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SMART PLANT BASED AIR PURIFIER USING NODEMCU

[1]PRANSHU TAPAN MANDAL, [2]DANISH ILTEZA ANSARI, [3]ANKIT AJAY NAGDEVE,

[4] PROF. JUNAID MANDVIWALA, [5]Dr. VARSHA SHAH.

[123]STUDENT, [4]ASSISTANT PROFESSOR,[5]PRINCIPAL.

"RIZVI COLLEGE OF ENGINEERING" (RCOE),

MUMBAI UNIVERSITY, MUMBAI, INDIA.

Abstract: The increase in pollution everywhere, due to increase in urbanization and industrialization, attracts the major concern of all the authority and the people at global level look forward to find out the way to resolve it. Pollutants are the substances that cause pollution and that affect the environment. Though the efforts were to control air pollution have traditionally focused on the outdoor air, it is now apparent that high concentrations of contaminants are common inside most private and public buildings (indoor air). The concerns about public health problems increase here due to indoor air pollution and are based on the fact that states, urban residents usually spend more than 90 percent of their time indoors, and the concentrations of some contaminants are higher in indoors than outdoors, and some of the pollutants personal exposures are not characterized effectively by outdoor measurements. Our idea is based on the NASA Clean Air Study. This idea is mainly focusing on reducing indoor air pollution through the use of plants.

Index Terms **- Clean Air Study, Volatile Organic Compounds, Air Pollution, Hydrocarbons, Humidity.**

I. INTRODUCTION

In this idea, the leaves, roots, soil, and associated microorganisms of plants have been evaluated as a possible means of reducing indoor air pollutants. Additionally, a novel approach of using plant systems for removing high concentrations of indoor air pollutants such as cigarette smoke, organic solvents, and possibly radon has been designed from this work. This air filter design combines plants with an activated carbon filter. The rationale for this design, which evolved from waste water treatment studies, is based on moving large volumes of contaminated air through an activated carbon bed where smoke, organic chemicals, pathogenic microorganisms (if present), and possibly radon are absorbed by the carbon filter. Plant roots and their associated microorganisms then destroy the pathogenic viruses, bacteria, and the organic chemicals, eventually converting all of these air pollutants into new plant tissue. It is believed that the decayed radon products would be taken up the plant roots and retained in the plant tissue.

The system is based on the NASA Clean Air Study. The NASA Clean Air Study was a project led by the National Aeronautics and Space Administration (NASA) in association with the Associated Landscape Contractors of America (ALCA) to research ways to clean the air in space stations. Its results suggested that, in addition to absorbing carbon dioxide and releasing oxygen through photosynthesis, certain common indoor plants may also provide a natural way of removing volatile organic pollutants (benzene, formaldehyde, and trichloroethylene were tested). The study further suggested that efficient air cleaning is accomplished with at least one plant per 100 square feet (9.3 m2) of space, but was conducted under sealed space station conditions and research conducted since has shown mixed results in the home or office.

II. INTERNET OF THINGS

In the new era of communication and technology, the explosive growth of electronic devices, smart phones and tablets which can be communicated physically or wirelessly has become the fundamental tool of daily life. The next generation of connected world is Internet of Things (IoT) which connects devices, sensors, appliances, vehicles and other "things". The things or objects may include the tag, mobile phones, sensors, actuators and much more. With the help of IoT, we connect anything, access from anywhere and anytime, efficiently access any service and information about any object. The aim of IoT is to extend

the benefits of Internet with remote control ability, data sharing, constant connectivity and so on. Using an embedded sensor which is always on and collecting data, all the devices would be tied to local and global networks. The term IoT, often called Internet of everything, was 1st introduced by Kevin Ashton in 1999 who dreams a system where every physical object is connected using the Internet via ubiquitous sensors. The IoT technology can provide a large amount of data about human, objects, time and space. While combining the current Internet technology and IoT provides a large amount of space and innovative service based on low-cost sensors and wireless communication. IPv6 and Cloud computing promote the development of integration of Internet and IoT. It is providing more possibilities of data collecting, data processing, port management and other new services. Every object which connects to IoT requires a unique address or identification with IPv6. There are so many people in the world whose health may suffer because they do not have proper access to hospitals and health monitoring. The Internet of things (stylised Internet of Things or IoT) is the internet working of physical devices, vehicles (also referred to as "connected devices" and "smart devices"),buildings and other items-embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) defined the IoT as "the infrastructure of the information society." The IoT allows objects to be sensed and/or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computerbased systems, and resulting in improved efficiency, accuracy and economic benefit.

III. Problem Statement and Objective

Environment has become the biggest concern of the society and now the concern for its conservation and protection is increasing among the people all over the world .The biggest problem is that there are various kind of pollution including air, water, soil, noise, radioactive, geothermal, light, visual, space, personal pollution etc. Studies are going on each of them and measures are being taken to reduce them .The primarily focus is on indoor air pollution, and its types, its effects on health & environment, and how to reduce it. Air pollution is defined as presence of any undesirable component in the air (indoor/outdoor) that deteriorates its quality and disturbs its natural composition and chemistry. Whenever we come across air pollution; the causes that come to our mind are vehicle or manufacturing exhaust, volcanic eruption, forest fires, burning fossil fuels, dry soil erosion, etc. These all are air pollutants causing outdoor pollution. We never think of indoor pollutants and indoor air pollution .Indoor air quality is of great importance since it has an effect on human health especially in developing countries where people spend 90% of their time indoors. It has been reported that indoor air is 12 times more polluted than the outdoor air. Indoor air pollutants primarily originate from building products, emission, human activities inside the building and infiltration of outdoor air and have increased as a result of lower gas exchange rates of newer, more energy-efficient buildings .The main indoor pollutants are: carbon monoxide, particulate matter, nitrogen oxides, Sulphur oxides,, arsenic, fluorine, volatile and semi-volatile organic compounds, ozone, radon, Trichloroethene (TCE), hydrocarbons, lead, asbestos, aldehydes, etc. Exposure to such pollutants can cause various kinds of acute and chronic illness including various pulmonary, cardiac, neurological, reproductive, developmental disorders and diseases and in some cases may even lead to cancer.

IV. Proposed System

4.1 Design Details

List of Hardware and Software

NodeMCU
DHT11- Humidity and Temperature Sensor
MS1100- VOC Sensor
Relay 5v
Mini Fan
Flowerpot
9V Batteries
Arduino ILE
Blynk App.

The Arduino software is compatible with the NodeMCU and the version 0.3.4 of Blynk application library.It will read the data from the MS1100 on Analog 0 and from a DHT11 on digital Pin 2. The sensors data will read every 2 seconds. If the DHT11 does not read any data, nothing is sent to the ESP8266.Some Virtual slots are to be created to communicate with Blynk over WIFI : Humidity values (virtual slot 4) Temperature values (virtual slot 5), MS1100 values (virtual slot 6), a LED trigger (virtual slot 7) to alert if the MS1100 is rising above a defined limit.To have a better control over communication, I added a switch to the Blynk interface to control the LED 13.

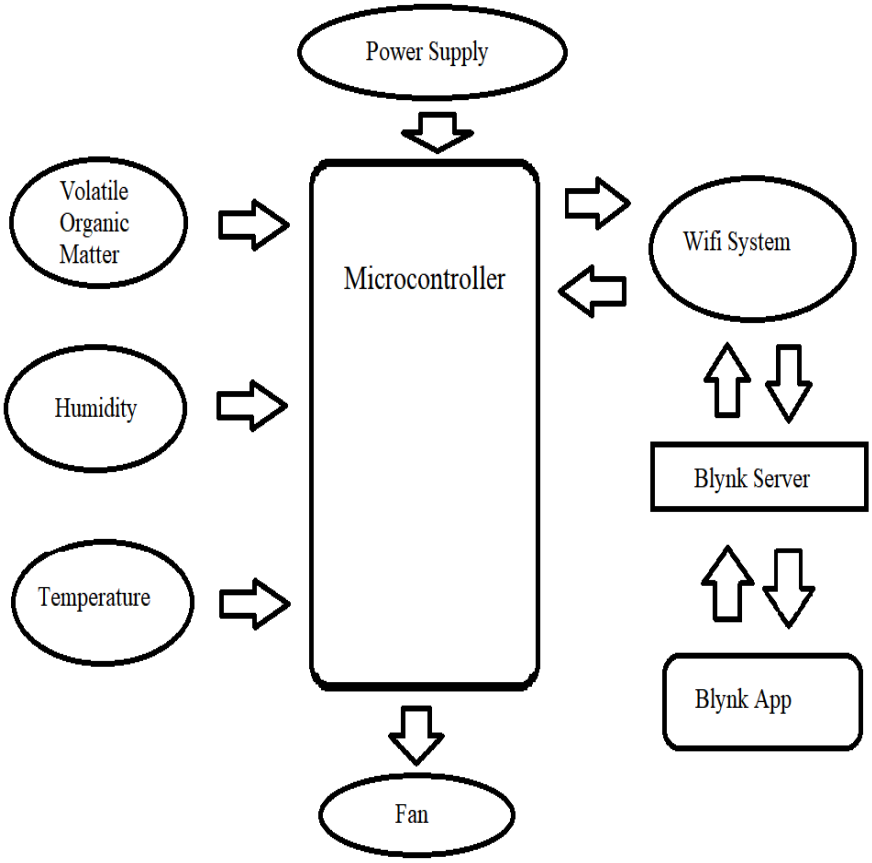

Fig1 Block Diagram Of the Air Purifier

4.3 Methodology

Our approach is to make this project more user friendly by using IOT technology. This idea will be implemented on NodeMCU board. It will be programmed using arduino ile. For this idea, we decided to use a fan to create an air depression under the pot. If the air under the soil has a lower density than the one from above, it will naturally flow through the dirt. The fan will through air out of the decorative pot so the pressure in the area between both pots is lower than outside. We will add to our system a MS1100 sensor that is able to detect Formaldehyde, Toluene and several others unhealthy particles commonly found in indoor air. We will also add a DHT11 to detect humidity and temperature, and gathered general data about the environment. To easily read and manage these data, we will link NodeMCU to the Blynk application. These values will be shown on the Blynk app interface and can also be controlled with the Blynk application. This way, we can directly read the curves from any wifi device. This will make our air purifier more user friendly and interactive.

Fig2 Working of the air purifier

Fig3 Implemented system

V. RESULT

We operated this purifier in a closed container for about 1 hour approximately.
We used Aloe Vera plant for this experiment

Before operating the purifier :
VOC - 779
Temperature - 32.0 ^{0}C
Humidity - 69

After operating the purifier :
VOC - 684
Temperature - 31.2 ^{0}C
Humidity - 63

VI. FUTURE SCOPE

The growing population and improved standards of living suggest that air pollution will persist and it will be an increasing problem until and unless the population is controlled which at present seems a nearly impossible thing to happen. Since we are all aware about the effects of air pollution on both health and environment it is necessary to wake up and do something to protect the present and future generations. Future researches will most likely happen in the highly populated countries like China, India, United States of America, etc. where the problem is more and air pollution is prominent. Since a lot of work has been done on outer air pollution, indoor air pollution now needs attention and need to be worked upon. With regard to indoor air pollution studying the characteristics of different household plants the pollutants that they are stabilizing or removing from the air, should be done. Even if certain plant is not that much efficient or effective is eliminating certain pollutant optimization needs to be done to increase its potential of remediation. The pollutants on which not much work is done should be identified focused and worked upon. Development of transgenic indoor plants at a faster pace to enhance the process of phytoremediation. Guidelines can be set for emission of particular pollutant in schools, offices, buildings or houses. Finally if one really wants to fight air pollution and get rid of this problem each and every individual will need to do his or her part as a whole.

VII. CONCLUSION

Low-light-requiring houseplants, along with activated carbon plant filters, have demonstrated the potential for improving indoor air quality by removing trace organic pollutants from the air . This plant system is one of the most promising means of reducing indoor air pollution associated with carbon monoxide, particulate matter, nitrogen oxides, Sulphur oxides,, arsenic, fluorine, volatile and semi-volatile organic compounds, ozone, radon, Trichloroethene (TCE), hydrocarbons, lead, asbestos, aldehydes, etc. The plant root-soil zone appears to be the most effective area for removing volatile organic chemicals. Therefore, maximizing air exposure to the plant root-soil area should be considered when placing plants in the pot for best air filtration. Activated carbon filters containing fans have the capacity for rapidly filtering large volumes of polluted air and should be considered an integral part of any plan using houseplants for solving indoor air pollution problems.

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