**SYSTEM STUDY**

**Microcontroller:**

* Raspberry Pi 3B+ or Raspberry Pi 4.

**Sensors:**

* BME680: For temperature, humidity, pressure, and VOC (volatile organic compounds) measurements.
* SCD30: For accurate CO2 measurement, along with temperature and humidity data.
* Grove-Multichannel Gas Sensor: For detecting multiple gases and air quality parameters.
* FS00202 Laser Dust Sensor (PM2.5): For particulate matter measurement.
* FS00511 Formaldehyde Sensor: For formaldehyde detection.
* Fire Detection Sensor: You can choose a suitable smoke or fire detection sensor, such as a smoke detector or a heat sensor, to provide early fire detection capabilities.
* HEPA Filter System: For air purification**.**
* MQ-7 or MQ-9 for Carbon Monoxide (CO) monitoring.
* MQ135 for a wider range of gases, including NH3, NOx, and various volatile organic compounds.

**Indoor Air Quality Management**

* *Humidifier***:** Connect a humidifier to your Raspberry Pi via a compatible relay or smart plug. Program the Raspberry Pi to control the humidifier based on the humidity readings from the humidity sensor. You may also integrate an additional sensor to monitor the water level in the humidifier's reservoir and send alerts when it's running low.
* *HEPA Filter:* Ensure the HEPA filter system is integrated into the setup to purify the air effectively.

**Connectivity:**

* Wi-Fi Module: ESP8266 or ESP32 for wireless data transmission to the cloud.

**Display:**

* LCD screen or a web-based dashboard for local data visualization, if needed.

**Cloud Platform and Software:**

* ThingSpeak for data collection, visualization, and analysis.
* MQTT for efficient IoT communication.
* Node-Red for workflow creation and data processing.
* InfluxDB for time-series data storage.
* Grafana for creating data visualizations and dashboards.

**Alerts and Notifications:**

Implement an alerting system to notify users of abnormal conditions or safety issues. This can include:

* High CO2 levels
* Low or high humidity levels
* Poor air quality
* Smoke or fire detection
* Alerts can be sent via push notifications and alert buzzer.

**Mobile Application:**

* Administrator Login
* Dashboard
* Alerts and Notifications
* Historical Data
* Control Functions
* Scheduling and Automation
* Remote Access
* Safety and Security
* Compatibility
* Updates and Maintenance