iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** IV **Month of publication:** April 2021

DOI: https://doi.org/10.22214/ijraset.2021.33592

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue IV Apr 2021- Available at www.ijraset.com

Analyzing Indoor Atomsphere by planting succulents using IoT - A Review

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Abstract: ***In the present year people have payout their daily life indoor rather than outdoor. But according to the survey indoor environment is more polluted than outdoor. Since people are likely to be indoor, the quality level of the environment in indoor should be good. At Times air quality in the indoor environment has various effects on human health together with respiratory diseases, eyes irritation, cancer, dizziness, heart diseases, headache, mental stress, etc. The deficient ventilation increases indoor pollution level, because outdoor air will not be sufficient to dilute emission in the indoor and carrying pollutants to the outer environment. This survey paper discusses the review about indoor air pollutants, implications on human health by breathing the pollutants and its control used in the different research papers.***

Keywords: Outdoor, Indoor Air Quality, Environment, Respiratory Disease, Dizziness, Cancer, Pollutants.

I. INTRODUCTION

Low indoor air quality is causing millions of deaths globally every year. Growing indoor plants will make an effective improvement in the indoor air quality by absorbing pollutants accumulated in the indoor air. These indoor plants act as a natural air purifier. Concentration of the pollutants in the indoor air is more than the concentration of the typical outdoor air[1]. According to the Environment Protection Agency the pollutants level of the indoor air is often 2 to 5 times more than outdoor pollutant level, so the air inside the home are more deleterious than the air outside [2]. As per the Global Burden of Disease Programme, the number of deaths attributed to illness because of IAP due to burning of solid fuels was highest in India in the year 2017, about 481,738 followed by China [3]. Indoor plants can scrub the air of cancer-causing volatile organic compounds like formaldehyde and benzene.

Later research has found that soil microorganisms in potted plants also play a part in cleaning indoor air. Based on this research, some scientists say house plants are more effective natural air purifiers [4]. Figure 1.1 show the benefits of indoor plants.

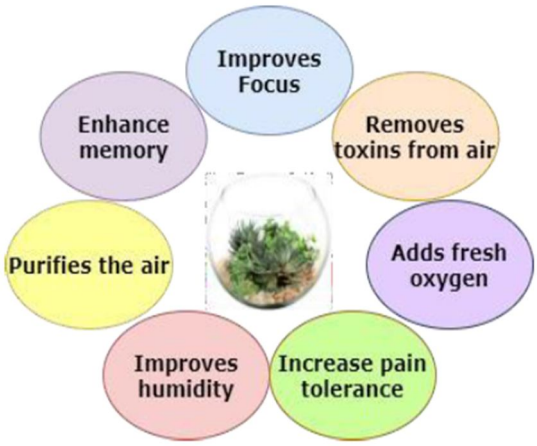

Figure 1.1: Indoor plants benefits.[5]

The level of the air quality present in the indoor have very bad effect on human health including respiratory disease, dizziness, irritation of eyes, headache, heart disease, fatigue, cancer, etc. Figure 1.2 shows different diseases that can cause human health hazards due to air pollution. These days concentration of the indoor pollutants have increased due to some factors like increased utilization of synthetic building materials, energy efficient building construction, personal care products, pesticides, furnishings, and household cleansers.

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Figure 1.2: Indoor plants as air purifiers recommended by NASA [10]

Deficient ventilation can result in increased indoor air pollutants level which does not bring ample of outdoor air to indoor to dilute emissions of indoor sources and not carry the pollutants to out of the area due to this temperature and humidity level can also increase the concentration of pollutants[6]. The listed pollutants are present in the indoor air[7].

1) Ozone
2) Bio Logical Agents
3) Formaldehyde
4) Volatile Oganic Compounds
5) Disinfectants
6) Pesticides
7) Carbon monoxide
8) Tobacco Smoke

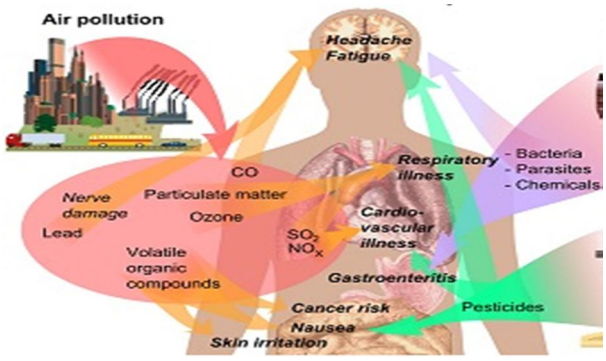

Figure 1.3: Different types of disease cause for human due to air pollution

Indoor plants are potentially acting as weapon to fight against the indoor air pollution. CO2 level in indoor is reduced by planting indoor plants which can also increases humidity there by improving the air quality. Figure 1.2 shows some of the indoor plants that purifies the air. Deaths caused due to indoor air pollution and their percentages are like lung cancer 6%, pneumonia 12%, stroke 34%, Chronical Heart Defects 26%, and Chronic Obstructive Pulmonary Disease 22% [8][9]. Since the previous work provided the technologies used to analyze the environment CO2 level, but did not provide the efficient solution improve the air quality. The idea is to examine and use the technology to efficiently improve the environment by planting succulent's as air purifiers to produce more Oxygen by consuming CO2 in the indoor environment.

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II. LITERATURE SURVEY

Quality of the indoor air can be tracked by using various techniques and technologies, according to the survey some of the technologies and techniques found are fan ventilators, botanical purifiers, air purifiers, IoT and wireless sensor networks. The technologies and techniques are attained using several software and hardware which performs the action after some set of calculations and continuous results. These types of technology codes are executed using microcontrollers such as Arduino Uno, bolt, raspberry Pi and, ESP8266.

Some of the machine learning algorithms are applied on the collected data from the sensor which fetches the air quality. This process is capable only when significant prediction is made based on the training dataset. Some of the machine learning algorithms used to indicate the indoor air quality are C4.5 decision tree algorithm, Naïve bayes algorithm and artificial neural networks. According to the survey indoor plants influences human to perform additional productivity work in an environment having more plants. This examination is carried out by keeping track of the blood pressure and heartbeat of a human in different surroundings.

III. COMPARATIVE ANALYSIS

This analysis deals with some dominant aspects come across from the survey in the tabulation form. The summary is based on technique like indoor air quality monitoring, wireless sensor networks, analysis of data collected and analysis of building predictive models based on data collected. Table 1 summarizes all the mechanisms related to air quality monitoring used in the different papers.

Table 1: analysis based on monitoring air quality.

Paper	Features	Inference	Future enhancement
11	DHT11 MQ13 WSP8266 Web server	Air quality monitoring using NodeMCU	Notifying prediction to the user
12	SMT32 Chip WSN,GPRS Gas Sensors Cloud Platform	NB-IOT module is used for air quality monitoring	Analysis of data collected and providing prediction
13	Raspberry Pi GP2Y10 Arduino Uno AWS Cloud	Monitoring air quality by adopting exhaust fan using fuzzy logic, interfacing Raspberry Pi and Arduino notification to user about the air quality	Different places data to be analyzed by using wireless sensor networks to monitor efficient air quality
14	Raspberry Pi Humidity and temperature sensors Air pressure sensors MLP models	Predicting acid, nitrogen di oxide and ozone	Uses wireless sensor networks to collect data and analysis of real time data

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Table-2: Summary of Indoor plants effect on human

Paper	Features	Inference	Future enhancement
15	Monitoring of real time sensor value	Use of C 4.5 decision tree algorithm	Handling variations in sensor data to increase the accuracy
16	Data were collected from central pollution control board and stored in thingspeak	Artificial neural network	Use of data records spanning longer duration with suitable data gaps
17	Apache Spark	Naïve bayes algorithm	Investigation of technology performance

Table-2 summarizes the salient features of all the papers incorporating how indoor plants affect human. Table 3 summarizes machine leaning techniques used for collected data analysis and predication used in the different papers.

Table 3: analysis based on algorithms of machine learning.

Paper	Features	Inference	Future enhancement
18	ThingSpeak MQ5 Temperature sensor Humidity sensor Raspberry Pi ESP8266 MYSQL	Raspberry Pi is used as central node which receives data from sub nodes which is configured using ESP8266	Installing sub nodes over large area for efficient use of the system
19	Arduino UNO RF module MQ7 GP2Y10 Zigbee	WSNs achieved using XBee RF module, which receives sensor data and upload to server from different nodes	Cloud we interface to view sensor data overlaid on goggle map.

Table 4 summarizes air quality monitoring using wireless sensor networks features in the different papers .

Table 4: analysis based on WSN

Paper	Salient Features	Inference	Future Enhancements
[20]	Stress reduction increases pain tolerance	Conducting experiments with and without plants	Identifying the plant species which gives better results
[21]	Improves mood	The task performance of participants was enhanced when placed in room with plants	Knowing the number of plants required
[22]	Reduce psychological stress, cardiovascular changes with common indoor plants	Performing the same task by two group in different environment	Age and number of leaf and plants affecting the human
[23]	Fast recovery from stress using foliage and house plants	Participants blood pressure and emotions were monitored while	Survey on how height of plant affect human

IV. CONCLUSION

The survey carried out talks about the dominant independent domains to monitor indoor environmental parameters. There exist various systems to monitor and control, but they barely talk about remedies and controlling mechanism. Sensor modules consist of preheated sensors like MQ135 for air quality monitoring. DHT11 for temperature, humidity monitoring. Float sensor for self-watering of indoor plants. The sensor values are calibrated using appropriate formulas to get accurate values. The large amount of sensor data is uploaded to cloud for further analysis and prediction. ESP8266 is best suited for WSN as it consumes low power and takes less time to upload data to cloud for further analysis. The data can be sent to cloud by connecting ESP8266 module with the internet with Wi-Fi SSID and password. It also provides better packet received rate compared to Zigbee technology.

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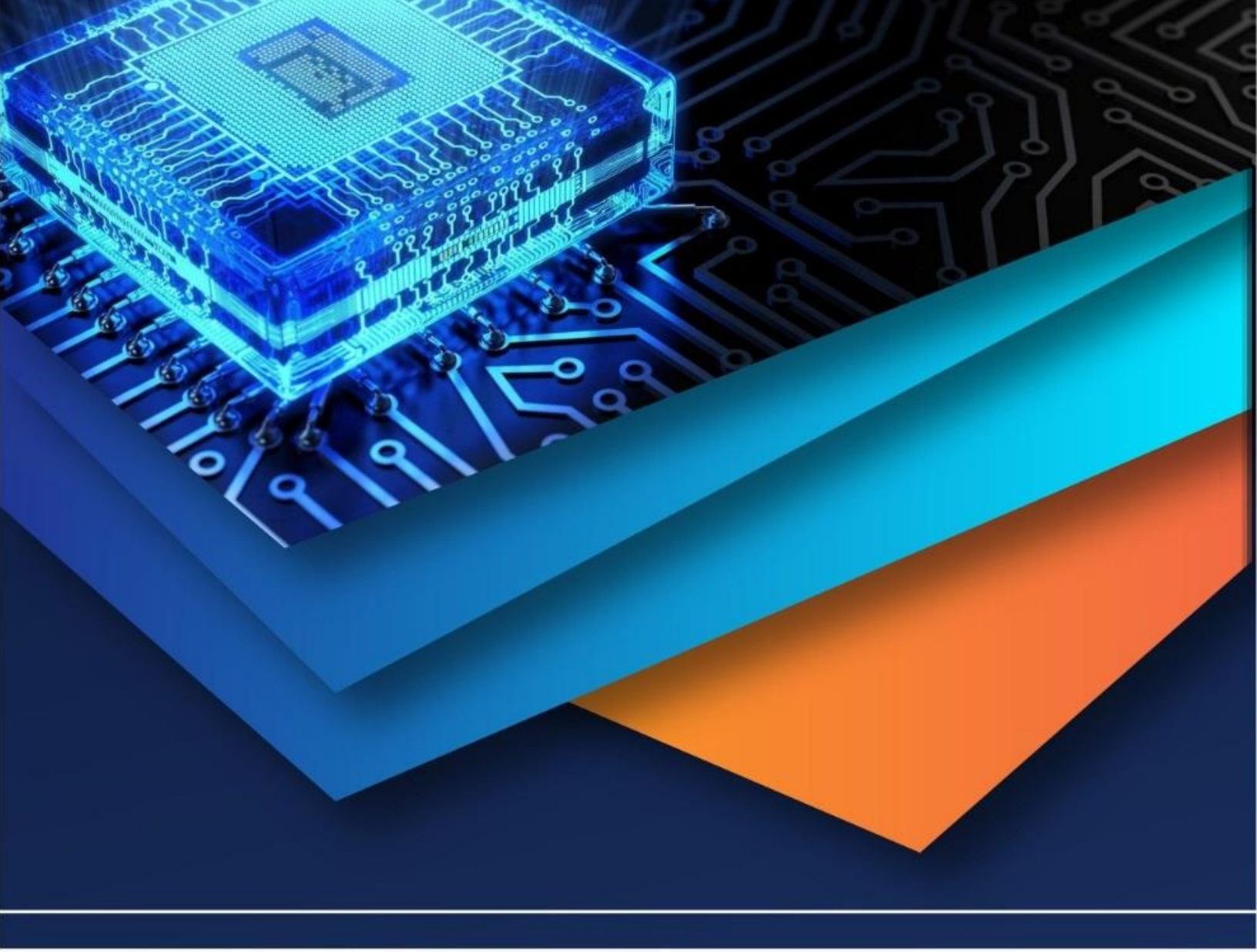

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