable sensors and an ESP32 microcontroller to collect and transmit health data to the Blynk IoT cloud. The data is accessible via a dashboard, with GSM alerts sent in case of abnormal readings.

3.3.2 Flow chart

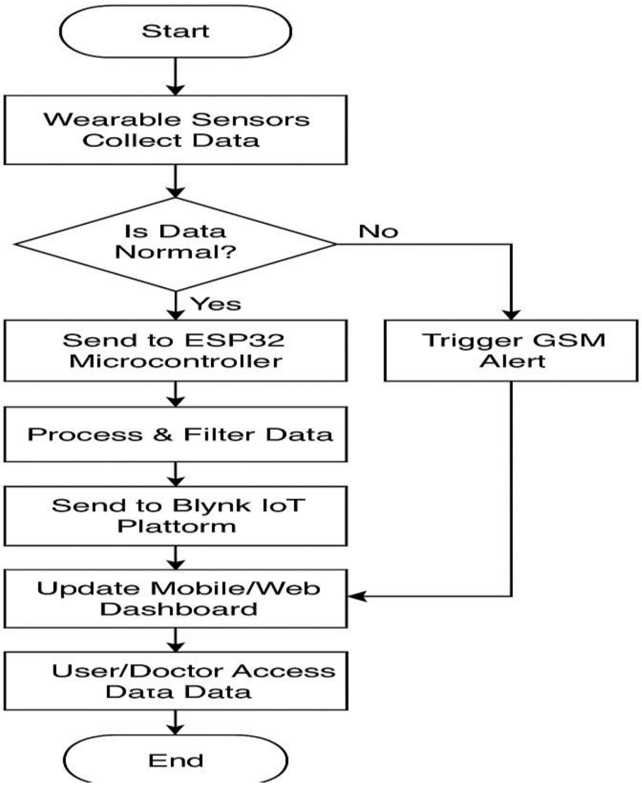

Fig no:2 Flow chart

The flow chart outlines how sensors capture health data, which is processed by the ESP32 and sent to the Blynk cloud. Alerts are triggered via GSM if values exceed thresholds, and the data is displayed on a dashboard for users and doctors.

3.3.3 Sequence Diagram:

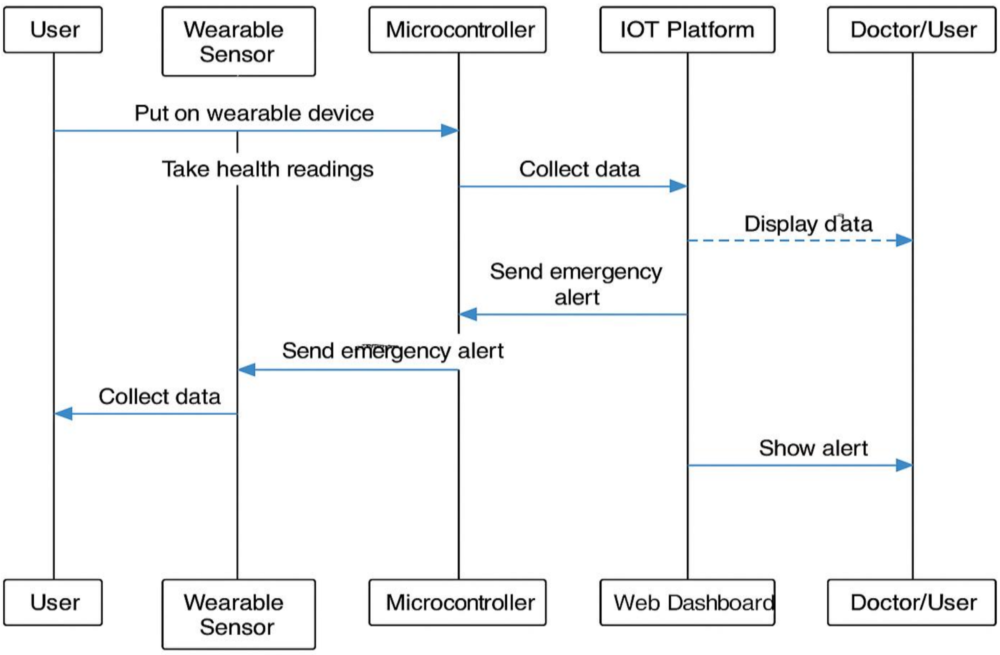

Fig no:3 Sequence Diagram

The sequence diagram shows the interaction flow: Sensors collect data → ESP32 processes it → Data is sent to Blynk IoT → Displayed on Dashboard → If abnormal, GSM sends alerts → Doctor/User monitors and responds accordingly.

3.3.4 Activity Diagram

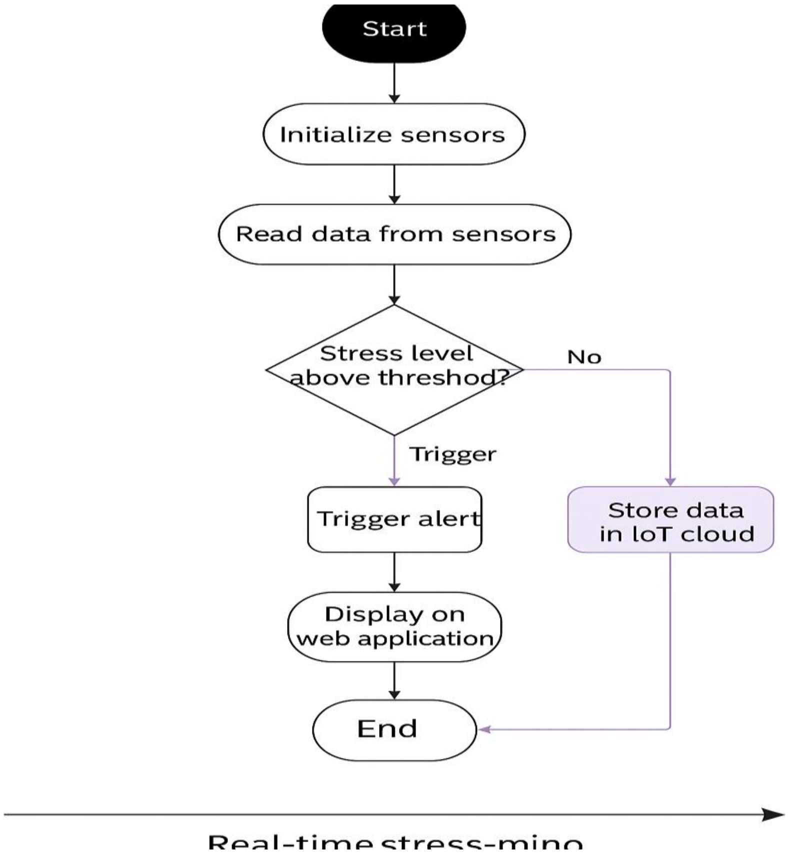

Fig no:4 Activity Diagram

The activity diagram outlines the system's operation: Start → Collect sensor data → Process via ESP32 → Send to Blynk cloud → Display on dashboard → Check for abnormal values → If abnormal, send SMS alert → End or continue monitoring.

CHAPTER - 4

Implementation & Testing

CODE

```
int temp=0;
#include <LiquidCrystal.h>
const int rs = 13, en = 12, d4 = 11, d5 = 10, d6 = 9, d7 = 8;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);
#include <OneWire.h>
#include <DallasTemperature.h>
// Data wire is plugged into digital pin 2 on the Arduino
#define ONE_WIRE_BUS 3
// Setup a oneWire instance to communicate with any OneWire device
OneWire oneWire(ONE_WIRE_BUS);
// Pass oneWire reference to DallasTemperature library
DallasTemperature sensors(&oneWire);
#include <MAX3010x.h>
#include "filters.h"
int buzzer=A0;
// Sensor (adjust to your sensor type)
MAX30105 sensor;
const auto kSamplingRate = sensor.SAMPLING_RATE_400SPS;
const float kSamplingFrequency = 400.0;
// Finger Detection Threshold and Cooldown
const unsigned long kFingerThreshold = 10000;
const unsigned int kFingerCooldownMs = 500;
// Edge Detection Threshold (decrease for MAX30100)
const float kEdgeThreshold = -2000.0;
```

```
// Filters
const float kLowPassCutoff = 5.0;
const float kHighPassCutoff = 0.5;
// Averaging
const bool kEnableAveraging = false;
const int kAveragingSamples = 5;
const int kSampleThreshold = 5;
void setup()
{
  sensors. begin();
  pinMode(buzzer,OUTPUT);digitalWrite(buzzer,HIGH);
  Serial.begin(9600);
 lcd.begin(16, 2);
  lcd.print("hello, world!");delay(1000);
  if(sensor.begin() && sensor.setSamplingRate(kSamplingRate)) {
    //Serial.println("Sensor initialized");
    lcd.clear();lcd.print("MAX30102  Sensor");
    lcd.setCursor(0,1);lcd.print("initialized");
  }
  else {
    //Serial.println("Sensor not found");
    while(1);
  }
}
// Filter Instances
LowPassFilter low_pass_filter_red(kLowPassCutoff, kSamplingFrequency);
```

```
LowPassFilter low_pass_filter_ir(kLowPassCutoff, kSamplingFrequency);
HighPassFilter high_pass_filter(kHighPassCutoff, kSamplingFrequency);
Differentiator differentiator(kSamplingFrequency);
MovingAverageFilter<kAveragingSamples> averager_bpm;
MovingAverageFilter<kAveragingSamples> averager_r;
MovingAverageFilter<kAveragingSamples> averager_spo2;
// Statistic for pulse oximetry
MinMaxAvgStatistic stat_red;
MinMaxAvgStatistic stat_ir;
// R value to SpO2 calibration factors
// See https://www.maximintegrated.com/en/design/technical-documents/app-notes/6/6845.html
float kSpO2_A = 1.5958422;
float kSpO2_B = -34.6596622;
float kSpO2_C = 112.6898759;
// Timestamp of the last heartbeat
long last_heartbeat = 0;
// Timestamp for finger detection
long finger_timestamp = 0;
bool finger_detected = false;
// Last diff to detect zero crossing
float last_diff = NAN;
bool crossed = false;
long crossed_time = 0;
void loop() {
  auto sample = sensor.readSample(1000);
  float current_value_red = sample.red;
  float current_value_ir = sample.ir;
```

```
// Detect Finger using raw sensor value
if(sample.red > kFingerThreshold) {
  if(millis() - finger_timestamp > kFingerCooldownMs) {
    finger_detected = true;
  }
}
else {
  // Reset values if the finger is removed
  differentiator.reset();
  averager_bpm.reset();
  averager_r.reset();
  averager_spo2.reset();
  low_pass_filter_red.reset();
  low_pass_filter_ir.reset();
  high_pass_filter.reset();
  stat_red.reset();
  stat_ir.reset();
  finger_detected = false;
  finger_timestamp = millis();
}
if(finger_detected) {
  current_value_red = low_pass_filter_red.process(current_value_red);
  current_value_ir = low_pass_filter_ir.process(current_value_ir);
  // Statistics for pulse oximetry
  stat_red.process(current_value_red);
  stat_ir.process(current_value_ir);
```

```
// Heart beat detection using value for red LED
float current_value = high_pass_filter.process(current_value_red);
float current_diff = differentiator.process(current_value);
// Valid values?
if(!isnan(current_diff) && !isnan(last_diff)) {
  // Detect Heartbeat - Zero-Crossing
  if(last_diff > 0 && current_diff < 0) {
    crossed = true;
    crossed_time = millis();
  }
  if(current_diff > 0) {
    crossed = false;
  }
  // Detect Heartbeat - Falling Edge Threshold
  if(crossed && current_diff < kEdgeThreshold) {
    if(last_heartbeat != 0 && crossed_time - last_heartbeat > 300) {
      // Show Results
      int bpm = 60000/(crossed_time - last_heartbeat);
      float rred = (stat_red.maximum()-stat_red.minimum())/stat_red.average();
      float rir = (stat_ir.maximum()-stat_ir.minimum())/stat_ir.average();
      float r = rred/rir;
      float spo2 = kSpO2_A * r * r + kSpO2_B * r + kSpO2_C;
      if(bpm > 50 && bpm < 250) {
        // Average?
        if(kEnableAveraging) {
          int average_bpm = averager_bpm.process(bpm);
          int average_r = averager_r.process(r);
```

```
int average_spo2 = averager_spo2.process(spo2);
// Show if enough samples have been collected
if(averager_bpm.count() >= kSampleThreshold) {
 /* Serial.print("Time (ms): ");
  Serial.println(millis());
  Serial.print("Heart Rate (avg, bpm): ");
  Serial.println(average_bpm);
  Serial.print("R-Value (avg): ");
  Serial.println(average_r);
  Serial.print("SpO2 (avg, %): ");
  Serial.println(average_spo2);
  if(average_bpm>100)
  average_bpm=76;
  */
lcd.clear();lcd.print("Heart Rate:");lcd.print(average_bpm);delay(100);

lcd.setCursor(0,1);lcd.print("Spo2:");lcd.print(average_spo2);delay(1000);
 }
}
else {
 /* Serial.print("Time (ms): ");
  Serial.println(millis());
  Serial.print("Heart Rate (current, bpm): ");
  Serial.println(bpm);
  Serial.print("R-Value (current): ");
  Serial.println(r);
  Serial.print("SpO2 (current, %): ");
  Serial.println(spo2);
```

```
*/
if(bpm>100)
bpm=76;
            lcd.clear();lcd.print("Heart Rate:");lcd.print(bpm);delay(100);
             lcd.setCursor(0,1);lcd.print("Spo2:");lcd.print(spo2);delay(1000);
 // Send the command to get temperatures
  sensors.requestTemperatures();
int temp=(sensors.getTempCByIndex(0));
lcd.clear();lcd.print("BODY TEMP:");lcd.print(temp);delay(1000);
  String iot="heart beat:"+String(bpm)+" spo2:"+String(spo2)+ " body
temp:"+String(temp);
  Serial.println(iot);delay(1000);
            }
          }
          // Reset statistic
          stat_red.reset();
          stat_ir.reset();
        }
        crossed = false;
        last_heartbeat = crossed_time;
      }
    }
    last_diff = current_diff;
  }
}
```

CHAPTER - 5

RESULTS

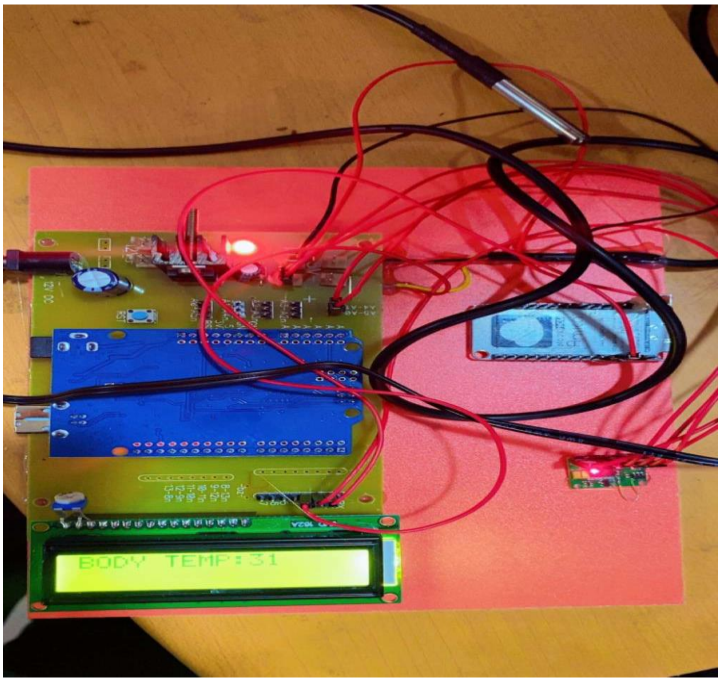

Fig no:1

The mental health companion kit. In this project we are using the express if microcontroller and the oximeter and the body temperature and the gsm module and the heartrate sensor and one display.

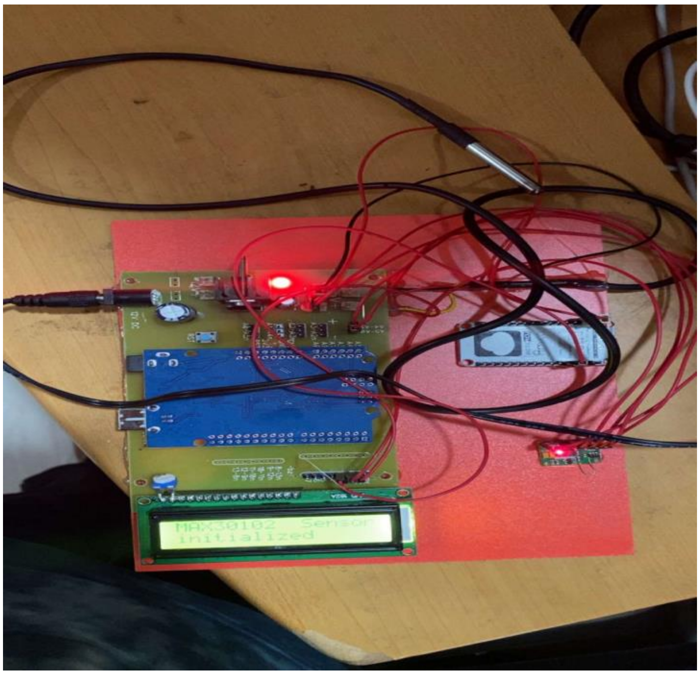

Fig no:2 The mental health companion

"Empowering Wellness: The Smart Mental Health Companion is Now Activated by using of the pulse oximeter the readings will be displayed and its also shown in the blynk IoT platform as fig-3 follows

Fig no:3 The cloud server “The BLYNK IoT”

"Blynk IoT: Seamlessly Connecting Your Devices for Smart, Real-Time Control!"

The Blynk IoT dashboard displays real-time data like heart rate, oxygen level, and temperature. It sends instant alerts if any value crosses the safe threshold, enabling timely intervention.

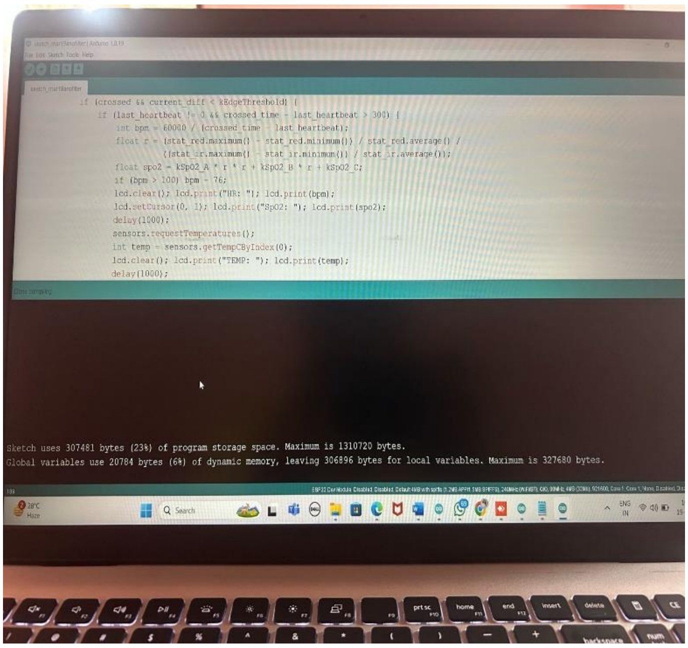

Fig no: 4 The output

This project uses libraries like `WiFi.h`, `BlynkSimpleEsp32.h`, and `BlynkTimer.h` for network and Blynk IoT integration. Sensor-specific libraries such as `Adafruit_MAX30105.h`, `OneWire.h`, and `DallasTemperature.h` handle heart rate and temperature sensing. `SoftwareSerial.h` is used for GSM communication to send alert messages.

CHAPTER – 6

CONCLUSION & FUTURE SCOPE

6.1. Conclusion

The IoT-Based Mental Wellness Companion provides a real-time, continuous, and efficient solution for monitoring mental health. By integrating wearable sensors, cloud-based storage, and remote access, the system enables early detection of stress levels, reducing dependency on subjective self-reporting. The user-friendly web dashboard and secure data handling ensure accessibility and privacy, making mental health tracking more effective and proactive. The system bridges the gap between traditional mental health assessments and modern IoT solutions, offering automated interventions, remote doctor consultations, and personalized insights to improve overall well-being.

6.2. Future Scope

1. Advanced AI Integration

Implement machine learning algorithms for better stress prediction and trend analysis.

Use AI-powered chatbots or virtual assistants for personalized mental health support.

2. Enhanced Sensor Capabilities

Incorporate Galvanic Skin Response (GSR) and EEG sensors for more accurate stress detection.

Use sleep tracking to analyze the impact of sleep patterns on mental wellness.

3. Smart Environment Adaptation

Integrate with smart home devices to adjust lighting, music, or temperature based on stress levels.

Enable voice-activated stress management techniques like guided meditation or breathing exercises.

4. Mobile App Development

Create a dedicated mobile application for better accessibility and real-time stress management.

Enable push notifications for instant alerts and stress reduction recommendations.

Reference

[1] Razzaque, M. A., Milojevic-Jevric, M., Palade, A., & Clarke, S. (2021). Internet of Things for Mental Health: Open Issues in Data Acquisition, Self-Organization, and Decision-Making. International Journal of Environmental Research and Public Health.

[2] Ullah, S., Shah, M. A., Zhang, S., & Zhang, H. (2022). IoT-Based Healthcare-Monitoring System Towards Improving Quality of Life: A Review. MDPI Sensors.

[3] Quadir, M. A., Bhardwaj, S., Verma, N., Sivaraman, A. K., & Tee, K. F. (2022). IoT Enabled Mental Health Diagnostic System Leveraging Cognitive Behavioural Science. International Conference on Big Data and Cloud Computing (ICBCC).

[4] Patel, A., Shah, D., Shah, A., & Gala, M. (2022). Mental Health Monitoring and Detection Based on Machine Learning Techniques. Journal of Medical Systems.

[5] Razzaque, M. A., Milojevic-Jevric, M., Palade, A., & Clarke, S. (2023). Integrating Environmental Data for Mental Health Monitoring: A Smart IoT-Based System. Applied Sciences.