SHIV NADAR UNIVERSITY CHENNAI
KALAVAKKAM – 603 110

STIRS PROJECT – 2023 - ‘24

IoT based - Integrative Monitoring System for Environmental Health: Air Quality, Noise Pollution, and Soil Acidity

Muhammad Farhaan M
1st Year, B.Tech CSE (IoT)

Achyuth Mukund
1st Year, B.Tech CSE (IoT)

B A.Saran
1st Year, B.Tech CSE (IoT)

Mr. P. Madhankumar
Lab Assistant
Department of Computer Science and Engineering

Budget (in thousands) – Rs.10,000

Project Duration (in months) – 09 Months

Signature of the Project Students

Signature of the Project Guide(s)

Signature of the HOD

1. Project Title: IoT based - Integrative Monitoring System for Environmental Health: Air Quality, Noise Pollution, and Soil Acidity

2. Broad Subject: IoT (Internet of Things)

3. Project Duration *(in months)*: 09 months

4. Budget: Rs. 10,000 (Rupees Ten Thousand only)

5. Project Summary:

The metro cities of our nation have turned into large Smog-clouds, noisy and acidic pH environments. The frail governance of the drainage plants and landfills for garbage have made plant growth a question mark around the cities. IoT systems in and around our nation have been created with this in mind. Various systems have obtained data on the particulate matter. For instance, an air quality sensing device called "Smart Air" and a web server to document the obtained data has been demonstrated. It has been developed based on IoT technology to efficiently monitor the air quality and transmit the data to a web server via LTE in real time. The device is composed of a microcontroller, pollutant detection sensors, and LTE modem. In the research, the device was designed to measure a concentration of aerosol, VOC, CO, CO2, and temperature-humidity to monitor the air quality. Then, the device was successfully tested for reliability by following the prescribed procedure from the Ministry of Environment, Korea. Such systems have allowed monitoring of the air conditions and assessed the quality of the environment.

On the face of our production, we propose to build a system that takes the data of the PM (Particulate Matter), Noise levels (dB), and pH levels. We also propose to craft an interface that tells the user the current conditions in the environment. This targets the seekers of weather quality information and informs them of the conditions thereof.

6. Keywords: Internet of Things, pH monitoring, AQ (Air Quality) monitoring, Particulate Matter (PM), Noise Monitoring (dB)

7. Objectives:

- To detect the levels of various particulate matters.
- To detect the PH levels of the soil environment.
- To give data on the growth of possible plants according to the conditions.
- To detect and collect data about noise levels in the open environment. (in dB)

8. Introduction:

The Monitoring System is planned with the intention of providing industrially reliable data on the noise, air, and pH levels of the environment. It ought to move the data reader and suggest measures that can be taken to improve the much-needed overall environmental

quality. It also includes domestic usage of the data to shape the healthy lives of aged individuals.

9. Definition of the Problem:

Several moist landforms in and around the city that are treated as garbage landfills have been left to waste. The rotting manure mass and pH conditions have gone unnoticed and show great potential in the growth of specific plant forms.

High particulate matter (PM) levels can lead to respiratory and cardiovascular problems, as well as an increased risk of cancer. PM can also cause haze and reduced visibility, and contribute to climate change. It's important to consider the health effects of long-term exposure when interpreting the data.

High noise pollution can cause stress, hearing damage, and sleep disturbance. It can also affect communication, learning, and productivity, and lead to cardiovascular problems and other health issues.

10. Review of status of Research and Development in the subject

10.1 National Status:

In recent years, there has been an increased focus on the deployment of low-cost air quality monitoring systems, which use sensors to measure air pollution levels in real-time. However, there are still challenges in ensuring the accuracy and reliability of these systems, as well as in addressing the root causes of air pollution in India.

Research on soil pH levels in India has shown that the majority of soils in the country are acidic, with pH values ranging from 4.5 to 6.5. This is attributed to several factors, including high rainfall, soil erosion, and the use of acidifying fertilizers. In some regions, particularly in the northeastern states, soil pH levels can be as low as 3.5.

Research studies have focused on measuring and analyzing noise levels in various settings, including transportation hubs, industrial areas, and residential neighborhoods. Studies have also examined the impacts of noise pollution on human health, including hearing loss, stress, and sleep disturbances. The government of India has established noise pollution regulations and guidelines, including limits on noise levels in different settings and times of day.

10.2 International Status:

In developing countries, there has been a growing interest in deploying low-cost air quality monitoring systems, similar to those being used in India. For example, in China, the government has implemented a network of more than 10,000 low-cost air quality sensors to complement the existing official monitoring stations. In Africa, a similar approach is being used to monitor air pollution levels in major cities, including Nairobi and Lagos.

Internationally, there are various efforts to monitor and manage soil pH levels, including the development of soil testing and mapping programs, the promotion of sustainable agricultural practices, and the use of amendments to adjust soil pH as needed.
In agricultural regions, research has shown that soil acidity can have a significant impact on crop yields and quality, with some crops performing best in soils with a pH range of 6.0 to 7.0.

There have been various international efforts to monitor and mitigate noise pollution. This includes the development of noise control policies and regulations, the implementation of noise monitoring systems, and the promotion of technologies and practices that reduce noise emissions, such as low-noise vehicles and noise barriers.

11. Novelty / Importance of the proposed project in the context of current status:

Many eminent researches have been carried out for the monitoring of the environmental conditions so far. The challenges of reliable reading of data and its clear interpretation for the common public living in metro cities is still a vast area where technology can improve. Therefore, the project aims at improving the style of monitoring the data collected from the sensors. The problem of pollution in all forms of terrain is ever-increasing in the modern industrial world and the need to detect the essential data follows suit.

12. Patent details- Nil

13. Work plan and Detailed technical information

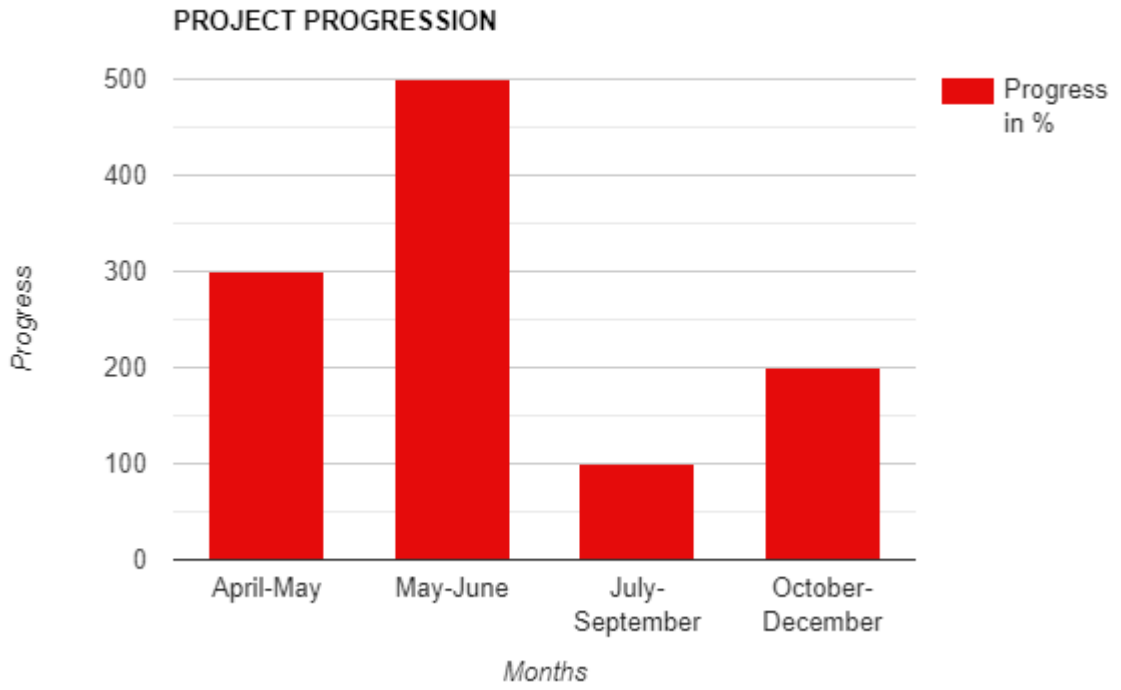
13.1 Methodology:

The methodology behind this study is to identify the current PM, Sound and pH using the respective sensors. The monitoring unit of the project is comprised of the Air Quality Sensor (Mq135), DHT11 Digital Relative Humidity Sensor, Arduino Sound Module, Soil Ph Sensor for obtaining the readings of PM, noise and Ph, respectively.

After obtaining the data, we use an OLED display to show the data obtained to the user/observer. Later, the data will be used to predict whether the environmental conditions are suitable for a healthy life and also the possibility of the growth of the desired plant variety in that area. The final part is combining the monitoring to a cloud or software so that humans can understand the data from the sensors.

14. Time schedule of activities giving milestones

14.1 Time schedule of activities through BAR Chart:



15. Deliverables:

- During April-May the Monitoring System will be materialized.
- In the time spanning May-June, the hardware portions of the project on the Arduino UNO will be implemented.
- During the months July-September, the coding part will be realized
- October- December will be the final stages of prototyping and field testing of the same.

16. Target beneficiaries of the proposed work:

This project aims at improving:

- The lives of the common public living in metro cities
- The strenuous work of Air Traffic Controllers at various commercial & non commercial airports and shipping controllers at various harbours
- The health of pollen stricken and lung-heart disease patients, hearing - impaired people without a noise sensor in their vicinity
- Plant growers who can plan their crops according to environmental and geographical conditions.

17. Suggested plan of action for utilization of research outcome expected from the project

17.1 As journal publication

18. References:

V. Barot and V. Kapadia, "Air Quality Monitoring Systems using IoT: A Review," 2020 International Conference on Computational Performance Evaluation (ComPE), Shillong, India, 2020, pp. 226-231, doi: 10.1109/ComPE49325.2020.9200053.

C. -H. Yang and T. -C. Wu, "IoT-based Programmable pH Measurement System," 2022 IEEE International Conference on Consumer Electronics - Taiwan, Taipei, Taiwan, 2022, pp. 341-342, doi: 10.1109/ICCE-Taiwan55306.2022.9869162.

https://www.nationalheraldindia.com/videos/indian-cities-rank-high-on-noise-pollution#:~:text=The%20government%20mandates%20that%20noise,day%20and%20night%20thrhttps://www.frontiersin.org/articles/10.3389/fpls.2018.01335/full/oughout%202018.

https://cpcb.nic.in/air-quality-standard/

https://cpcb.nic.in/who-guidelines-for-noise-quality/

19. List of facilities and equipments available with department for the project

- **Breadboard**
- **Resistors**
- **Multimeters**

20. Budget Estimates – Rs. 10,000

21. Budget Justification:

S.NO.	NAME OF THE COMPONENT	QUANTITY	COST (In Rs.)
1	**Air Quality Sensor (MQ 135)**	1	300
2	**Arduino Nano R3**	3	3,000
3	**DHT11 Digital Relative Humidity Sensor**	1	100
4	**I2c OLED Display**	1	300
5	**Soil pH Sensor**	1	3,600
6	**MAX485 Modbus Module**	1	100
7	**Arduino Sound Module**	1	100
8	**LCD(16x2)**	1	300
9	**Capacitors, Switches and Oscillators** (Resistors: R1=100E, R2=1M, R3=330E) (Ceramic Capacitors: C1=C2=22pF) (Electrolytic Capacitors: 10uF/63v 16 MHz Crystal Oscillator, Tactile Switch)	1	400
10	**Connecting Wires and Breadboard**	As required	600
11	**Miscellaneous**	As required	900
		Total Cost : 10,000	