Integrated Air Purifier for Vehicles/Homes

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Abstract— **Particulate contamination has bad outcomes for human wellbeing, and is an issue of worldwide concern. Open air contamination has turned into a reason to get excited in India specifically on the grounds that current information propose that encompassing contamination levels in Indian urban areas are a portion of the most noteworthy on the planet. We contemplate the quantity of particles in the vicinity of 0.5µm and 2.5µm inside while utilizing moderate air purifiers in the profoundly dirtied city of Delhi. Despite the fact that significant decreases in indoor number fixations are seen amid air purifier utilize, indoor air quality while utilizing an air purifier is oftentimes more terrible than in urban communities with direct contamination, and frequently more regrettable than levels watched even in dirtied urban areas. At the point when open air contamination levels are higher, by and large, indoor contamination levels while utilizing an air purifier are likewise higher. Additionally, the proportion of indoor air quality amid air purifier use to two examination measures of air quality without an air purifier are likewise emphatically related with open air contamination levels, recommending that as encompassing air quality compounds there are unavoidable losses to upgrades in indoor air quality amid air purifier utilize. The discoveries of this investigation demonstrate that despite the fact that the most moderate air purifiers at present accessible are related with huge enhancements in the indoor condition, they are not a trade for open activity in areas like Delhi. Albeit private arrangements may fill in as a stopgap, diminishing surrounding air contamination must be a general wellbeing and approach need in any area where air contamination is as high as Delhi's amid the winter.**

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I. INTRODUCTION (HEADING 1)

An air purifier or air cleaner is a device which removes contaminants from the air in a room. These devices are commonly marketed as being beneficial to allergy sufferers and asthmatics, and at reducing or eliminating second-hand tobacco smoke. The commercially graded air purifiers are manufactured as either small stand-alone units or larger units that can be affixed to an air handler unit (AHU) or to an HVAC unit found in the medical, industrial, and commercial industries. Air purifiers may also be used in industry to remove impurities such as CO_2 from air before processing. Pressure swing adsorbers or other adsorption techniques are typically used for this.
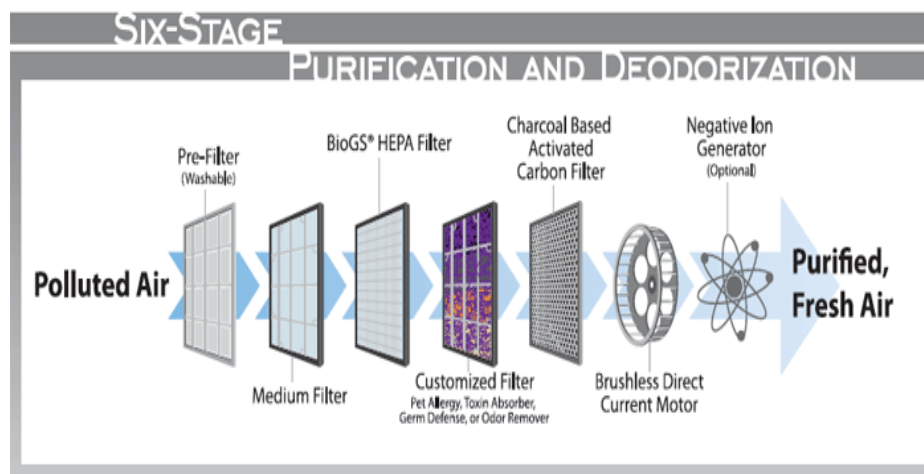

Fig.1- Ideal commercial Air purifier Ease of Use

A. History

Charles Anthony Deane was awarded with a patent for a device which comprise of a copper helmet attached with a flexible collar and a garment. At the rear of helmet a long leather hose is attached which is used to supply air, a short pipe allowed breathe air to escape. With secured straps, garment was to be constructed from a leather or airtight cloth. Two patents applying the absorbent properties of wood charcoal to air purification was filled by John Stenhouse in 1860 and 1867. In 1950s came the highly efficient HEPA filter which were commercialized after being put to use in United States to control airborne radioactive contaminants.

B. Types of Airpurifiers

1) HEPA Filters: It utilizes a fabric channel that can trap 99.9% of particles that are .3 microns or bigger and a fan to circle air all through the machine. Any unsafe molecule that is found in air can be recovered successfully. Contingent upon the air quality these replaceable channel can keep going for a long time. HEPA channel is viable unit however utilizes part of vitality.

2) Ozone purifiers: Ozone is a responsive oxidant that can demolish a few chemicals and microscopic organisms. When it responds with a few substances noticeable all around, those substances are separated into materials that are poisons. An Ozone purifier battles those toxins. It is likewise extremely viable in battling smells yet does not conflict with allergens or generally chemicals.

3) Carbon air purifiers: This sort of air purifier is exceptionally powerful in catching specific particles, including gas, smoke, and scent. It is likewise the most permeable channel sold available. A carbon air channel contains little pores that are extremely retentive and synthetically respond to particles as they go through and the smells and particles append to the carbon. This specific air purifier does not conflict with allergens or small scale living beings.

4) Ionic air purifiers: This sort of purifier works by 'ionizing' air, making particles pick up either a positive or negative charge. The ionic air purifier has an accumulation of plates that contain a contrary charge from the air particles; accordingly, the particles are pulled in to the plates. The charged particles will draw in different particles with the contrary charge to them. An ionic air purifier can evacuate fine particles noticeable all around, even from a few feet away, however it doesn't take a shot at scents or eliminate germs.

5) Ultraviolet light air purifiers: The Ultraviolet light air purifier cleans smaller scale living beings as they go through, including infections, germs, microscopic organisms and shape. After they are treated with the bright light, the small scale creatures are never again ready to repeat and develop. Bright light air purifiers don't conflict with smoke, scents, allergens or chemicals.

II. METHODLOGY

In spite of the fact that they may appear like another development, air purifiers have been around for over 200 years. What began as defensive covers for fire fighter, air purifiers have now advanced the capacity to shield you and your family from airborne poisons.

As sensitivities and asthma now influence in excess of 50 million Americans, the worry for safe indoor air quality has quickly expanded. Presently like never before, Americans are searching for approaches to enhance their indoor air quality. Air purifiers stand out in progressions for cleaner air. AchooAllergy.com speaks to the best air purifier and air cleaner producers including Austin Air, Blueair, and IQAir.

Allergens like smoke, shape spores, dust, microscopic organisms, infections, pet dander, and different toxins harm your lungs and safe framework. Shockingly, the greater part of these aggravations can't be seen by the exposed eye. Air purifiers channel allergens and contaminations seen or concealed by the human eye. To expel these articles, air purifiers regularly utilize channels, electrical fascination, or ozone.

Air channels use fine sifters that channel particles from flowing air. As wind streams into the air purifier, the better the sifter utilized, the littler the particles it traps. The acknowledged benchmark for air channels has been set by the High Efficiency Particulate Air (HEPA) channels, which are ensured to trap 99.97% of airborne particles bigger than 0.3 microns. Microns are the standard unit utilized for estimating air particles. Every micron is comparable to 1/25,400 of an inch. The stripped eye can't see anything littler than 10 microns, so toxins like microscopic organisms and infections escape identification. Room aeration and cooling system channels just catch particles 10.0 microns or bigger. HEPA channels evacuate littler allergens like tidy, smoke, chemicals, asbestos, dust, and pet dander.

The more circumstances the air goes through the HEPA channel, the cleaner the air progresses toward becoming. The room limit of a HEPA air purifier will decide if the air cleaner can deal with your air decontaminating needs. Untouchable brands like Austin air purifiers will give roughly 6 air trades for every hour in a normal room and contain a normal of 15 lbs of enacted carbon/zeolite mixes, which adsorb chemicals and scents. Notwithstanding the HEPA channel, brands like NQ air purifiers offer a discretionary restorative review ultra-violet (UV) light framework, used to rapidly execute infections, microscopic organisms, and parasites upon section into the air purifier. UV light likewise shields the HEPA channel from natural and viral pollution.

Electrical attraction is another technology utilized by air purifiers to trap particles. Three types of air cleaners work using electrical attraction: electrostatic precipitating cleaners, electret filters, and negative ion generators.
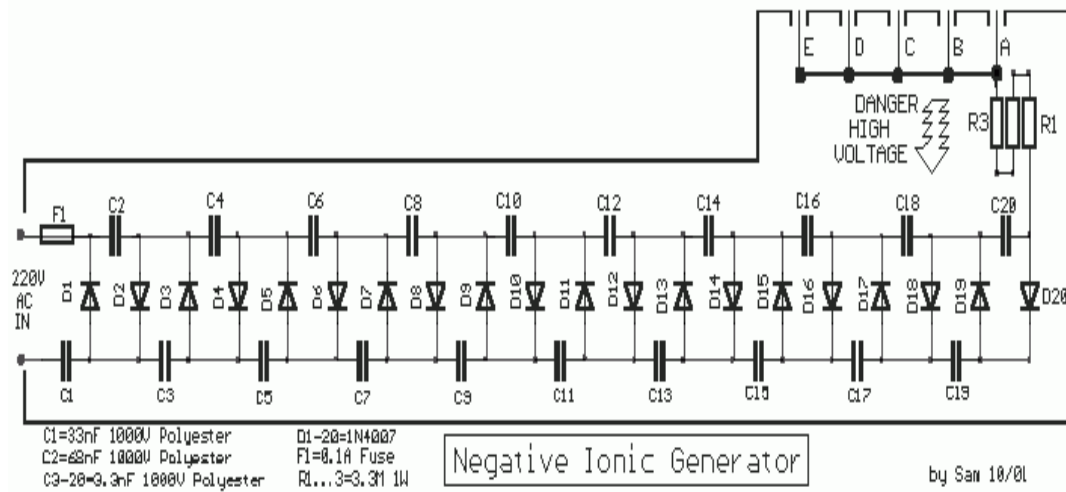

Fig.2 Ckt. Diagram of negative ion generator

III. AIR POLLUTION SENSING CIRCUIT

We measure the air level and analysis contents intensity of air. The value of air intensity is displayed on LCD. In this project gas sensor senses the air intensity and display on LCD in form of current value. But for further application we want to give the set value in LCD then we use the SPST switch with the help of this switch we can change the set value and display in LCD. System automatically checks this condition and provides the information on LCD. As the measured value exceeds the set value a negative signal goes to relay which make the air purifier start working.

A. Technical prospective idea-

- Printed circuit board size: 9*5
- Mdf board size 18*12
- Height 5cm

B. Circuit proposal methodology

We make a project in different mode:

1st mode: In this mode we design over all frame script such as Idea of project, Components list &Circuit diagram.

2nd mode: In this mode we calculate the value of Components. Decide the component rating. Name of components that may be used in the project. Purchase the components.

3rd Mode: In this mode we design a circuit on pcb. Assemble the components. Test the soldering dry or not.

4th mode: In this mode we use software for coding.

- We use keil software.
- We design a code in assembly or embedded c.
- We create the hex file.

5th mode:

- In this mode we design a circuit diagram on proteus for simulation
- Try to simulate on proteus.

6th mode:

- In this mode we use the top-win software.
- We programmed the ic.

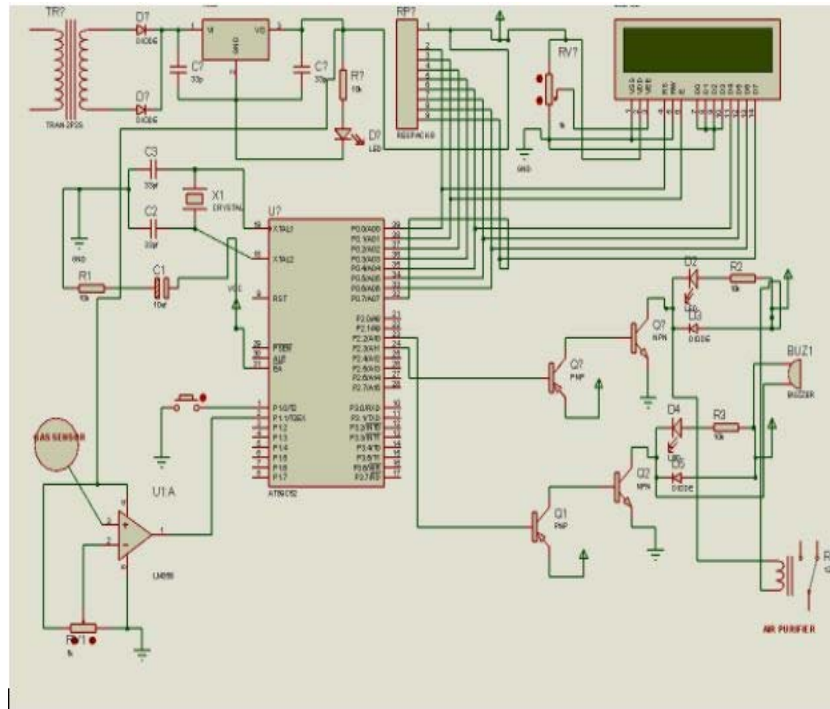7th mode: In this mode we test the features of project.

Fig.3 Air pollution sensing circuit designed on proteus.

C. Working Procedure

220V A.C supply from home is fed to a step down transformer which gives 12V A.C as output. Using a rectifier circuit which further converts 12V A.C to D.C. DC current from rectifier is passed through 1000µf capacitor to remove noise from the current signal. Then using a regulator 7805 IC we converted 12V to 5V operational voltage for the components of the circuit. And noise during conversion is also eliminated through 1000µf capacitor. 12V D.C was used to turn on the fan for purifier. To check the current in PCB we used a resistance and an LED for indication. We serve the voltage to micro-controller ATMEL 89S52 (8KB ROM, 256 Bytes of RAM, 3 Timer counters, 8 bit processor, EEPROM flash memory). Its an 40 pin IC, 4 ports P0, P1, P2 & P3 and each port contains 8 pins. Pin 18 & 19 is connected to a crystal oscillator for feeding machine cycles to µc (11.0592 MHz). Ceramic capacitors (27 pf each) are used to stabilize the frequency of the crystal oscillator. Reset circuit containing capacitor and resistance and push button is attached to reset pin (pin 9) of µc. 2x16 LCD (P7-P14 data lines, Pin 4 to select command and data, Pin 5 to read and write & Pin 6 is enable pin. Pin 1 is grounded and Pin 2 is for Vcc supply) is inserted on PCB.

1) MQ2 Gas Sensor

Gas sensors work by recognizing measures of particular gases in ppm, or parts per million. Ppm is a unit of focus in the prompt encompassing territory. You can ascertain percent from ppm by partitioning the ppm by 1,000,000 and increasing by 100. So in the event that you can recognize 800ppm of oxygen noticeable all around, the air is 8% oxygen. (Our atmosphere is over 20% Oxygen, yet this is only a case)
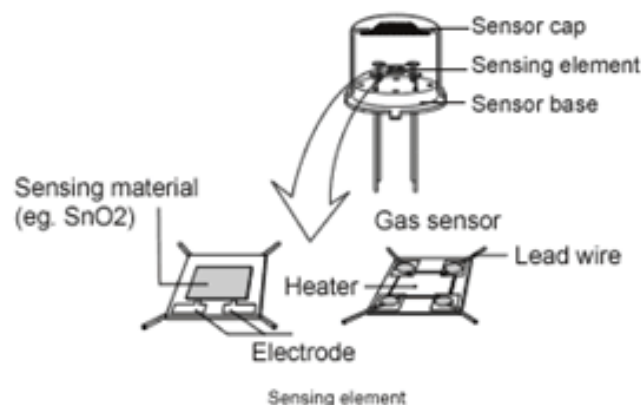

Fig.4 Gas sensor MQ2 inside structure

These sensors use a Wheatstone bridge to detect gases, which is essentially two voltage dividers in parallel with each other. As you can see in the diagram, two pins are connected to a heating element, whereas the other two are connected to the sensor itself. The sensing element for gas sensors is coated with a metal oxide, and the Figaro models we are interested in use Tin oxide specifically (SnO_2). When the heating element receives power, the SnO_2 becomes oxidized and donates electrons to the Oxygen yielding positively charged SnO_2 molecules on the coating of the sensing element. This situation causes a barrier to electron flow, increasing resistance of the sensor. When a de-oxidizing gas is introduced in the equation (such as ethanol, or C_2H_5OH), the amount of available oxygen decreases. This means that there is less oxygen to accept the donor electrons from the SnO_2 coating, which reduces the resistance of the sensor due to the SnO_2 not being as positively charged.

The actual gas levels in ppm are measured by determining the voltage across a load resistor which is put between the negative pin of the sensing element and ground. As this resistance value is altered, this can be sent to the analog value to an ADC.

Gases like- Hydrogen (H), Ethanol (C_2H_6O), Iso-butane ($CH_3CH(CH_3)_2$), Carbon Monoxide (CO), Methane (CH_4), Toluene (C_7H_8), Hydrogen Sulfide (H_2S), Ethanol (C_2H_6O), Ammonia (NH_3) in earth's atmosphere apart from Oxygen(O_2) heat the filament in the sensor which ultimately act as a transducer which converts thermal energy to electrical energy. It depends on negative temperature coefficient, greater the heat generated more will be the conductivity and greater an analog signal is generated. Analog signal is fed to ADC IC (0809) which converts analog signal to digital signal. Microcontroller convert the digital signal to ASCII code and according to the program stored in µc displays the value of pollutants on LCD in ppm. Now by default in program code we stored a value of 29 ppm and we can change the set value through the manual push button present on the PCB which is programmed accordingly to increase or decrease the ppm value. As when the measured value through sensor increases µc gives a negative signal through its port into a darlington pair which acts as current gain for supplying relay which requires a large voltage and current to operate which can't be fulfilled by µc and thus decreasing load on microcontroller to energize the relay. Relay is already fed with a positive supply. led is attached for its indication to make sure the circuit is working. As relay starts working it switch on the air purifier intake fans for air purification process.

IV. FUTURE SCOPE AND CONCLUSION

This project has a wider scope for commercial application in cars, homes as well as corporate sectors. It is the need of an hour in the cities like Delhi which has highest rate of air contamination. Higher contamination leading to several health problems, in result short span of life. This integrated air purifier is a cost efficient automated purifier which can be made easily with readily available items in market. The technology behind in designing the impurity measurement system is easy to understand. In today's world of artificial intelligence where we can see home and car automation system, this air purifier can be integrated easily with IOT based projects thus leading to healthy way of living.

The project which is proposed and implemented in this paper is kind of a prototype which can be given more dynamic look with industrial implementation. The air purifier is successful upto 70% of its ideal working condition. Easy to handle, portable nature of this project makes it energy and cost efficient. The problem of air pollution caused by city traffic, industries, garbage burning and construction work can be greatly eliminated through the use of air purifiers. Everyone has a right to live in a healthy environment and it's a matter of concern for upcoming generation to provide them with healthy environment to breathe.

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