**SYSTEM STUDY**

**Microcontroller:**

* Raspberry Pi 3B+ or Raspberry Pi 4.

**Sensors:**

BME680: For temperature, humidity, pressure, and VOC (volatile organic compounds) measurements. [Price : 2643/-, The BME680 sensor is preferred over others with similar features due to its high accuracy, pre-calibration, gas sensing capability, and compact design, making it well-suited for various applications, including indoor air quality monitoring and environmental sensing.

Journal : LSTM-Based IoT-Enabled CO2 Steady-State Forecasting for Indoor Air Quality Monitoring

* Grove-Multichannel Gas Sensor: For detecting multiple gases and air quality parameters. [Price : 3600/-, The Grove-Multichannel Gas Sensor is capable of sensing a variety of gases such as Carbon Dioxide (CO2) ,Volatile Organic Compounds (VOCs) ,Nitrogen Dioxide (NO2), Ammonia (NH3), Methane (CH4),Hydrogen (H2)]

Journal : Internet of Things (IoT) Based Indoor Air Quality Sensing and Predictive Analytic A COVID-19 Perspective(JAN-2021,MDPI)

* FS00202 Laser Dust Sensor (PM2.5): For particulate matter measurement. [Price : 1821, The FS00202 Laser Dust Sensor is a sensor designed to measure particulate matter (PM) in the air]

Journal : A Design of Indoor Air-Quality Monitoring System  (J. Phys. - Conf. Ser. - 2022)

* Fire Detection Sensor(Flame Sensor Module): 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. [Price: below 100]
* MQ-7 or MQ-9 for Carbon Monoxide (CO) monitoring. [Approx 100]

Journal : AI powered IoT based Real-Time Air Pollution Monitoring and Forecasting

* MQ135 for a wider range of gases, including NH3, NOx, and various volatile organic compounds. [Price Approx 200/-, The MQ-135 gas sensor is versatile, cost-effective, and capable of detecting various gases, making it suitable for a range of applications. ]

Journal : Development of an IoT-Enabled Air Pollution Monitoring and Air Purifier System, Journal of Metrology Society of India (September 2023)

**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. [ Primary Filter (Pre-Filter): This is the first line of defense in an air purification system. It captures larger particles such as dust, pet hair, and debris. The primary filter prevents these particles from reaching the more sensitive carbon and HEPA filters, thereby extending the lifespan of the latter.
* Activated Carbon Filter: The activated carbon filter is designed to adsorb and neutralize odors, gases, and volatile organic compounds (VOCs) in the air. It consists of a layer of activated carbon, which is highly porous and has a large surface area to capture and trap these airborne contaminants.
* HEPA Filter (High-Efficiency Particulate Air Filter): The HEPA filter is a key component for removing fine particles from the air, including dust, pollen, mold spores, smoke, and other allergens. It has a high level of filtration efficiency, capturing particles as small as 0.3 microns with 99.97% efficiency.] Journal : Development of an IoT-Enabled Air Pollution Monitoring and Air Purifier System, Journal of Metrology Society of India (September 2023)

**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.(Journal : Development of an IoT-Enabled Air Pollution Monitoring and Air Purifier System,Journal of Metrology Society of India (September 2023)
* MQTT for efficient IoT communication. (Journal : LSTM-Based IoT-Enabled CO2 Steady-State Forecasting for Indoor Air Quality Monitoring)
* Node-Red for workflow creation and data processing. (Journal : LSTM-Based IoT-Enabled CO2 Steady-State Forecasting for Indoor Air Quality Monitoring)
* InfluxDB for time-series data storage. (Journal : LSTM-Based IoT-Enabled CO2 Steady-State Forecasting for Indoor Air Quality Monitoring)
* Grafana for creating data visualizations and dashboards. (Journal : LSTM-Based IoT-Enabled CO2 Steady-State Forecasting for Indoor Air Quality Monitoring)

**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