Task 2

Bill of Material-

Sr. No.	Component	Function
1.	Microcontroller	Cortex M0+ MCU, Power Management and Low-Power Modes.
2.	Health Sensor(SPO2/HR Sensor)	Pulse oximeter and heart-rate sensor (SpO2)
3.	Battery(LiPo400mAh)	Rechargeable battery, lightweight design
4.	LoRa Module	Wireless communication capabilities, LoRa transceiver module
5.	OLED Display	128x64 pixels for displaying info.
6.	Gateway Antenna	LoRAWAN gateway antenna long range, low power consumption for communication.
7.	Server	Cloud(AWS , Azure VM) or self hosted

Implementation Solution-

1. Hardware Configuration

- **MCU**: 32-bit Cortex M0+ (e.g., SAM L21) for ultra-low-power operation.
- **Sensors**: MAX30102 for SpO_2 & heart rate (I^2C interface).
- **LoRa Module**: RN2483 (EU) / RN2903 (US) for long-range (3km+) communication.
- **Battery**: 400mAh LiPo with buck converter for efficiency.
- **Display**: 128x64 OLED for basic stats (SpO_2, HR, battery).

2. Firmware Implementation

Sensor Reading:

- I²C/SPI communication with **MAX30102** (SpO_2/HR).
- Sampling rate: **50-100Hz** (adjustable for power optimization).

LoRaWAN Transmission:

- **RN2483/RN2903** module controlled via UART + AT commands.
- **Payload**: 6-byte packed struct (SpO_2, HR, battery %, status flags).
- **Confirmed uplinks** for critical alerts (low SpO_2).

3. Network & Cloud

- **Gateway**: 8-channel LoRaWAN gateway (RAK7249) with high-gain antenna.
- **Server**:
    - **Option 1 (Cloud)**: AWS IoT Core → Lambda → Timestream (time-series DB).
    - **Option 2 (Self-hosted)**.

4. GUI (Web Dashboard)

- **Tech** : React.js + Chart.js for real-time graphs.
- **Features**:
- Live SpO_2 & HR trends.
- Battery status alerts.
- Historical data logs.