HEALTH MONITORING SYSTEM

BY IOT \ BC (2A)

Team Members

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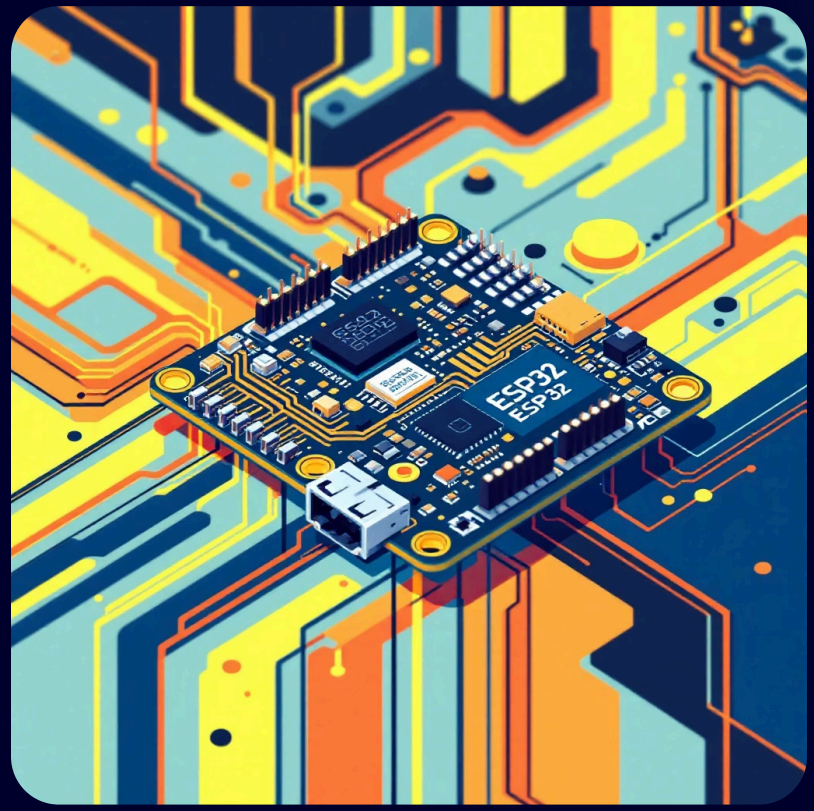
Project Introduction: Smart Health Monitoring

This project utilizes an ESP32 microcontroller to create a smart health and environment monitoring system.

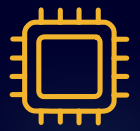
It collects real-time data from multiple sensors, providing continuous and efficient tracking.

- Real-time data collection (Heart Rate, SpO_2, Temp, Fall Detection).
- Data uploaded to Firebase Realtime Database.
- Instant alerts via Telegram and optional IFTTT notifications.



Core Components: The Sensor Array

Five key components work together to gather comprehensive health and environmental data.



ESP32

Collects, processes, and uploads all sensor data to Firebase via Wi-Fi, and sends alerts.

MAX30102

Measures vital signs: Heart Rate (BPM) and Blood Oxygen Saturation (SpO_2).

DHT11

Measures environmental conditions: Room Temperature and Humidity.

MPU6050

Detects motion, orientation, and critical events like falls.

LDR

Monitors ambient light intensity in the room.

ESP32: The Central Hub

Data Collection

Gathers readings from MAX30102, DHT11, MPU6050, and LDR using analog, digital, and I²C pins.

Processing & Upload

Processes raw readings and uploads data to Firebase in real-time via Wi-Fi.

Alert System

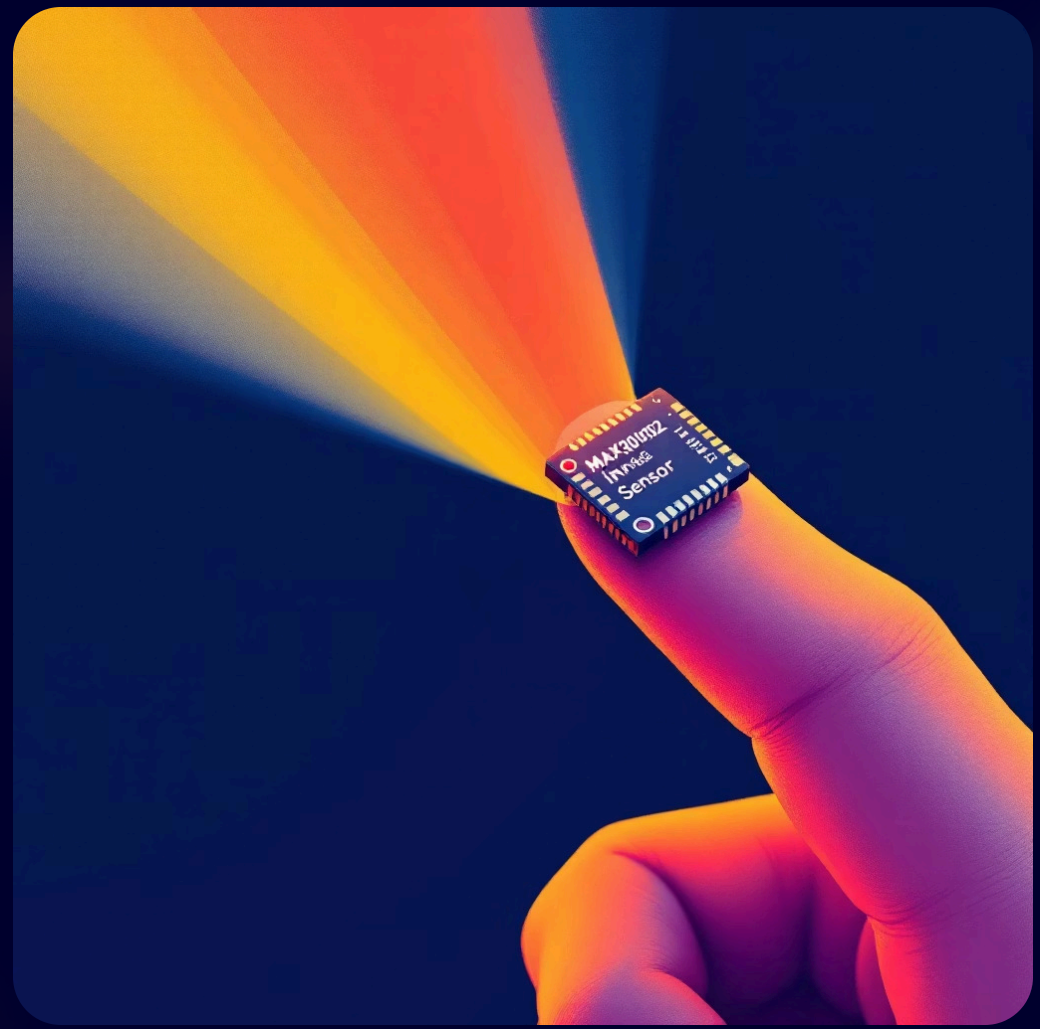
Sends instant Telegram alerts upon detecting abnormal conditions or a fall.

Vital Sign Monitoring: MAX30102

The MAX30102 sensor is crucial for health monitoring, using red and infrared LEDs to measure two key vital parameters:

- Heart Rate (BPM)
- SpO_2 (%)

The ESP32 reads this data via I^2C, ensuring continuous, real-time tracking of the user's cardiovascular and respiratory status.



Fall Detection and Environmental Sensing

MPU6050 (Fall Detection)

Reads accelerometer and gyroscope data via I^2C to detect motion, orientation, and fall patterns. Triggers alerts for abnormal activity.

DHT11 (Temp & Humidity)

Measures air temperature (thermistor) and moisture (capacitive sensor). Data is uploaded to Firebase for environmental context.

LDR (Light Intensity)

A photoresistor that detects ambient light by changing resistance. ESP32 reads analog values to monitor room lighting conditions.

Hardware Required

ESP32 (DevKit V1 or similar)	1	
MAX30102, DHT11, MPU6050, LDR	1 each	Breadboard + Jumper wires, Micro-USB cable, 10kΩ resistor

Key Connections Overview

The system relies on specific connections for I²C communication and data transfer.

I²C Connections (MAX30102 & MPU6050)

- VCC → 3.3V
- GND → GND
- SDA → GPIO 21
- SCL → GPIO 22

DHT11 (Temp & Humidity)

- VCC → 3.3V
- GND → GND
- DATA → GPIO 4

LDR (Room Light Sensor)

Connected in a voltage divider circuit:

3.3V --- [LDR] --- A0 (GPIO 34) --- [10KΩ] --- GND

1. MAX30102 (HEART RATE & SPO₂)

Software & Libraries

The project requires several libraries to interface with the hardware and manage data transmission.

Sensor Libraries

Adafruit MAX3010x, Adafruit MPU6050, DHT sensor library by Adafruit.

Dependency Libraries

Adafruit Unified Sensor, Adafruit Sensor, Adafruit GFX (optional for display).

Connectivity

WiFi and HTTPClient for sending data online to Firebase and alerts.

Conclusion: A Comprehensive Monitoring System

This ESP32-based system continuously measures vital parameters (Heart Rate, SpO_2, Body Temp, Room Temp, Humidity, Light) and detects falls.

Real-Time Data

Data is sent to Firebase Realtime Database for continuous monitoring.

Instant Alerts

Prompt notifications are delivered via Telegram for critical events.

Non-Blocking

Uses non-blocking scheduling, allowing all sensors to operate simultaneously.

NOTE: This prototype is for educational and demonstration purposes only and is not a certified medical device.

Submitted to - Vikash Sir