iJRASET
International Journal For Research in Applied Science and Engineering Technology

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

**Volume:** 9 **Issue:** VIII **Month of publication:** August 2021

**DOI:** https://doi.org/10.22214/ijraset.2021.37857

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

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 VIII Aug 2021- Available at www.ijraset.com*

# Smart Air Quality Monitoring and Sensing Device (SAQM Sensing Device)

Hareetaa Mallani[1], Neha Dhakad[2], Disha Sharma[3], Kesar Singh[4], Khushal Ameta[5]
[1]*Asst. Prof., Dept. Of Electronics and Communication Engineering, MLV Textile and Engineering College, Rajasthan, India*
[2, 3, 4, 5]*Student, Dept. Of Electronics and Communication Engineering, MLV Textile and Engineering College, Rajasthan, India*

***Abstract:*** ***Air pollution is the biggest problem of every nation, whether it is developed or developing. Health problems have been growing at faster rate especially in urban areas of developing countries where industrialization and growing number of vehicles leads to release of lot of gaseous pollutants. Harmful effects of pollution include mild allergic reactions such as irritation of the throat, eyes and nose as well as some serious problems like bronchitis, heart diseases, pneumonia, lung and aggravated asthma. According to a survey, due to air pollution 50,000 to 100,000 premature deaths per year occur in the U.S. alone. LPG sensor is added in this system which is used mostly in houses. The system will show temperature and humidity. The system can be installed anywhere but mostly in industries and houses where gases are mostly to be found and gives an alert message when the system crosses threshold limit.***
***The advantages of the detector, have a reliable stability, rapid response recovery and long-life features. It is affordable, user-friendly, low-cost and minimum-power requirement hardware which is appropriate for mobile measurement, as well as comprehensible data collection.***

## I. INTRODUCTION

The drawbacks of the conventional monitoring instruments are their large size, heavy weight and extraordinary expensiveness. These lead to sparse deployment of the monitoring stations.

In order to be effective, the locations of the monitoring stations need careful placement because the air pollution situation in urban areas is highly related to human activities (e.g. construction activities) and location dependent (e.g., the traffic choke-points have much worse air quality than average).

IOT Based Air Pollution Monitoring System monitors the Air 5Quality over a webserver using internet and will trigger an alarm when the air quality goes down beyond a certain level, means when there are amount of harmful gases presents in the air like CO2, smoke, alcohol, benzene, NH3, NOx and LPG.

In industrial fuel, sulfur content is limited to a maximum of 2–3% by weight, whereas in automotive diesel, the maximum limit is 0.05–0.5% by weight. The manual air quality monitoring stations, however, measure air pollutants once every 6 days. The air quality is reported based on the Air Pollution Index (API) computed from five criteria parameters, namely, PM10, carbon monoxide, nitrogen dioxide, ozone, and sulfur dioxide. The main sources of air pollution identified were stationary sources (e.g., industries), mobile sources (e.g., motor vehicles), open burning, and trans-boundary haze pollution.

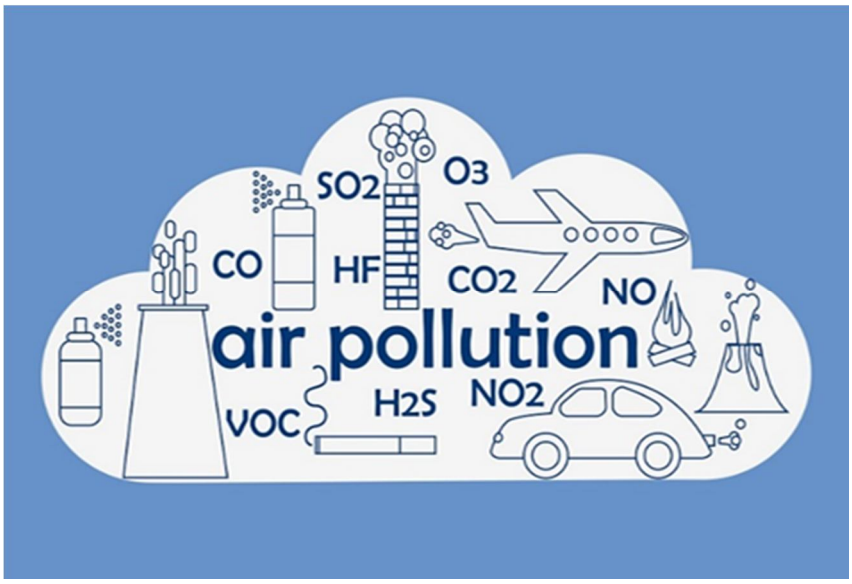
The effect of air pollution ranges from difficulty in breathing, coughing, aggravation of asthma and emphysema. Polluted air can also impair visibility. Air pollution is accountable for the death of 7 million persons worldwide each year or one in eight premature deaths yearly. Almost 570,000 children under the age of five die every year from respiratory infection linked to indoor/outdoor pollution and second-hand smoke.

Children exposed to air pollution have an elevated risk of developing chronic respiratory problems such as asthma. In the monitoring of air pollution, several researchers worldwide have developed models to monitor many of the pollution gases such as Sulphur Dioxide (SO2), Carbon Monoxide (CO), Carbon Dioxide (CO2), Nitrogen Oxides (NO) etc. This report focuses on the design and implementation of a smart air pollutant monitoring system. We can use this device for many projects, like fire prevention monitoring, overheat monitor and many more.

We take a view on various different sensing devices related to our project and we also take a look on their drawbacks and their issues related to the user side which helps us to cure that issues and make the better version of that sensing devices for the help of users.

In past years of Electronics with sensing devices we consider that the major issue of that devices or the users is the large sizes of the devices and their expensive costs and they do not have all the properties at a same base which a user wants.

*ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429*
*Volume 9 Issue VIII Aug 2021- Available at www.ijraset.com*




## II. SIGNIFICANCE OF THE SYSTEM

This whole Research work is combination of three different sensors which are mounted on a single Arduino base and those are Air quality sensor, Temperature sensor, Humidity sensor .There are Temperature Sensor applications in many industries including medical, motorsport, HVAC, agriculture, industrial, aerospace and automotive.

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly proportional to the Centigrade temperature.

## III. LITERATURE SURVEY

A systematic monitoring network in support of a successful implementation plan to reduce regional air pollution exposure must represent most of the population, and cover a diverse range of topography, meteorology, emissions, and air quality in the region. If possible, multiple pollutants and precursors need to be monitored at the same locations at the same time.The monitoring network represents various geographical areas, such as coastal areas, desert areas, interior valleys, mountain areas, and border areas, with more monitors in populated and polluted areas than in remote and clean areas. For individual monitors, spatial scales, whether they are microscale, middle scale, neighborhood scale, urban scale, or regional scale, are important considerations. In addition, diverse functions may be served by a monitor for the benefit of researchers, industries and media, as well as the general public.

Air pollution is the biggest problem of every nation, whether it is developed or developing. Health problems have been growing at faster rate especially in urban areas of developing countries where industrialization and growing number of vehicles leads to release of lot of gaseous pollutants. Harmful effects of pollution include mild allergic reactions such as irritation of the throat, eyes and nose as well as some serious problems like bronchitis, heart diseases, pneumonia, lung and aggravated asthma.

According to a survey, due to air pollution 50,000 to 100,000 premature deaths per year occur in the U.S. alone. Whereas in EU number reaches to 300,000 and over 3,000,000 worldwide. IOT Based Air Pollution Monitoring System monitors the Air quality over a web server using Internet and will trigger an alarm when the air quality goes down beyond a certain threshold level, means when there is sufficient amount of harmful gases present in the air like CO2, smoke, alcohol, benzene, NH3, LPG and NOx. It will show the air quality in PPM on the LCD and as well as on webpage so that it can monitor it very easily.

LPG sensor is added in this system which is used mostly in houses. The system will show temperature and humidity. The system can be installed anywhere but mostly in industries and houses where gases are mostly to be found and gives an user based features are used for cumulative distribution function. A dataset collected from SinaWeibo that includes 30,116 users and more than 16 million messages when the system crosses threshold limit.

Air pollution in India is a serious health issue. Of the 30 most polluted cities in the world, 21 were in India in 2019. As per a study based on 2016 data, at least 140 million people in India breathe air that is 10 times or more over the WHO safe limit and 13 of the world's 20 cities with the highest annual levels of air pollution are in India. The 51% of pollution is caused by the industrial pollution, 27 % by vehicles, 17% by crop burning and 5% by fireworks.[1] Air pollution contributes to the premature deaths of 2 million Indians every year.

## IV. METHODOLOGY

The model was designed using an Arduino Uno microcontroller, Wi-Fi module 8266, MQ135 Gas Sensor and a 16 by 2 liquid crystal display (LCD) Screen. The proposed system overview and the functional block diagram is depicted. The system overview procedure was classified into Five (5) layers. The first layer was the environmental parameters which are obtained by measurement. The second layer was the study of the characteristics and features of the sensors.

The third layer was the decision making, sensing, measuring, fixing of the threshold valve, periodicity of sensitivity, timing and space. The fourth layer was the sensor data acquisition. The fifth layer was the ambient intelligence environment. The sensor collected data when operated by the microcontroller and forwarded it over the internet for analysis via the Wi-Fi module. Users were able to monitor measured parameters on their smartphones.

### *A. Working Principle of Proposed Model*

The library in the Arduino was loaded and a message was sent to the LCD. Air quality data was collected using the MQ135 sensor. The calibrated sensor made the analog output voltage proportional to the concentration of polluting gases in Parts per Million (ppm) and temperature and humidity and concentration of CO2 and other different other gases which is hazardous for humans. The data is first displayed on the LCD screen and then sent to the Wi-Fi module.

The Wi-Fi module transfers the measured data valve to the server via internet. The Wi-Fi module is configured to transfer measured data an application on a remote server called “Thing speak”. The online application provides global access to measured data via any device that has internet connection capabilities. Data collected from the sensor was converted into a string and used to update the information sent to the remote server.

#### *1) Mathematical Analysis of Proposed Model*

The level concentration of pollutants in the air is measured in parts per million (ppm) or percentage. Conversion factors include the following:

1 ppm = 1.145 mg/m3
1 mg/m3 = 0.873 ppm
1% = 1/100
1 ppm = 1/1000000
1 ppm = 0.0001%

#### *2) Existing Methodology for LPG GAS Sensor*

In the existing method, different gas sensing technology is used. The LPG gas leakage is detected by the semiconductor sensor. Nowadays LPG accidents occur very common.

The main reason of these accidents is due to the leakage of LPG. This leakage of LPG starts when we forget to close the main regulator valve. This is the basis of these kinds of accidents. Already there are some sorts of remedial measures such as when the leakage is detected, alert message is sent to the fire station and the owner.

#### *3) Hardware Requirement*

*a)* Gas sensor
*b)* Arduino Uno
*c)* Wi-Fi module ESP826
*d)* 16x2 LCD
*e)* Breadboard
*f)* 10K potentiometer
*g)* 1K ohm resistors
*h)* 220-ohm resistor
*i)* Buzzer
*j)* MQ 6 LPG gas sensor
*k)* Temperature sensor LM35
*l)* Humidity sensor SY-H5220

*B. System Design*

The device developed in this project can be installed near any Wi-Fi hotspot in a populated urban area. As the device is powered, the Arduino board loads the required libraries, flashes some initial messages on the LCD screen and start sensing data from the MQ-135 sensor.

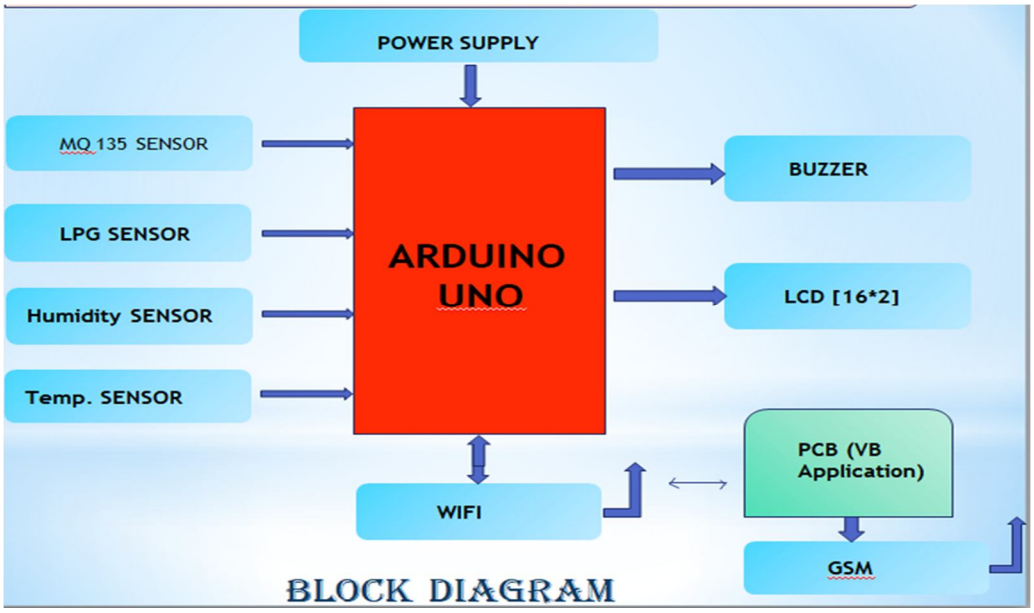
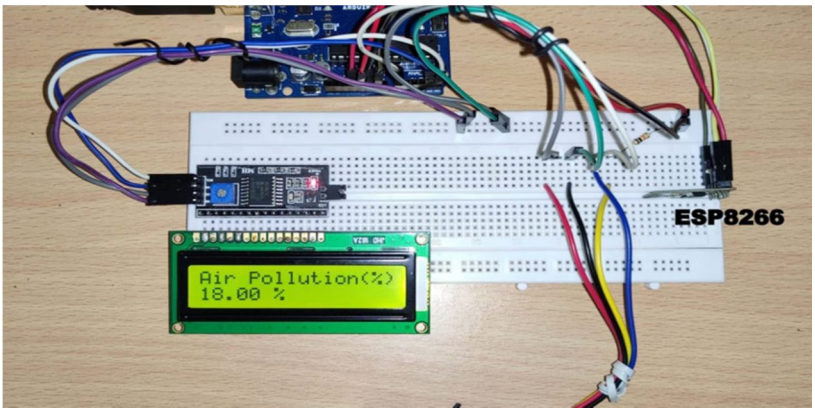



Fig1. System Design

## V. EXPERIMENTAL RESULTS





Sample Result of temperature SAQM Sensing Device

Above both figures showing the real-time output of our SAQM sensing device.

According to our criteria the other appliances connected to our device are programmed to be start automatically if the values gets out of our limits.

| S.NO. | AREA | AIR QUALITY(pm2.5) | TEMPERATURE | HUMIDITY |
|---|---|---|---|---|
| 1. | Room | 15.76 | 33.40C | 56.00% |
| 2. | Garden | 13.34 | 32.12*C | 60.08% |
| 3. | Rest Room | 19.45 | 35.23*C | 57.78% |
| 4. | Near Lake | 12.86 | 27.12*C | 59.23% |
| 5. | Road (Traffic Area) | 29.00 | 38.09*C | 44.65% |

## VI. CONCLUSION AND FUTURE WORK

The system to monitor the air of environment using Arduino microcontroller, IOT Technology is proposed to improve quality of air. With the use of IOT technology enhances the process of monitoring various aspects of environment such as air quality monitoring issue proposed in this paper. Here, using the MQ135 and MQ6 gas sensor gives the sense of different type of dangerous gas and Arduino is the heart of this model. Which control the entire process. Wi-Fi module connects the whole process to internet and LCD is used for the visual Output.

In this paper the development of an IoT-based indoor air quality monitoring platform is presented. Experiments were performed to verify the air quality measurement device used in the platform based a method suggested by the Ministry of Environment, Korea. We verified the accuracy of indoor air quality monitoring and the desirable performance of the device.

For Future Work we can also add Several electronic devices with this model like Air Cooler for maintaining the level of Temperature ,Water Pumps for the maintaining the level of humidity, Gas Extinguisher for safety from disaster .

Also, experiments making use of the platform were conducted and demonstrated suitable performance and convenience of the air quality monitoring platform. Several achievements of the platform were accomplished, including the following:

*1)* Indoor air quality can be efficiently monitored anywhere and in real time by using an IoT and a cloud computing technologies;
*2)* The platform used Amazon Web Services as a certified web server for security of the platform and the data;
*3)* The Smart-Air device has an expandable interface, and the web server is also easily extendable, allowing easy application to various environments through the addition of appropriate sensors to the device or installing more Smart-Air devices to appropriate monitoring locations.

In future this model t can be upgraded in more ways than one.

*a)* Interface more number of sensors to know gases present in air.
*b)* Design web page and upload data on web page
*c)* Interface SD CARD to store data.
*d)* Interface GPS Module to monitor the pollution in a wide range.

## REFERENCES

Reference Papers

[1] G. Parmar, S. Lakhani, and M. Chattopadhyay, “An IoT based low cost air pollution monitoring system,” in 2017 International Conference on Recent Innovations in Signal processing and Embedded Systems (RISE), Bhopal, India, October 2017.
[2] K. Okokpujie, E. Noma-Osaghae, O. Modupe, S. John, and O. Oluwatosin, “A smart air pollution monitoring system,” International Journal of Civil Engineering and Technology, vol. 9, pp. 799–809, 2018.
[3] K. A. Kulkarni and M. S. Zambare, “The impact study of houseplants in purification of environment using wireless sensor network,” Wireless Sensor Network, vol. 10, no. 03, pp. 59–69, 2018.
[4] World Health Organization, Air Pollution and Child HealthPrescribing Clean Air, WHO, Geneva, Switzerland, 2018, September 2018, https://www.who.int/ceh/publications/Advancecopy-Oct24_18150_Air-Pollution-and-Child-Health-mergedcompressed.pdf.

[5] G. Rout, S. Karuturi, and T. N. Padmini, "Pollution monitoring system using IoT," ARPN Journal of Engineering and Applied Sciences, vol. 13, pp. 2116–2123, 2018.
[6] B. C. Kavitha, D. Jose, and R. Vallikannu, "IoT based pollution monitoring system using raspberry–PI," International Journal of Pure and Applied Mathematics, vol. 118, 2018.
[7] D. Saha, M. Shinde, and S. Thadeshwar, "IoT based air quality monitoring system using wireless sensors deployed in public bus services," in ICC '17 Proceedings of the Second International Conference on Internet of things, Data and Cloud Computing, Cambridge, United Kingdom, March 2017.
[8] J. Liu, Y. Chen, T. Lin et al.,"Developed urban air quality monitoring system based on wireless sensor networks," in 2011 Fifth International Conference on Sensing Technology, pp. 549–554, Palmerston North, New Zealand, December 2011.
[9] United States Environmental Protection Agency, Managing air quality - air pollutant typesOctober 2018, https://www.epa .gov/air-quality-management-process/managing-air-qualityair-pollutant-types.
[10] C. Arnold, M. Harms, and J. Goschnick, "Air quality monitoring and fire detection with the Karlsruhe electronic micronose KAMINA," IEEE Sensors Journal, vol. 2, no. 3, pp. 179–188, 2002.

## AUTHORS PROFILE

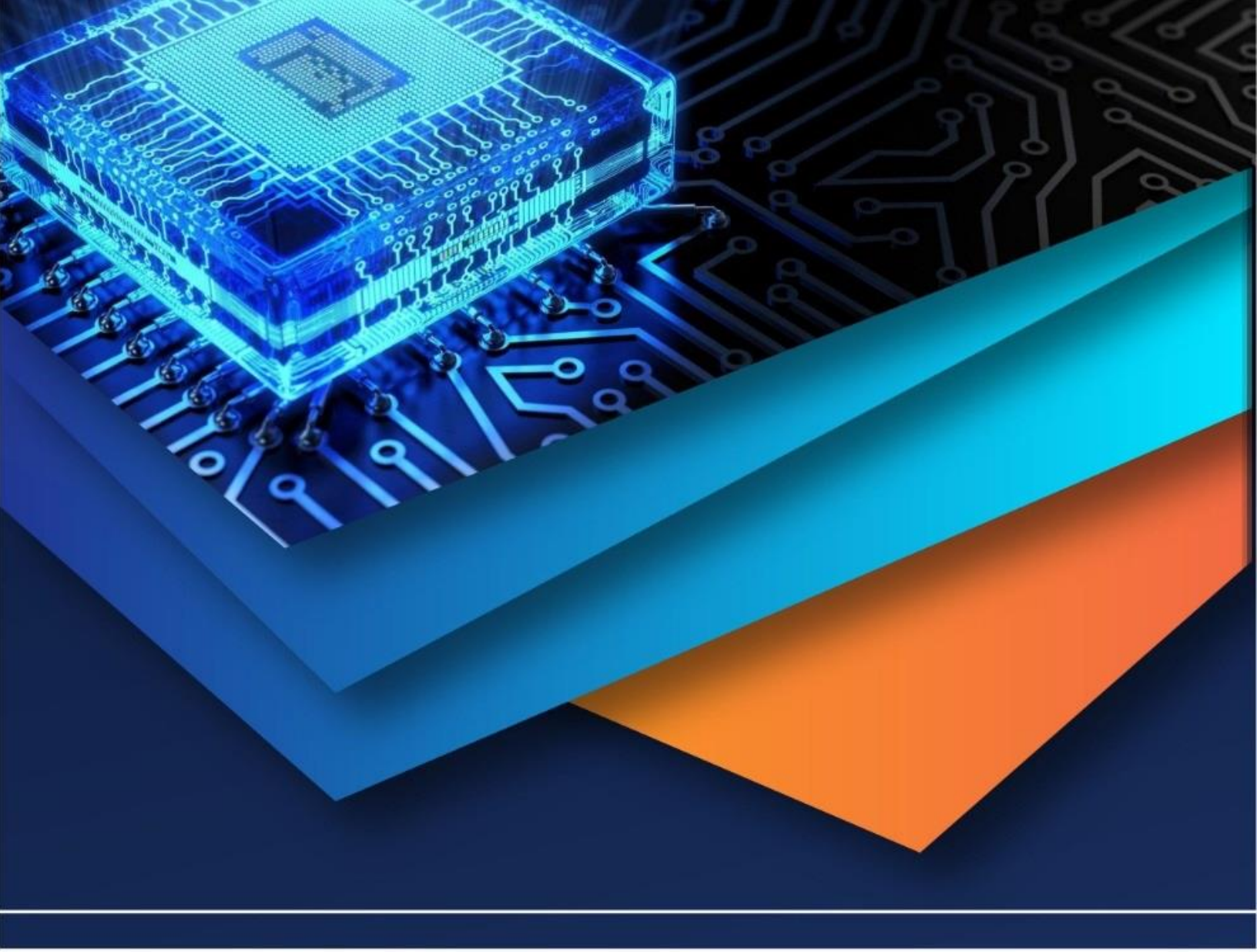
*A.* Smt. Hareetaa Mallani M.tech from RTU kota is working at MLVTEC, Bhilwara in the capacity of Assistant Professor in ECE Department and has more than 17 years of experience .She has more than 20 publications in International Journals and conferences . Her field of interest are Wireless communication , Digital Signal Processing, Image processing ,Embedded system etc.

*B.* Neha Dhakad, student of Bachelor of Technology in Electronics and Communication Engineering from MLV Textile and Engineering College, Bhilwara.

*C.* Disha Sharma, student of Bachelor of Technology in Electronics and Communication Engineering from MLV Textile and Engineering College, Bhilwara.

*D.* Kesar Singh, student of Bachelor of Technology in Electronics and Communication Engineering from MLV Textile and Engineering College, Bhilwara.

*E.* Khushal Ameta, student of Bachelor of Technology in Electronics and Communication Engineering from MLV Textile and Engineering College, Bhilwara.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY