IoT Based Smart Air Purifier

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Abstract- *Air pollution has crossed all bounds in 2021. The spread of air pollution is so high that about 91% of the world population is exposed to air pollution. This also means that the air you breathe in your house is polluted. The project IoT based air purifier that does not use expensive filters but rather uses car air filter. It also acts as an air humidifier and can be used as disinfectant diffuser too which helps to kills certain bacteria and viruses present in the air. This project consists of DC cooling fans, Arduino NANO, air quality sensor, temperature sensor, IR sensor, motors and relays. This system makes use of 12V DC low noise cooling fans that are used to suck in air through the air filter. The pulled air is purified by the air filter and passed out through the cooling fans. This system monitors the air quality, temperature and persons in the in the room or work space. If the air quality level is decreased below the determined level the oxygen in the can is automatically sprayed to balance the oxygen level in the room by using air quality sensor. And disinfectant spray is also added in this system to spray whenever it is needed. All the information can be monitored and controlled in the smart phone application using IoT module through cloud communication. The ON/OFF control and the oxygen or perfume diffusion is also controlled by the smart phone application using IoT.*

Keywords- Internet of Things, Relay, Arduino Nano, Air quality.

I. INTRODUCTION

The aim of this project is to purify the air using low-cost air filter and to add extra oxygen in the air during abnormal air quality index. This system consists of Arduino Nano, NodeMCU, air filter, cooling fans, relays, InfraRed (IR) sensor, air quality sensor, temperature sensor, servo motor, dis-infectant spray and oxygen can. The Arduino nano acts as the brain of the system and all the inputs from the sensors are processed in it. Whenever a signal from the smart phone application is received through the wi-fi module the required functional operation is performed. All the parameters of the sensors are monitored and the ON/OFF control of the cooling fans, dis-infectant spray is also controlled through the smart phone application. This system not only purifies the air, it also adds oxygen in the air whenever the air quality index level is abnormal. So, we aim to utilize the best knowledge of engineering to design such a cost-efficient smart air purifier that can be operated using IoT. Therefore, this air purifier will save the money and gives a good quality of purified air.

II. LITERATURE SURVEY

According to recent survey, 91% of world pollution is exposed to air pollution. Because of this many people are affected by breathing related issues and many diseases.

The smart indoor air quality monitoring and purifying system by Akanksha Dhamija, 2019 identifies the air quality level and provides information about the levels and also purifies the air by HEPA filter. But this system costs more and replacement of filter is also expensive.

Due to various factors in both monitoring and purifying system, we got an idea to combine both the monitoring and purifying system into a single system. And oxyen can and dis-infectant spray is also added in this system to provide extra benfits to the user.

III. CONSTRUCTION

The proposed system consists of an Arduino Nano to control the entire system. The model also consists of aNodeMCU module, relays, temperature sensor, air quality sensor, Infrared (IR) sensor, servo motors, cooling fans, voltage regulator, dis-infectant spray, oxygen spray and air filter. The Arduino is supplied with the 12V DC. TheIR sensor is also connected with Arduino Nano which turn ON the air purifierincase of any detection in room. Two relays are used which are directly connected with the cooling fans, two fans are connected in one relay and the third fan in another relay. The ESP8266 module integrated with the mobile application is also connected to check the real time condition of electrical parameters and control them using IoT.The air quality sensor data is observed and the oxygen can is opened using a servo motor when the air quality index is abnormal. A dis-infectant is also used to spray whenever needed with the help of servo motor controlled by smart phone. All the sensor data are monitored and controlled by a smart phone application.

IV. BLOCK DIAGRAM

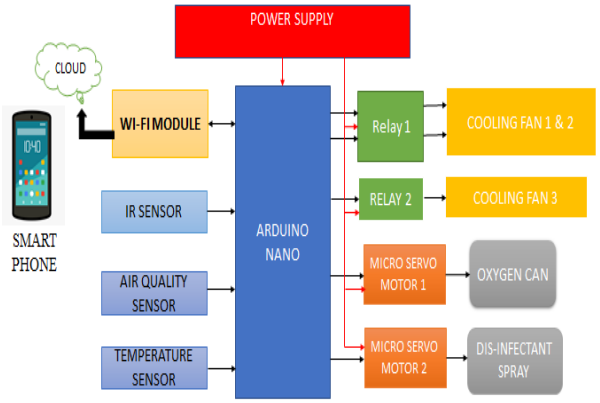

Fig1: Block diagram of IoT based smart air purifier

V. WORKING PRINICIPLE

An input of 230V is given to the adopter, which converts 230V AC to 12V DC. The 12V DC is given to DC-DC voltage buck regulator to adjust the voltage level.The air is sucked-in through the air filter using cooling fans and send out. This air filter eliminates the dust particles in the air and gives us dust free air. Air quality sensor is used to monitor the air quality level and whenever the air quality index crosses a particular level the oxygen is sprayed to maintain a good air quality. The temperature sensor is used to monitor room temperature. The IR sensor is used to ON one of the cooling fan when anyone opens the door to enter. The other cooling fans can be operated by using a smart phone application, also manually. An dis-infectant spray is also fixed in this system to spray whenever needed by using smart phone application. This smart air purifier is full monitored and controlled by a smart phone application.

VI. COMPONENTS DESCRIPTION

Arduino Nano:

Arduino Nano is anopensource microcontroller. The ATmega328P provides UART TTL serial communication and is equipped with sets of digital and analog I/O pins that is interfaced with various components. The board has 14 digital I/O pins, 6 analog I/O pins and it is programmed with Arduino IDE. It is powered with USB cable or external 9v battery.

NodeMCU:

NodeMCU is an open-source Lua based firmware and development board specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.

Temperature sensor:

This is a type of resistor whose resistance varies with change in temperature. These NTC thermistors are made up from the combination of metal oxides which passed through sintering process which gives negative electrical resistance versus temperature (R/T) relationship to it.

Air Quality sensor:

Air quality sensor for detecting a wide range of gases, including NH3, NOx, alcohol, benzene, smoke and CO2. Ideal for use in office or factory. MQ135 gas sensor has high sensitivity to Ammonia, Sulfide and Benze steam, also sensitive to smoke and other harmful gases.

Relay:

Relay is a electromechanical switch that is used to make or break the electrical connection. The electromagnet is activated by a low-power signal from a micro controller. The electromagnet pulls to either open or to close an electrical circuit when it is activated.

Infra-Red (IR) Sensor:

IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation.

Cooling fan:

The provided 12V/24V ATO BLDC motor has excellent torque characteristics, three phase 4 pole, delivers 5000 rpm high speed dynamic operation, brushless design for a long life, is intended to fill the need for a small motor with high performance.

Servo motor:

Tiny and lightweight with high output power. Servo can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds but smaller. You can use any servo code, hardware or library to control these servos. Good for beginners who want to make stuff move without building a motor controller with feedback & gear box, especially since it will fit in small places. It comes with 3

horns (arms) and hardware. Position "0" (1.5 ms pulse) is middle, "90" (~2ms pulse) is middle, is all the way to the right, "-90" (~1ms pulse) is all the way to the left. Position "0" (1.5 ms pulse) is middle, "90" (~2ms pulse) is middle, is all the way to the right, "-90" (~1ms pulse) is all the way to the left.

Air filter:

The air filter prevents any insects, dust, particles, sand or debris reaching the engine and ensures a good mixture of air and fuel to support performance.

VII. CIRCUIT DIAGRAM

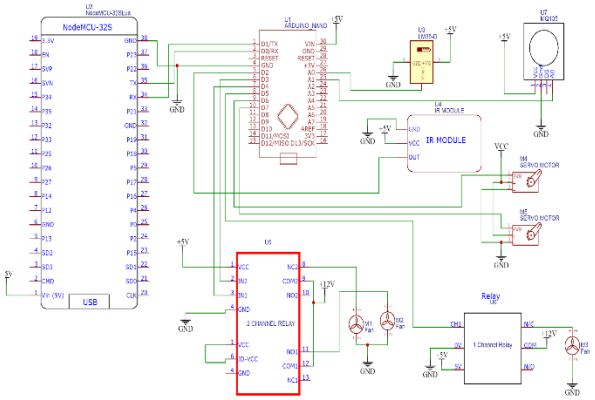

Fig2: Circuit diagram

VIII. ADVANTAGES

- The proposed system IoT smart air purifier provides the following advantages:
- Additional oxygen is provided when air quality index is abnormal.
- The wireless monitoring and operation will be user friendly.
- The replacement of filter will be easy at a low cost.
- It improves the air quality level in the room.

IX. RESULTS

This system purifies the airand displays the temperature, air quality level in the mobile application. It also operates on both smart phone and manually. If the air quality level reaches above the threshold value i.e., 200 it releases oxygen to manage good quality of air. And also sprays dis-infectant spray whenever needed.Thus the user can view and control the real time function at any instant.

Fig3: Front and rear view

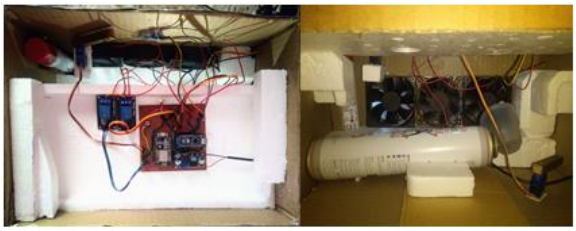

Fig4: Top and inner view

X. CONCLUSION & FUTURE SCOPE

This project IoT based smart air purifier that does not use expensive filters but rather uses car air filter. It also adds oxygen in the air during abnormal conditions and can be used as disinfectant diffuser too which helps to kills certain bacteria and viruses present in the air. And everything is monitored and controlled by smart phone application.

In future, this work can be continued by adding better ventilation system. It can be controlled efficiently using AI (Artificial Intelligence) and by using PM2.5 (Particulate Matter) sensors to identify harmful particles under 2.5 microns. More security warnings and notifications about air quality will help the user to know in advance and control the appliances to make the indoor environment breathable before going in that area.

XI. ACKNOWLEDGMENT

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REFERENCES

[1] Du L, Batterman S, Parker E, Godwin C, Chin JY, O'Toole A, et al. Particle concentrations and effectiveness of free-standing air filters in bedrooms of children with asthma in Detroit, Michigan. Build Environ. 2011; 46(11): 2303–2313. pmid:21874085.

[2] "Indoor Air Quality Monitoring using Wireless Sensor Network" Sayantani Bhattacharya, Sridevi S, Pitchiah R

Centre for Development of Advanced Computing Chennai, India.

[3] A WiFi-enabled Indoor Air Quality Monitoring and Control System: the Design and Control Experiments Xiaoke Yang, Lingyu Yang, and Jing Zhang.

[4] Intelligent Controlling of Indoor Air Quality based on Remote Monitoring Platform by Considering Building Environment ShaodanZhi Technical Center, China State Construction Engineering Corporation Limited No. 15 of Linhe Street, Shunyi District, Beijing 101300, China.

[5] Al-Haija, Q. A., Al-Qadeeb, H., & Al-Lwaimi, "Case study: Monitoring of air quality in king Faisal University using a microcontroller and WSN", Procedia Computer Science, volume 21,pp.517–521, 31 Dec 2013.

[6] Air purifiers with Second Hand Smoke education is a feasible intervention in homes of women and infants stated by (Rice et. al. 2018). After application of air purifier, what kind of air pollution level inside the room can be maintained Proceedings of the International Conference on Industrial Engineering and Operations Management Bangkok, Thailand, March 5-7, 2019.

[7] C.H. Ao and S.C. Lee, "Indoor air purification by photocatalyst TiO2 immobilized on an activated carbon filter installed in an air cleaner", *Chemical engineering science*, vol. 60, no. 1, pp. 103-109, 2005.