Cairo University
Faculty of Engineering
Systems and Biomedical Engineering
Credit Hours System

Medical Monitors and Life Support Equipment:

Final Project Report

Abdullah Saeed **1190222**, Mohamed Nasser **1190438**, Hassan Samy **1190025**,

Zeyad Mansour **1190368**, Mario Samy **1190287**

Cairo University, Faculty of Engineering

SBEN226: Medical Monitors and Life Support

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Problem Statement

Even though hospitals and medical centres operate on a rotational shift basis, ensuring 24/7 presence of medical staff to attend to patients, this still does not guarantee the immediate attention of a nurse/doctor to a patient in need. This could simply be due to the outnumbering of patients compared to medical staff available, amongst various other reasons.

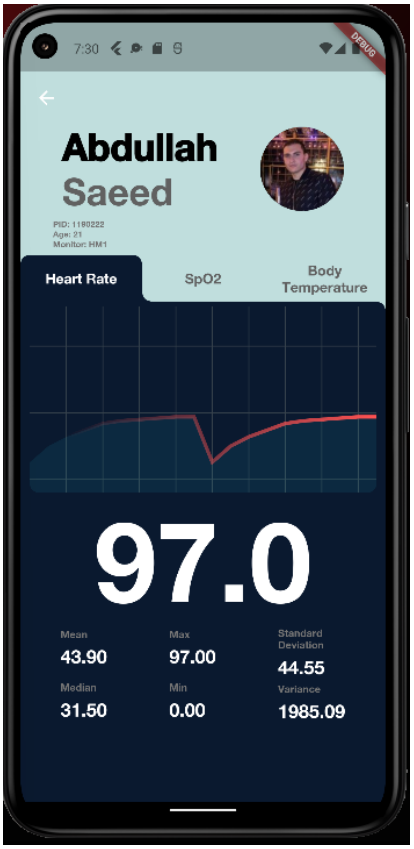
A solution to this problem that is both convenient and potentially life-saving would be the installation of an all round monitoring system. This system would not only monitor patient conditions in real time using a complex array of embedded sensors and display them on seamlessly designed mobile apps available for designated personnel, it also notifies these personnel whenever an alarm goes off or if any patient needs attention. In critical conditions where time cannot be wasted in the logistics, the systems embedded to the bed monitors automatically administer essential medication to the patient as well.

System Overview

Frontend

Flutter was used to build a cross platform application that can be used on pc, mobile and web. It displays patient vitals polled from the backend server in real time, and offers in-app visual alerts to critical conditions. Notifications are also sent to the mobile when alarms are triggered.

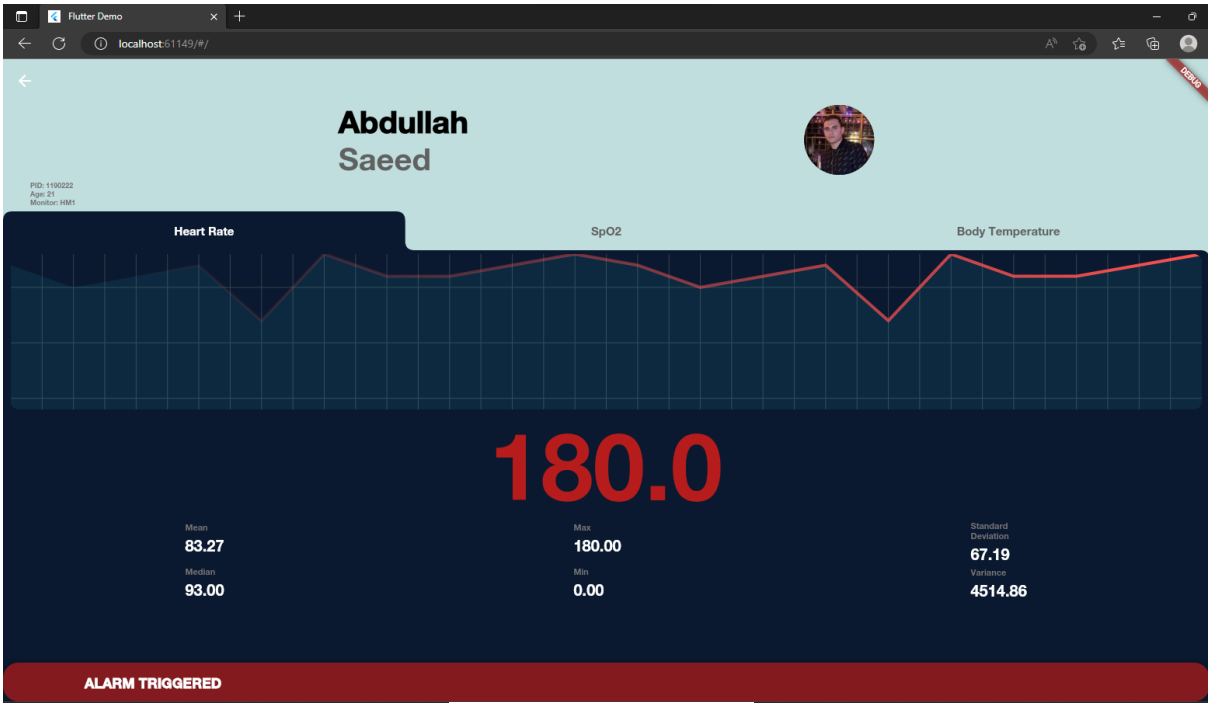
The following are some screenshots



Patient screen with no alarms triggered.

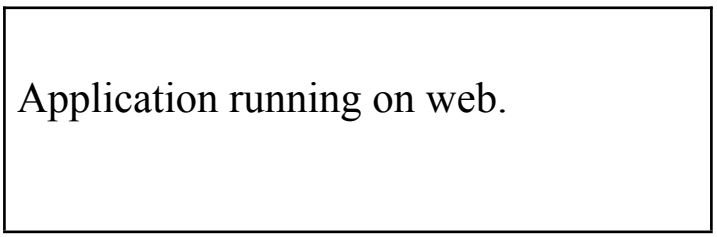
Patient screen with a triggered alarm and notification visible.

Alarm details as visible in the slide-up panel.



Application running on web.

Application running on web.



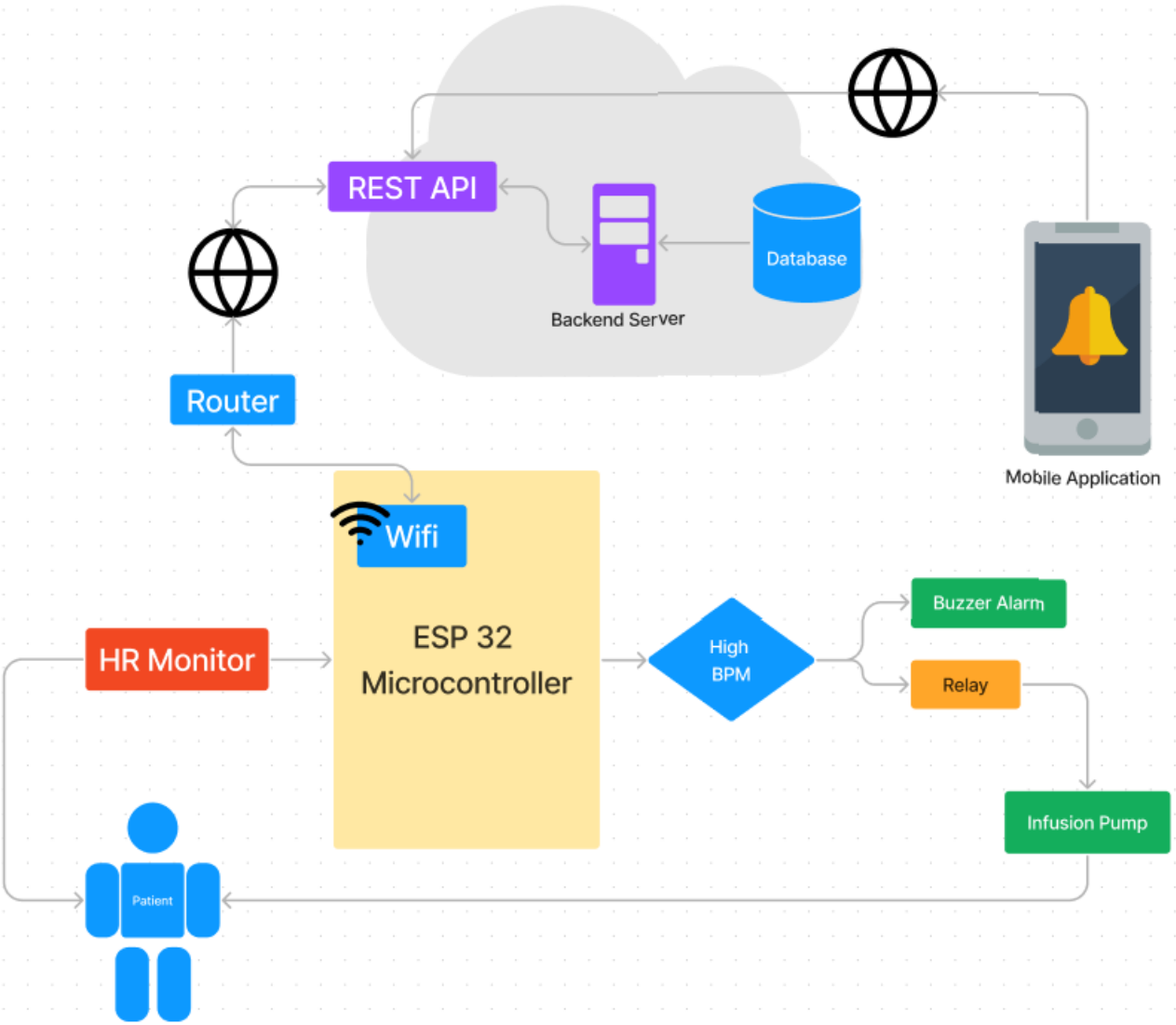
Backend

The backend was built from scratch, based on FastAPI and the ASGI uvicorn engine. Hosting of the server and NoSQL database was done on www.deta.sh free of charge. API Documentation was generated automatically by swagger for ease of integration

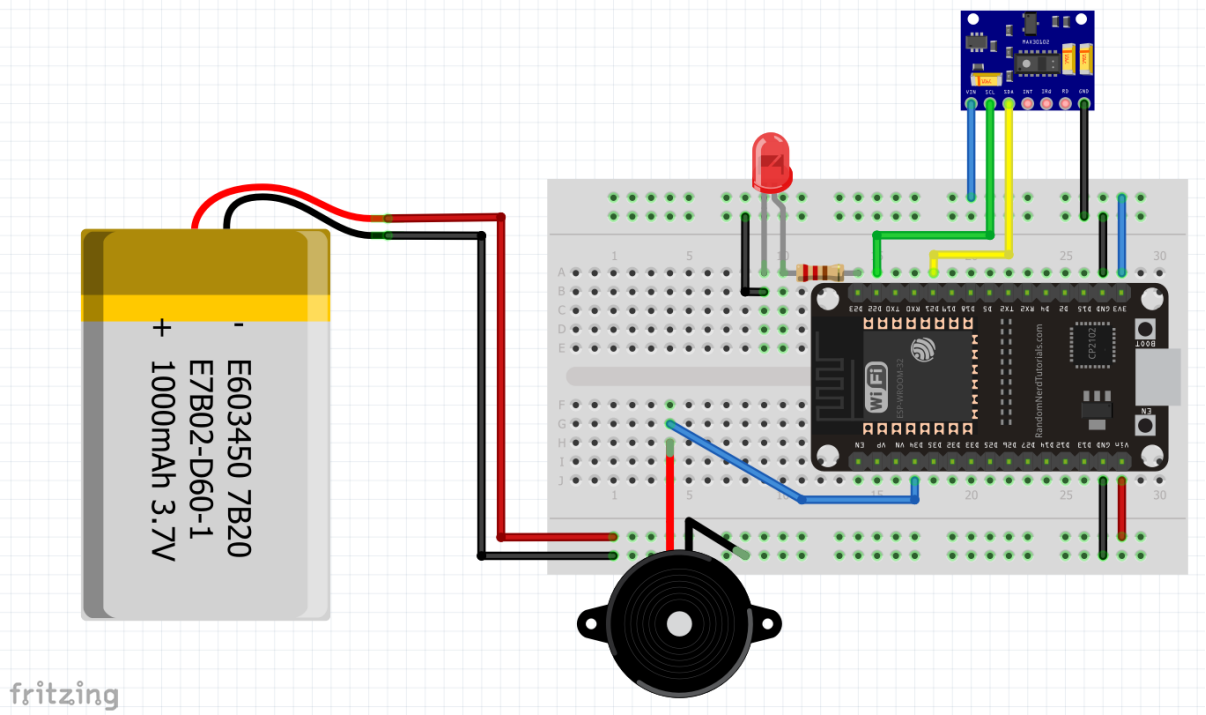
Embedded

An ESP-32 (Espressif) microcontroller was used due to its built-in wifi radio
The microcontroller is responsible for signal acquisition from the MAX30102 HR sensor , signal buffering and sending api requests to the cloud server for processing and storage. The MCU is also responsible for motor actuation and control through magnetic relays as the patient's blood pressure goes down (low heartrate is one of the symptoms) the syringe pump is activated and a drug is administered.

Architecture Block Diagram



Circuit Wiring Diagram



Source Code Repository

[mo-gaafar/iot-cloud-monitor: Full stack signal monitor mobile application, with cloud computing capabilities. (github.com)]

API Documentation Link

[FastAPI - Swagger UI (no1rz2.deta.dev)]

Useful References

[Interface MAX30100 Pulse Oximeter and Heart Rate Sensor with ESP32 (microcontrollerslab.com)]