Embedded Systems Lab – Project Synopsis

DATE OF SUBMISSION: 6th December 2024

PROJECT TITLE: Real-Time Health Monitoring System

BRIEF DESCRIPTION ABOUT THE PROJECT:

The proposed project is a Real-Time Health Monitoring System that uses an embedded system based on the LPC 1768 microcontroller to monitor vital health parameters like heart rate, body temperature, and SpO2 (blood oxygen saturation).

The system will interface sensors such as the MAX30102 for heart rate and SpO2, and LM35 for body temperature (The exact specifications for the same are mentioned below in the components description). The sensor data will be collected, processed, and displayed on an LCD or sent wirelessly to an external device supporting Bluetooth communication using a Bluetooth module. The data then can be remotely monitored on any external such as a mobile phone or a smartwatch (This is in future scope).

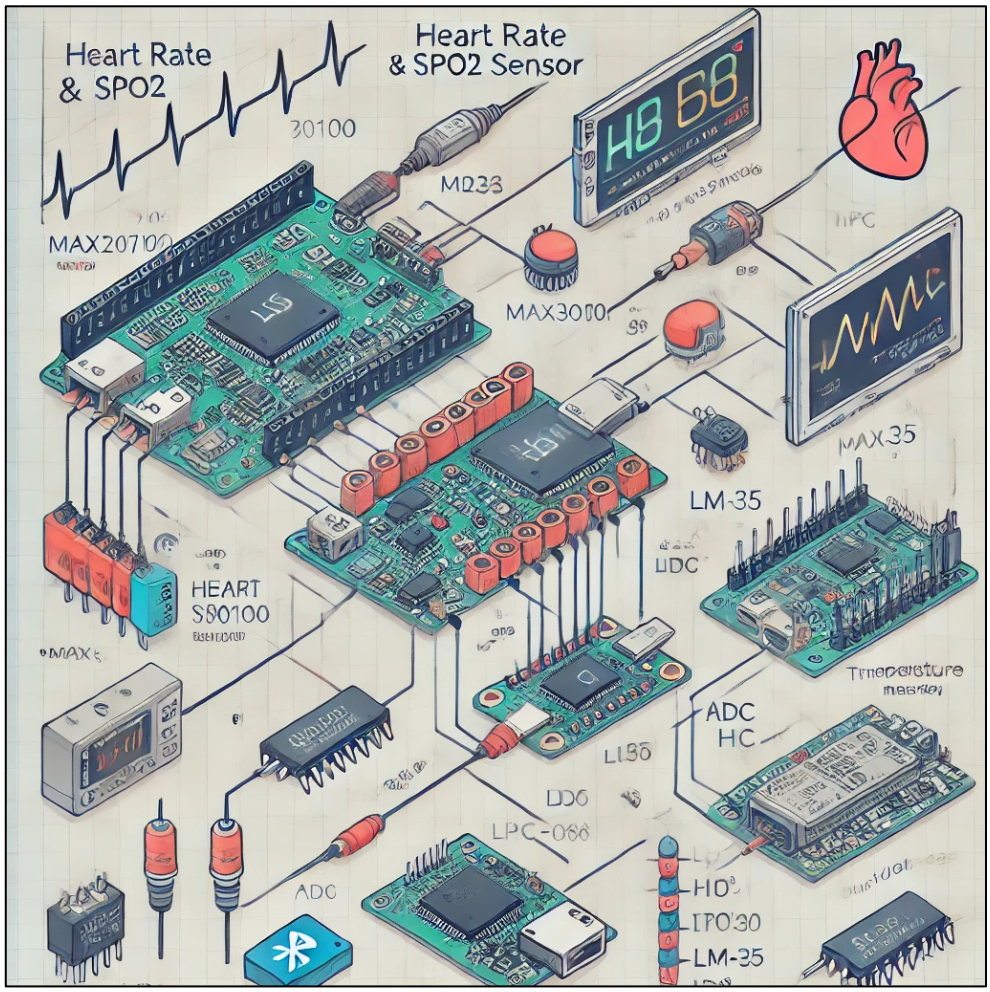
In the current healthcare landscape, there is a growing demand for efficient, low-cost, and reliable systems that can continuously monitor health parameters, especially for the elderly or individuals with chronic health conditions. This project aims to address that need by building a compact, real-time monitoring system that can be used in homes, hospitals, or even in emergency situations.

METHODOLOGY:

1. **Sensor Interface**:
    - **Heart Rate and SpO2 Sensor (MAX30102)**: The sensor is connected to the LPC 1768 via I2C communication. It measures heart rate and blood oxygen levels, and the data is transmitted digitally to the microcontroller.
    - **Temperature Sensor (LM35)**: This analog temperature sensor is connected to the LPC 1768 through one of the ADC channels, converting analog voltage readings into temperature values.
2. **Data Processing**:
    - The microcontroller reads raw data from the sensors, processes it, and converts it into meaningful health metrics.
    - For heart rate and SpO2, signal processing algorithms are used to calculate accurate pulse and oxygen levels.
    - For temperature, the ADC value is converted into degrees Celsius.

3. **Display and Communication**:
    - The processed data is displayed on an **LCD** screen in real-time.
    - Additionally, a **Bluetooth module (HC-05)** can be used to transmit the data to a mobile app or another device for remote monitoring.
4. **Power Supply**:
    - The entire system is powered by a regulated power supply, ensuring stable voltage for the sensors and microcontroller.
5. **Real-Time Monitoring**:
    - The system continuously monitors the user's health and provides instant feedback, which can be viewed on the display or transmitted for remote monitoring.

Here is the block diagram showing the methodology for your **Real-Time Health Monitoring System** using the LPC 1768. The diagram illustrates how the sensors (heart rate and SpO2 sensor, temperature sensor) interface with the microcontroller, and how data is processed and displayed, or transmitted via Bluetooth.



NOTE – This diagram is generated using an AI tool called DALL-E which was provided with prompts as to what to be put in the diagram.

USE CASES:

- Home Healthcare
- Hospital Monitoring
- Emergency Care

CHALLENGES:

- **Noise Reduction**: Heart rate and SpO2 sensors often pick up noise from movement, so implementing effective filtering algorithms will be important.
- **Power Efficiency**: Making sure the system operates on low power, especially if it is to be used as a wearable device.
- **Real-Time Data Accuracy**: Ensuring that the data displayed and transmitted is accurate and without significant delays.

FUTURE SCOPE:

- Cloud Integration
- AI-Based Analysis
- Wearable Version

CONCLUSION:

This project demonstrates how embedded systems can play a pivotal role in healthcare by providing a compact, affordable, and real-time solution for monitoring critical health parameters. By interfacing sensors with the LPC 1768 microcontroller, the system enables continuous monitoring and easy data access through wireless communication, improving patient care and early intervention in case of health anomalies.

COMPONENTS REQUIRED:

- NXP LPC 1768 + component kit (LCD + Power Supply)
- Temperature Sensor – LM35/ DS18B20
- Pulse Oximeter SpO2 Sensor – MAX30102
- Bluetooth Module – HC-05/ HC-06 (Future Scope)

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