MAKERERE UNIVERSITY

COLLEGE OF COMPUTING AND INFORMATION SCIENCES.

DEPARTMENT OF COMPUTER SCIENCE.

BACHELOR OF SCIENCE IN COMPUTER SCIENCE.

CSC2118 EMBEDDED SYSTEMS

GROUP 9.

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YouTube Link: https://youtu.be/MqX9jUKdD2o

GitHub Link:

1. INTRODUCTION.

a) User Problem.

In today's fast-paced world, many individuals struggle to find the time or the motivation to visit doctors regularly for routine health check-ups. This often leads to the neglect of early warning signs of health issues, which could have been easily addressed if identified early. The lack of accessible and continuous health monitoring tools contributes to this challenge, leaving individuals reliant on infrequent or emergency visits to healthcare providers. As a result, preventable health complications go unnoticed, creating a gap in proactive healthcare management.

b) Project Solution

To address this issue, we propose the development of an embedded system device capable of continuously monitoring vital health parameters such as heartbeat and body temperature. This portable device will provide real-time data, enabling users to keep track of their health conveniently. By integrating these features with a user-friendly interface and alert mechanisms, the system empowers individuals to identify potential health concerns early, reducing the dependency on regular physical visits to doctors. This innovation bridges the gap between proactive health management and accessibility, making it easier for individuals to take control of their well-being.

2. FUNCTIONAL REQUIREMENTS.

a) Hardware Functionality

This project is built around four interconnected Arduino boards each assigned a specific role in the system to ensure seamless health monitoring and alert mechanisms. The boards and their respective functionalities are outlined below:

I. **Board 1: Vital Sign Monitoring**

Components: Heartbeat sensor and temperature sensor.

Functionality: This board is responsible for measuring the user's vital signs, including heart rate and body temperature.

Operation:

- The heartbeat sensor detects pulse rates in real time.
- The temperature sensor measures the user's body temperature.
- Data from both sensors is processed and transmitted to Board 2 via the infrared transmitter.

II. Board 2: Data Transmission

Components: Infrared transmitter.

Functionality: Acts as the communication bridge between Board 1 and Board 3.

Operation:

- Receives the processed health data from Board 1.
- Transmits the data using infrared signals to the receiver on Board 3.

III. Board 3: Display and Monitoring

Components: Infrared receiver and LCD display.

Functionality: This board handles the reception and display of the transmitted health data.

Operation:

- The infrared receiver collects data sent by Board 2.
- The LCD display presents the user's heart rate and temperature readings in a readable format for easy monitoring.

IV. Board 4: Alert Mechanism

Components: Alert alarm and switch for debouncing.

Functionality: Provides safety alerts based on critical health data thresholds stored in the EEPROM.

Operation:

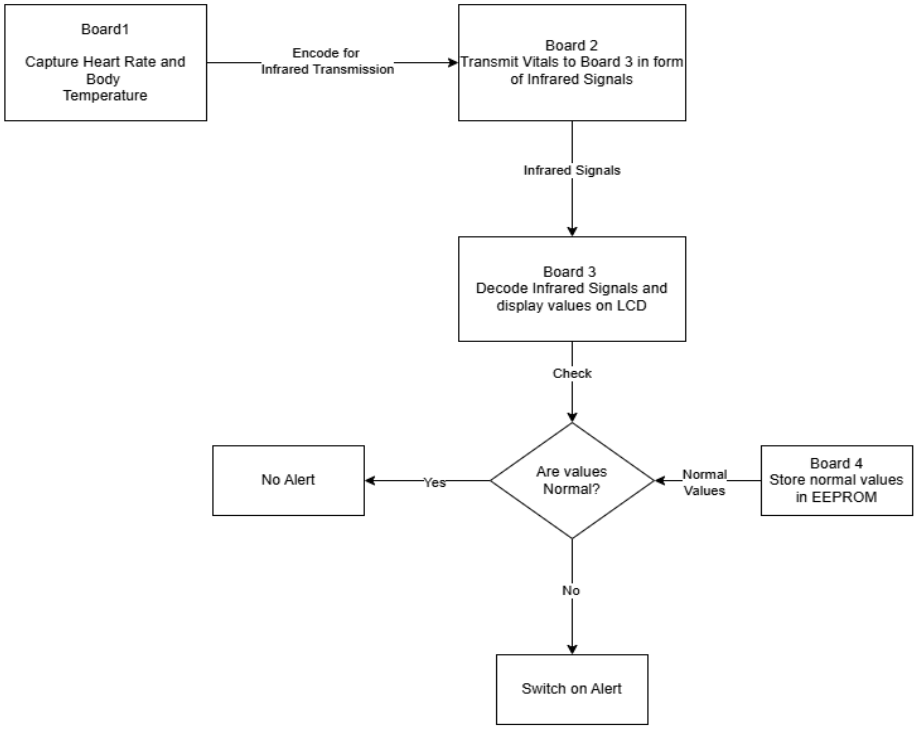
- Continuously monitors the health data from Board 3.
- If abnormal readings are detected (e.g., heart rate or temperature exceeds safe limits), an alert alarm is triggered with necessary debouncing.

b) How project meets Requirements.

This project effectively utilizes various embedded system concepts to function seamlessly. **ADC (Analog-to-Digital Converter)** is used to convert analog signals from the heartbeat and temperature sensors on Board 1 into digital data for processing. **GPIOs (General Purpose Input/Output)** are employed to interface components such as the LCD display, infrared transmitter/receiver, and alert alarm. **Interrupts** ensure prompt responses to critical events, such as abnormal health readings or switch inputs for debouncing, without constantly polling the sensors. **Counters/Timers** are used to measure pulse intervals for heartbeat monitoring and to implement accurate delays or periodic tasks. The **EEPROM** stores user-defined thresholds for triggering the alert alarm, ensuring these values are retained even after power loss. **Serial Communication** facilitates data transmission between the boards, particularly for the infrared module, enabling reliable inter-board communication. Lastly, **switch debouncing** ensures that the reset or alarm-silencing switch functions reliably, avoiding false or unintended actions due to signal noise.

3. PROJECT RESULTS

a) Project Flow Diagram.



b) Project Snapshots