**Project Objective**

The objective of this project is to develop a Personal Outdoor Health Monitor that can measure various environmental and body parameters to ensure safety and health. The system will monitor air quality, UV levels, and body temperature, providing real-time alerts if any measurements exceed predefined safety thresholds. The monitor will also have the capability to alert users through a visual display and an audible buzzer, which can be activated remotely via a web interface.

**Related Theory**

This system integrates several sensors to monitor environmental air quality, UV exposure, and body temperature. The application is designed for individuals who spend a significant amount of time outdoors, providing them with real-time data and alerts to ensure they remain within safe exposure limits. The system measures concentrations of NH3, NOx, CO, smoke, and CO2, calculates a UV index, and monitors body temperature, making it a comprehensive health and safety tool.

**System Overview and Design**

**Description:**

The Personal Outdoor Health Monitor utilizes sensors to gather data on air quality, UV levels, and body temperature. It processes this data to check against predefined safety thresholds, displaying visual alerts and sounding an audible buzzer if necessary. The system can be accessed and controlled remotely via a web interface.

**Requirements:**

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**Block Diagram of the Application:**

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**Components Description:**

Air Quality Sensor (MQ135): Measures concentrations of various gases (NH3, NOx, CO, smoke, CO2).

UV Sensor: Measures UV radiation levels and calculates UV index.

Temperature Sensor: Monitors body temperature.

Arduino UNO R4 WiFi: Central processing unit for data collection, processing, and communication.

LED Matrix: Displays visual alerts ("!!!" or "OK!").

Buzzer: Provides audible alerts.

WiFi Module: Enables wireless communication.

Web Server: Allows remote access and control of the system.

**Additional Features Provided or Developed:** Remote activation and deactivation of the buzzer via the web interface. Dynamic adjustment of alert thresholds. Visual alert of status.

**Limitations and Justifications:**

Limitations: The system is dependent on WiFi availability for remote access and control. Sensor calibration may require regular adjustments to maintain accuracy.

Justification: WiFi dependency ensures real-time data accessibility and remote management. Regular calibration enhances the reliability of measurements.

**System Implementation & Results**

The system was implemented by integrating the sensors with the Arduino UNO R4 WiFi.

The code reads analog values from three sensors: the MQ135 air quality sensor, a UV sensor, and a body temperature sensor. The MQ135 sensor readings are converted to concentrations of NH3, NOx, CO, smoke, and CO2 using empirical equations based on the sensor’s resistance (Rs) and a baseline value. The UV sensor readings are converted to a UV index based on predefined voltage ranges. The body temperature is calculated by converting the analog reading to a temperature value. The original thresholds for each pollutant and parameter are set based on safety guidelines: 25 ppm for NH3, 5 ppm for NOx, 50 ppm for CO, 100 ppm for smoke, 5000 ppm for CO2, a UV index of 7, and a body temperature of 38.0°C. If the sensor readings exceed these thresholds, the status color changes from green to red. There are functions to reduce these thresholds and to reset them to their original values. Sensor data was read, processed, and compared against safety thresholds. Visual and audible alerts were configured based on these comparisons. The web server provided a user-friendly interface for monitoring and controlling the system remotely. The system was tested in various outdoor conditions to ensure reliability and accuracy.



**Discussion**

The Personal Outdoor Health Monitor successfully measured and reported environmental and body parameters. Alerts were promptly triggered when thresholds were exceeded, ensuring timely warnings to the users. The web interface allowed for convenient remote monitoring and control, enhancing the system's usability.

**System Functionality**

The code connects the device to a specified WiFi network, initializes an HTTP server, and reads analog values from the MQ135 air quality sensor, UV sensor, and body temperature sensor. It converts the MQ135 sensor readings to concentrations of NH3, NOx, CO, smoke, and CO2 using empirical equations based on sensor resistance. The UV sensor readings are converted to a UV index value, and the body temperature is calculated from the analog reading. Data is averaged over a specified interval, with totals and counts reset after each interval. An LED matrix is used to display visual alerts, showing "!!!" if thresholds are exceeded and "OK!" if all readings are safe. The code serves sensor data to connected clients via a web interface, refreshing every 5 seconds. Functions to reduce and reset alert thresholds help manage the monitoring system's sensitivity. The code determines alert status by comparing sensor readings with thresholds and changing status colors accordingly. Additionally, the buzzer is activated to alert users when certain thresholds are exceeded, providing an audible warning alongside the visual alerts. The buzzer can also be remotely activated or deactivated via the web interface, allowing users to control it from a connected device.



**Budget**

Arduino Board (R4 with onboard WiFi): $30

UV Sensor: $18

Combination Pollution Gas Sensor (NOx, CO, NH3): $18

Temperature Sensor: $10

Miscellaneous Components: $23

Total: $99

**Work Distribution**

Phil Hutchison: Hardware setup, sensor integration, system testing, web interface development, code implementation, logic implementation, report.

Raima Zeeshan: UI design, report, presentation.

**Conclusion**

The Personal Outdoor Health Monitor project successfully developed a comprehensive system for monitoring environmental air quality, UV levels, and body temperature. It provided real-time alerts through visual and audible means and allowed remote control via a web interface. The project achieved its objective in making a personal health outdoor remote monitor.