FPT Education

TỔ CHỨC GIÁO DỤC FPT

PROJECT REPORT FOR IOT 102

Topic: Remote Patient Health Monitoring System

Class	**IA1905**
Group members	1. Trần Hoàng Long 2. Nguyễn Công Hiếu 3. Trần Thị Ngọc Lan 4. Trần Thanh Bảo Phúc
Instructor	Đặng Minh Đức
External Mental	None

Hoa Lac, July 5, 2025

Project: Remote Patient Health Monitoring System

Group Members:

1. Trần Hoàng Long
2. Nguyễn Công Hiếu
3. Trần Thị Ngọc Lan
4. Trần Thanh Bảo Phúc

Project Summary:

The remote health monitoring system is designed to collect vital signs from patients, such as body temperature and heart rate, using biomedical sensors. Data is displayed on an LCD screen and through a Web/App interface, allowing doctors to monitor and respond remotely. All data is stored in real-time in a database, which can be exported as spreadsheets (Excel) for analysis and reporting. The system also integrates a buzzer to emit signals when data is successfully sent to the database. This project aims to support remote healthcare, especially in regions lacking medical personnel or during pandemics.

I. Project Introduction

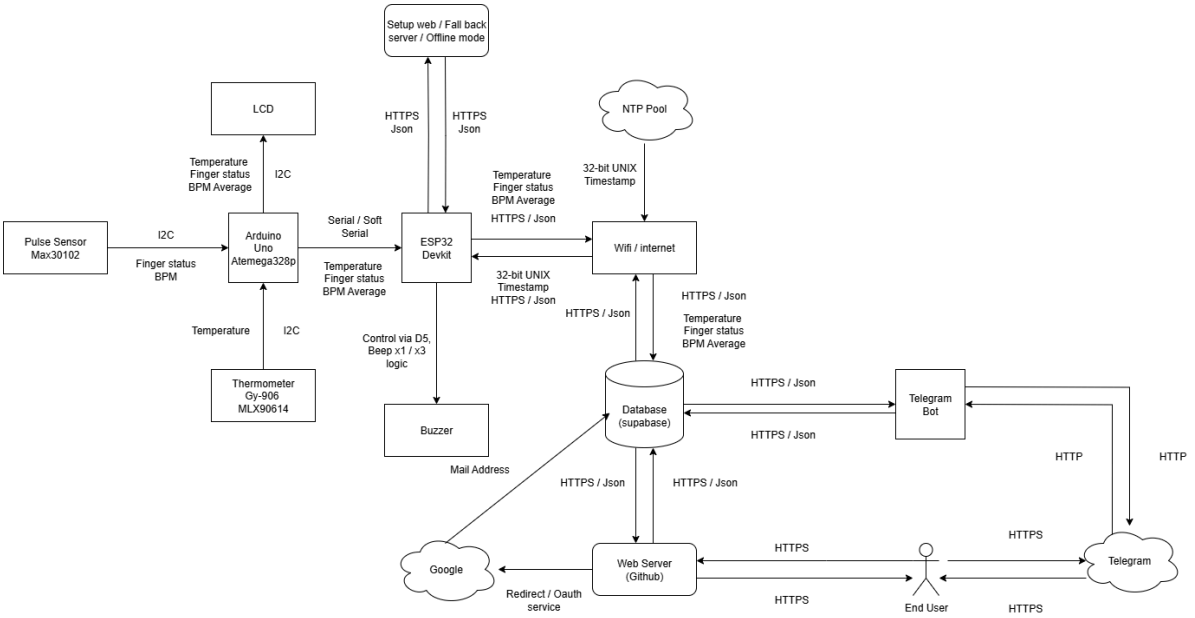
I.1. Motivation

The demand for remote health monitoring is increasing, especially in the context of pandemics or in underserved areas. Vital signs like heart rate and temperature need constant monitoring. Automating and remotely accessing this data can help reduce strain on healthcare systems.

I.2. Project Overview

- The system reads and records heart rate and temperature using sensors.
- Displays the data on an LCD and a Web/App interface.
- Allows doctors to remotely monitor the patient's vital signs.

System Block Diagram:

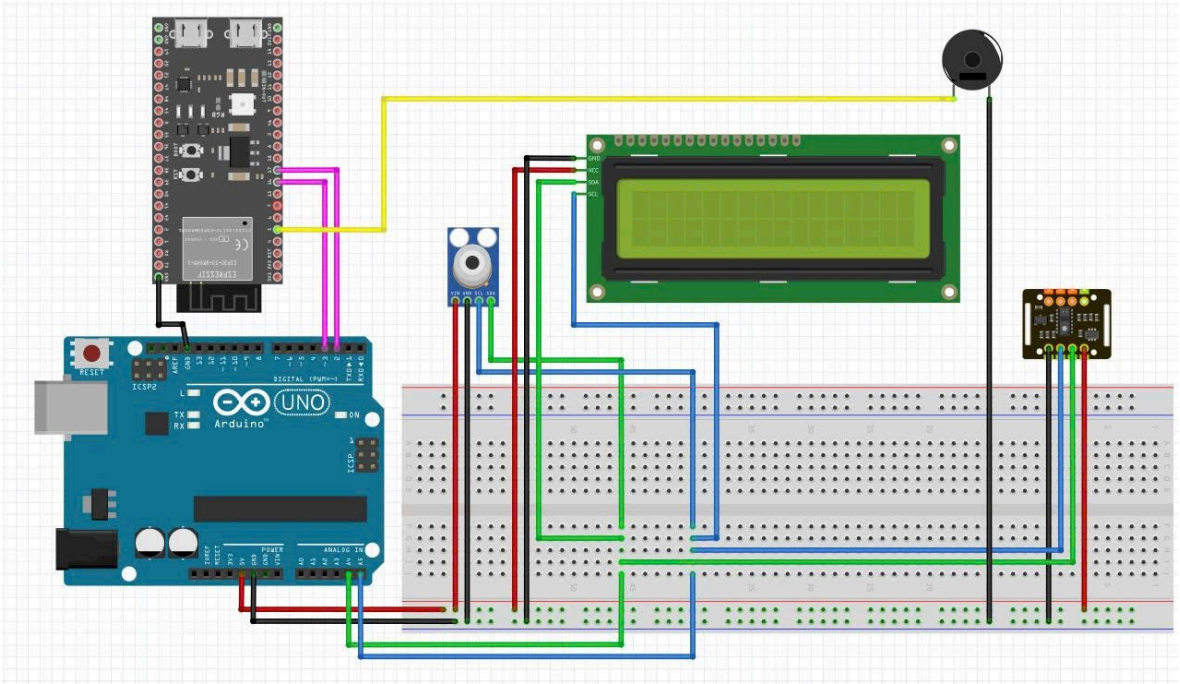


II. System Analysis and Design

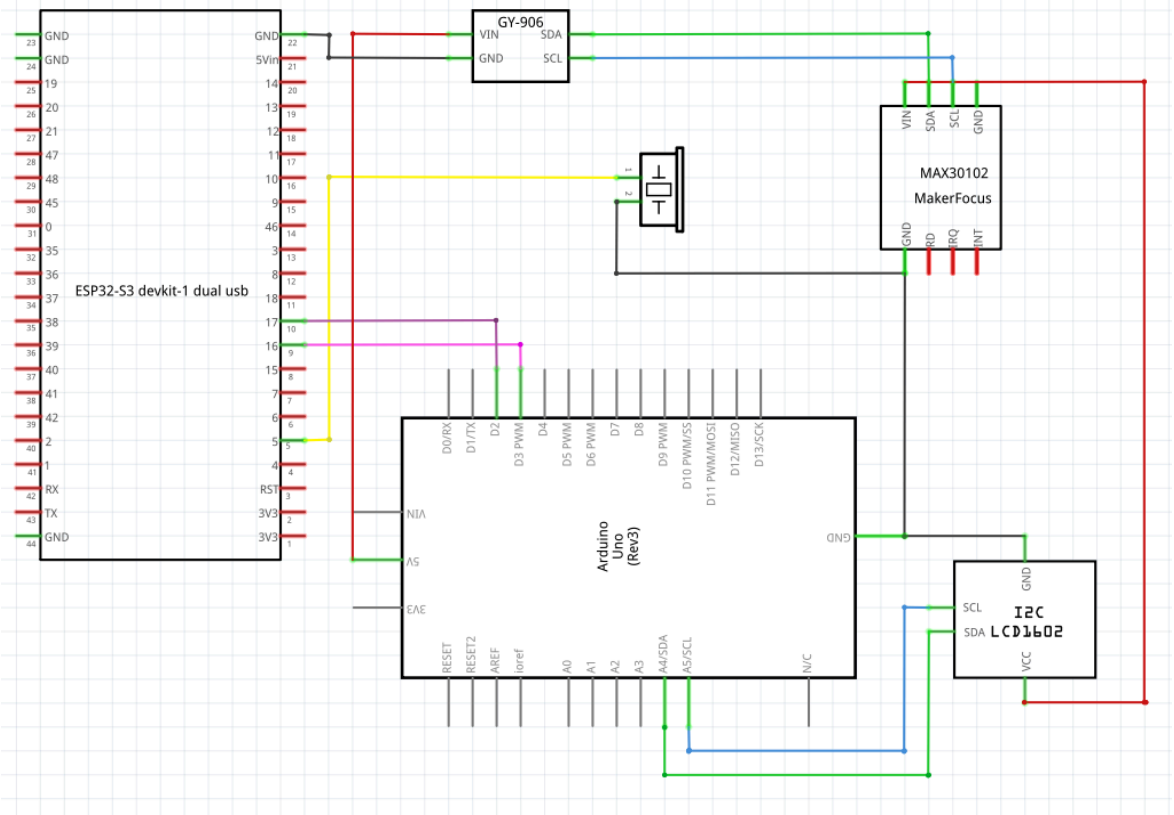
II.1. Hardware Design

Device	**Description**
ESP32	WiFi module with integrated microcontroller
Arduino Uno	Central controller that reads data from sensors and communicates with ESP32
MAX30102	Heart rate sensor
GY-906 MLX90614	Temperature sensor
LCD I2C 16x2	Screen to display heart rate and temperature data
Breadboard and Jumper Wires	For flexible component connection
Buzzer	Emits alert signals

Circuit Wiring Diagram:

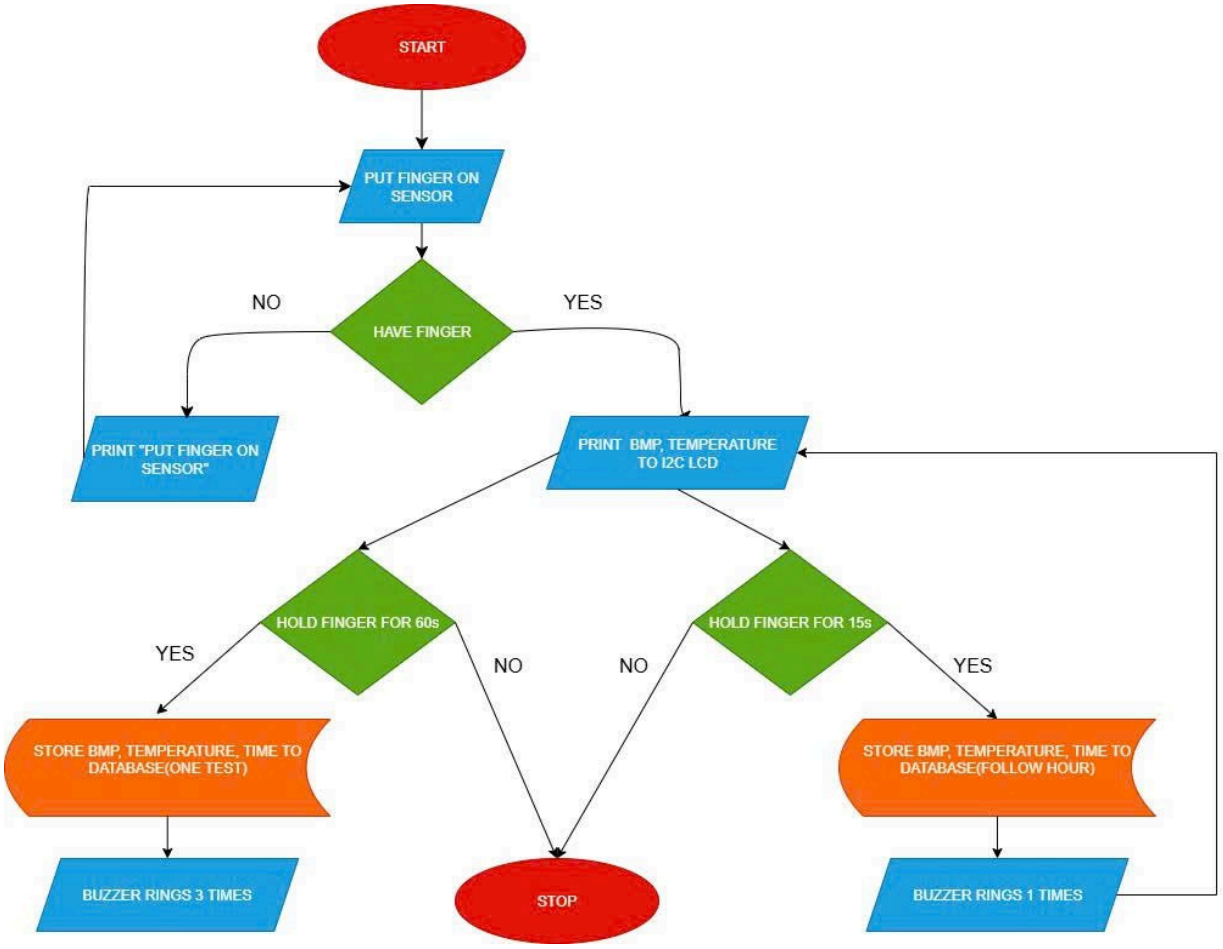


Schematic Diagram:



II.2. Software Design

Algorithm Flowchart:



Key Functions:

```
// Detect heartbeat
if (checkForBeat(irValue)) {
  long delta = millis() - lastBeat;
  lastBeat = millis();

  beatsPerMinute = 60 / (delta / 1000.0);

  if (beatsPerMinute > 20 && beatsPerMinute < 255) {
    rates[rateSpot++] = (byte)beatsPerMinute;
    rateSpot %= RATE_SIZE;

    beatAvg = 0;
    for (byte x = 0; x < RATE_SIZE; x++)
      beatAvg += rates[x];
    beatAvg /= RATE_SIZE;
  }
}
```

- **Meaning:** Detects heartbeats, calculates BPM, and averages recent measurements for stability.

```
// Read temperature every 1s
if (millis() - lastTempRead >= 1000) {
  temperature = tempSensor.readObjectTempC();
  lastTempRead = millis();
}
```

- **Meaning:** Measures user temperature every second and stores the result in a temperature variable.

III. Experimentation and Evaluation

II.1. Experiment:

Video of the experiment: Sensor-based testing demonstration.

III.2. Results

The system was fully assembled and operated stably during testing. The sensors accurately recorded vital signs such as heart rate and body temperature.

Measured data is instantly displayed on the device's LCD screen and transmitted to an online database (Supabase) in real-time. The web interface is designed to fetch this data directly, allowing users to monitor remotely with ease.

The data can be downloaded as Excel spreadsheets for analysis or reporting. Additionally, the system integrates a Telegram bot for quick interaction. The bot can send automatic alerts or respond to user requests directly via Telegram, providing a convenient health update channel, especially on mobile devices.

Data is stored in spreadsheet format, accessible via the following links:

- One Test
- Follow Hour

IV. Project Development Plans

IV.1. Fundraising and Development Model

- Crowdfunding via Kickstarter and Patreon
- Development in two directions: Open Source and Paid Services

IV.2. Hardware & Sensor Upgrades

- Monitor all 5 vital signs: heart rate, temperature, blood pressure, respiration rate, and SpO2
- Use high-precision, stable medical-grade sensors
- Redesign the physical layout and custom PCBs for clinical use
- Simplify operations with more autonomous sensors
- Add battery backup for portable power supply

IV.3. Connectivity & Communication

- Add SIM card support, SMS notifications, mobile network, and Bluetooth alerts
- Patient ID classification using NFC from ID cards or integration with hospital databases

IV.4. Database & Management System

- Develop proprietary database and server infrastructure
- Enable abnormal value alerts when thresholds are exceeded
- Implement access control with account-based permission levels

IV.5. Software & Interface Enhancements

- Develop a standalone application for enhanced security and customization
- Provide data visualization on web and app
- Add emergency signaling features, including remote alerts by authorized users and physical panic buttons for patients
- Enable automatic updates via WiFi or mobile

IV.6. Product Segmentation & Optimization

- Develop two product lines: one for general monitoring and another for ICU use
- Optimize costs for user accessibility

V. Appendix

V.1. Links

- Presentation Slide: Báo cáo dự án IOT102_IA1905
- GitHub Project: Dự án IOT102_IA1905