Smart Air Purifier with Air Quality Monitoring System

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ABSTRACT - The project introduces the concept and physical model of an air purification system for modest public spaces or residences. The model is equipped with a set of sensors and an Arduino UNO series microcontroller that are used to determine the air quality. As the LCD system senses the quality of the air in the room, as well as the temperature and relative humidity, it displays live air quality index, temperature, and relative humidity. The air purifier's body is made of transparent glass sheets and filters. Activated carbon and HEPA filters are used as filters. It also includes a UV-C lamp to kill harmful viruses.

Key Words: IoT, Arduino, Air Purifier

1. INTRODUCTION

An air purifier is a device that cleans the air in a room. These devices are commonly used to improve the air quality in homes, offices, and other indoor spaces. Air purifiers remove pollutants from the air by drawing it in from the surrounding environment and passing it through a series of filters. The purified air is then restored to the room.

The proposed air purifier removes particles from the air with HEPA filters, whereas others on the market remove gasses and odors with activated carbon filters. Some air purifiers are intended for particular rooms or spaces, such as kitchens or bedrooms, whereas others are portable and can be used in any indoor space.

2. LITERATURE SURVEY:

Large urban areas with high air pollution have negative effects on both people and the environment. Indian environmental problems are getting worse quickly. Vehicles and industries, which contribute to a variety of respiratory illnesses like asthma and sinusitis, are the main sources of air pollution. Due to the quantity of carbon dioxide and other dangerous chemicals released by vehicles and industries, the air quality is poor in major cities like Kolkata, Delhi, and Mumbai. In the References section, you can find examples of references from many categories, such as:

1) Based on the information provided in the paper[1], we have extracted sensor values from the MQ135 sensor and have a rough idea of how to construct our air monitoring system using wireless sensor networks.
2) By referring to a publication [2], we learned a basic method for creating an air purification system that uses an Arduino and a dust sensor.
3) The next item was a reference book that discussed various air filtration techniques and their applicability in the contemporary era [3].
4) An example of a conference paper that goes into further detail about different air monitoring systems and how IOT may be used to implement them. [4]
5) We used a patent that described the operation of an air filter to gain insight into how an industrial air filter was actually built. [5]
6) The study [6] provided a thorough explanation of a Shop Air Filter plan and its design.

3. DESIGN AND WORKING:

3.1 THE STEPS FOR FILTERING AIR ARE AS FOLLOWS:

1) Air is drawn into the air purifier's first filter through an aperture in the front panel.

2) The first filter is referred to as the "Dust Filter" and its primary job is to filter out the large airborne particles. It eliminates 3 to 10 micron-sized contaminants.

3) The second filter is the so-called "Pre Filter," and its primary job is to remove particles in the air that are visible to the unaided eye, including hairs. It eliminates particles between 10 and 25 microns in size.

4) The Fine filter eliminates the majority of particles with a diameter larger than or equal to 3 microns.

3.2 CIRCUITS:

A) Sensors NH_3, NOx, alcohol, benzene, smoke, and CO_2 are just a few of the gasses that the MQ 135 air quality sensor can detect. Perfect for usage in a factory or office. The MQ135 gas sensor is very sensitive to hazardous gasses like smoke and ammonia, sulfide, and benzo steam. It is inexpensive and especially useful for applications involving the monitoring of air quality

B) Specifications include the following:

a) High Sensitivity

b) High sensitivity to Ammonia, Sulfide, and Benzene

c) Stable and Long Life

d) Detection Range: 10 - 300 ppm NH3, 10 - 1000 ppm Benzene, 10 - 300 Alcohol

e) Heater Voltage: 5.0V

f) Dimensions: 18mm Diameter, 17mm High excluding pins, Pins - High

g) Low cost and long life.

C) The display module and the microprocessor:

The HD44780U dot-matrix LCD display module and the 3.3V 8MHz Arduino Uno were both used in the hardware design.

D) Hardware Interconnections: The connections between the modules are shown in Fig. The fan is driven by the Relay module, which is operated at 230V, and the Arduino Uno is powered at 5V by stepping down the voltage.

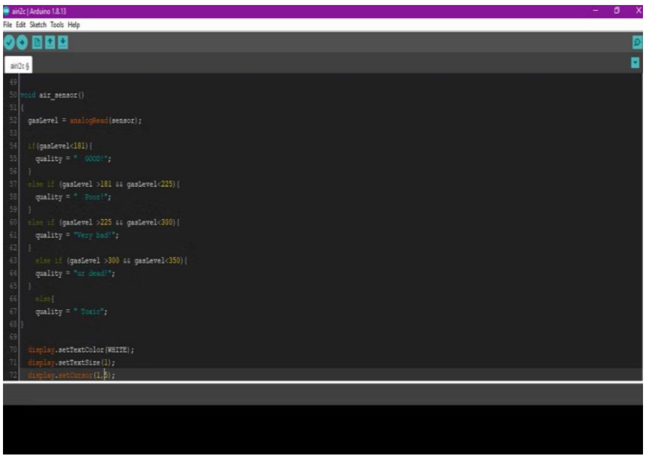

Fig -1: Code snippet

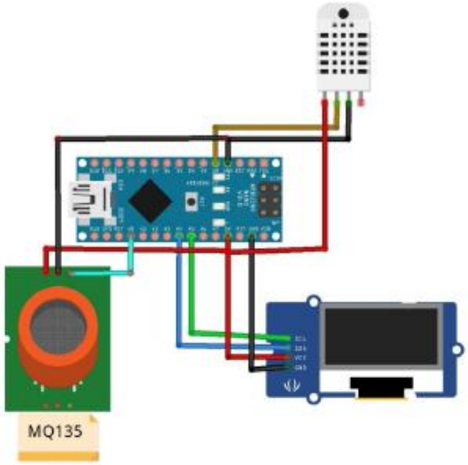

Fig -2: Schematics

4. CALCULATIONS:

Choosing the appropriate components for the air purifier requires knowing the size of the room. The size is decided using the CFM (cubic feet per minute) value of the room, and then the fan for the air purifier is chosen using the same CFM value of the room. The fan's rpm is used to calculate its CFM.

CFM= (L x W x H x Q)/60 min

L= Length of room (sq ft)

W= Width of room (sq ft)

H= Height of room (sq ft)

Q = Air Flow rate

CFM = 3.1416(PI) X (0.5- S) X R X A

S = Square feet radius of fan (sq ft)

R = Rpm of fan (rad/s)

A = Area of fan

The Calculations Of The Air Purifier In The Project Are As Follows:-

1) The Measurements Of Room Is Given In Order To Determine CFM

L = 30 SQ FT, W = 30 SQ FT, H= 30 SQ FT, Q = 4

CFM= (L X W X H X Q)/60 MIN

CFM = (30 X 30 X 30 X 4)/60

CFM =27000/60

CFM = 450

THE CFM OF SELECTED ROOM IS 450

2) The Measurement OF CFM of Fan FROM RPM (Rotations Per Minute) of Fan

S= 150mm = 0.242sq ft , R = 2000, A=666.66ft

CFM = 3.1416(pi) x (0.5- S) x R x A

CFM = 3.1415 X (0.5 – 0.242) X 666.66

CFM = 3.1415 X 0.258 X 666.66

CFM = 540.332

THE CFM OF FAN IS 540.332

The values of CFM for room and fan which are obtained for the project are

a) The CFM of Selected Room is 450

b) The CFM of Fan IS 540.332

The room and fan values that were acquired for the project are as follows:

a) The selected room's CFM is 533.33;

b) The fan's CFM is 540.332. The equations take into account the given values, and any revisions might take into account a change in the selectivity of the components.

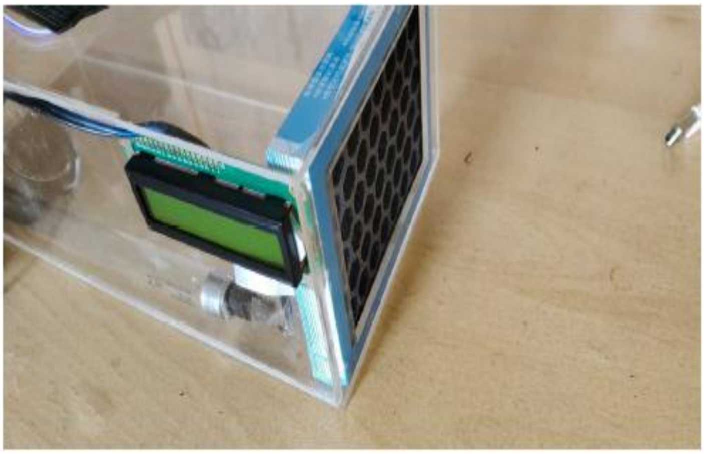

Fig -3: Structure (1)

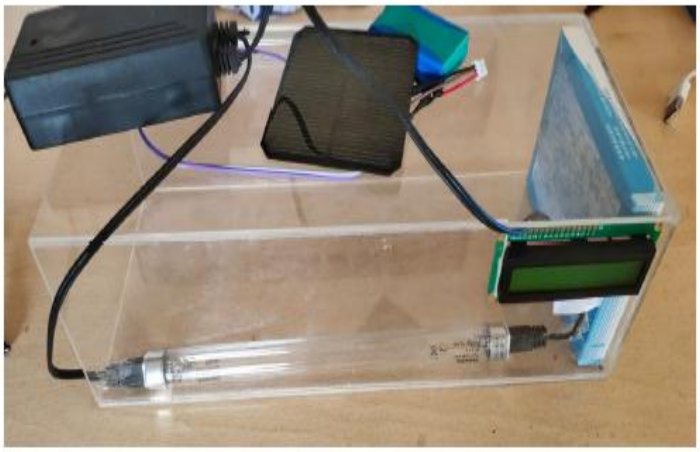

Fig -4: Structure (2)

5. RESULTS

The MQ135 sensor outputs are thus calculated and the filters were found to be effective in various situations as stated under:

Table -1: Results

	MQ-135 Output	MQ-135 Output (Proposed)	Place of Observation
1.	229	137	Classroom
2.	236	288	Corridor
3.	226	430	Workshop
4.	560(Polluted)	754(polluted)	Roadside Area

6. CONCLUSIONS

Attention to how people interact with physical items and gadgets is growing. Many research have tried to offer a simple and intuitive method for making service requests. Future advances are exciting thanks to the current trend of using IoT technology to control devices. Additionally, the proposed solution makes use of smart home technology, such as an IoT enabled air purifier. The outcomes not only demonstrate the major advancement of the IoT-based air purifier system, but also satisfy customer needs. The fundamental idea underpinning the Internet of Things could involve new operational procedures, new ways to connect devices, or perhaps a completely fresh start. There are several research concerns that can be addressed as the full operational definition is finalized.

FUTURE SCOPE:

1) Wearable air purifiers with HEPA filters and UV light can become a convenient tool in Hospitals

2) In future, air purifier would be considered as a tool of removing pet dander

3) Air-purifier can be made more attractive and appealing part of interior design of houses

4) The new Nanofibers can remove 90% of all particles as small as 2.5 microns, while allowing for flow rates 2.5 times better than conventional air filters

4) Plant-powered air purifiers use an active plant to clear the air plus creates oxygen for your room

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