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AIR QUALITY MONITORING SYSTEM WITHIN AREA USING IOT

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ABSTRACT

Air pollution is a growing issue these days. It is necessary to monitor air quality and keep it under control for a better future and healthy living for all. Here we propose an air quality as well as sound pollution monitoring system that allows us to monitor and check live air quality in particular areas through IOT. System uses air sensors to sense presence of harmful gases/compounds in the air and constantly transmit this data to microcontroller. Also system keeps measuring sound level and reports it to the online server over IOT. The sensors interact with microcontroller which processes this data and transmits it over internet. This allows authorities to monitor air pollution in different areas and take action against it.

This project gives a proposal for addressing the issue of indoor air quality using the internet of things communication model. The description of the effects of low moderate levels of pollutants on the occupants on the indoor space is presented. A system, containing sensor networks and being internet of things enabled, is proposed, to facilitate in achieving efficient indoor air quality system. The system is designed to contain three major areas of functionality: first, the wireless sensor network that will provide the pollutant levels of the room. Second, this information is passed through a wireless access point and gets dumped on a server machine. Third, the server side stores and processes this data. The server side contains user interface and notification system functionalities.

Keywords: Air Pollution, MQ135 Sensor, IOT, Arduino Uno.

1.INTRODUCTION

1.1 Motivation

Not a single living thing can survive without air. Air is the most important element for living. According to the SDG (Sustainable Development Goals) by the UN (United Nations) there are seventeen goals to transform the world to clean, healthy and natural way to live in

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because at this time there are several problems in human life. The SDG says,Ensure healthy lives and promote well-being for all at all ages,Ensure access to affordable, reliable, sustainable and modern energy for all,Ensure sustainable consumption and production patterns,Take urgent action to combat climate change and its impacts,Conserve and sustainably use the oceans, seas and marine resources,Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss.

1.2 Problem Statement

Air pollution is one of environmental issues that cannot be ignored. Inhaling pollutants for a long time causes damages in human health. Traditional air quality monitoring methods, such as building air quality monitoring stations, are typically expensive. This project is suitable for air quality monitoring in real time.Design a tool which will sense quality of air and display it in the form of percentage,Sense how much carbon mono-oxide(CO) is present in air and display in the form of percentage,Sense the temperature and display it in degree celcius.

1.3 Objective

To measure and display temperature and humidity level of the environment.To combine advanced detection technologies to produce an air quality sensing system with advanced capabilities to provide low cost comprehensive monitoring.To display the sensed data in user friendly format in LCD display panel.

1.4 Limitations of Project

- Only three sensors are used
- Humidity should be less than 95%
- Accurate measure of containing gases cannot be detected in ppm

2.Existing System

At present, pollution of air is measured by a portable air quality meter. But the main drawback of this system is that we have to find the air pollution of each area manually. Instead of that we're trying to implement a Air Quality Monitoring System in each and every area as a node and the information about the pollution is automatically updated to IoT Application.

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2.1 Disadvantages of Existing System

- This system design is cost
- System is complexity

2.2 Proposed System

We present a solution to monitor CO2 emissions produced by vehicles within area. The system is implemented based on distributed sensor nodes by using WiFi technology. Several sensors were placed around the main streets in order to monitor CO2 concentrations. Data suggested that speed bumps generate increased levels of CO2, which are emitted by vehicles.

2.3 Content Diagram of Project

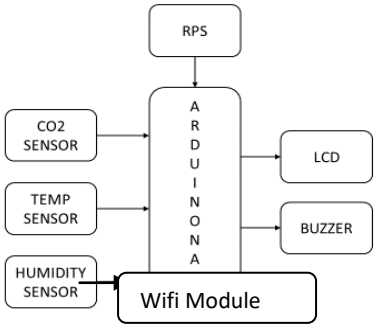

Fig 1:Content Diagram of Air Quality Monitoring System

3.Architechture

The paper aims at designing an air pollution monitoring system which can be installed in a specific locality and to enhance the system from the previously developed systems beating the earlier disadvantages by developing an android app available for the public. This app can be used by anyone to get in live updates about the pollution in their region. It uses Arduino integrated with individual gas sensors like carbon monoxide, ammonia along with particulate matter, humidity, and smoke which measures the concentration of each gas separately. The users can install an android application through which they get the recent updates and graphical content up to date.The average concentration of each gas is analyzed using matlab. Then certain time

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control is assigned based on the standard level of each gas measured and the result can be viewed in android application. The architecture of air pollution monitoring and awareness creation system is shown in the above fig.The concentration level of each gas can be viewed both as a graph and in numerical format. Based on these values the air quality index value is calculatedand the nature of the air quality in that area is determined which is also displayed through the app.

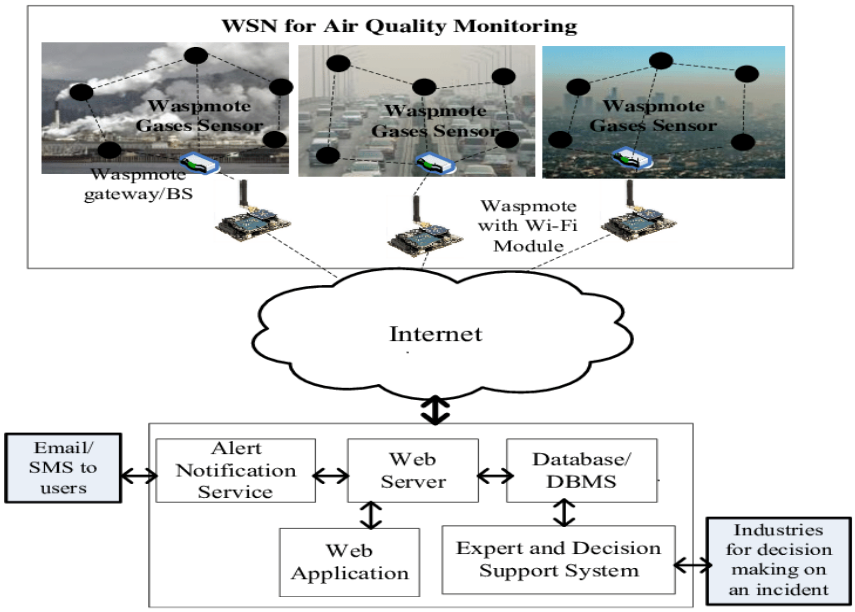

Fig 2:Architecture of Air Quality Monitoring System

Air quality monitoring system design to asses the pollution of air in a particular area using a micro-system,as a node in Wireless Sensor Network(WSN),is proposed.The system provides a real-time information about the level of air pollution in different regions,as well as provides alerts in cases of drastic change in quality of air.This information then can be used by the authorities to take prompt actions such as evacuating people or sending emergency response team.It uses an Air Quality Index to categorize the various levels of air pollution.

4. IMPLEMENTATION & RESULTS

4.1 Introduction

Project implementation (or project execution) is the phase where visions and plans become reality. It is the stage of the project when the theoretical design is turned out into a working system. The implementation stage involves careful planning, investigation of the existing system

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and it's constraints on implementation, designing of methods to achieve changeover and evaluation of changeover methods. It is important to take into account that independently of the nature of the project, implementation takes time, usually more than it is planned, and that many external constraints can appear, which should be considered when initiating the implementation step.

4.2 Explanation of Key Functions

The key functions of the project are as follows:

- **Storing the values in the database securely:**
  In this application tha values of pollution,temperature and humidity in the air are stored in the server in a secured way.These values are calculated through various sensors and are displayed on LCD.
- **Retrieving values from the database securely:**

4.3 Output Screens

Pollution Detected Page

Pollution Un-Detected Page

4.4 Result Analysis

Here, we have seen that our device is capable of taking almost accurate results of temperature and humidity. Though there is a margin of error and it is 5.66% for temperature and 1.57% for humidity. So, we can say that our device is working perfectly.The device working rate is very good and it has a very high accuracy,so that the result is accurate and perfect.

- The data collected from air quality monitoring helps us assess impacts caused by poor air quality on public health.

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- Air quality data helps us determine if an area is meeting the air quality standards devised by CPCB, WHO or OSHA.
- The data collected from air quality monitoring would primarily help us identify polluted areas, the level of pollution and air quality level.
- Air quality monitoring would assist in determining if air pollution control programmes devised in a locality are working efficiently or not.
- Air quality data helps us understand the mortality rate of any location due to air pollution. We can also assess and compare the short term and long term diseases/disorders which are a result of air pollution.
- Based upon the data collected control measures can be devised for protection of environment and health of all living organisms.

5.Design of Test Cases and Scenarios:

Test Case ID	Test Case Type	Testcase Description	Expected Value	Actual Value	Result
TC_1	Pollution Sensor is detected	These sensors are devices that monitors the presence of air pollution at a particular area.	A sensor is used to detect the pollution in the air only when the pollution is more and it exceeds the range then we get a beep sound.	Pollution in the air is detected.	Success

Table 6.2.1: Test Case#1

Test Case ID	Test Case Type	Testcase Description	Expected Value	Actual Value	Result

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TC_2	Pollution Sensor is not detected	These sensors are devices that monitors the presence of air pollution at a particular area.	If the pollution in the air is less and is not exceed the range then we can't get any sound.	Pollution in the air is not detected.	Success

Table 6.2.2: Test Case#2

Test Case ID	Test Case Type	Testcase Description	Expected Value	Actual Value	Result
TC_3	Temperature Sensor	Here LM35 sensor is used as temperature sensor.A sensor is a device that measures a physical quantity and converts it into a signal which can be ready by an observer or by an instrument.	A Rain sensor with nodes which doesn't collide with each other is placed in an area based on the temperature we get the values.	A microcontroller reads the temperture in the air through sensors and gives the value,it ranges between 0° to 50°C	Success

Table 6.2.3: Test Case#3

Test Case ID	Test Case Type	Testcase Description	Expected Value	Actual Value	Result

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TC_4	Humidity Sensor	A Humidity sensor senses,measures and reports both moisture and air temperature.	Based on the humidity we can get the values through various sensors	A microcontroller reads the humidity in the air through sensors and gives the value,it ranges between 20% to 70%	Success

Table 6.2.4: Test Case#4

5.1 Validation

- A Temperature sensor is used to detect the pollution in the air only when the pollution is more and it exceeds the range then we get a beep sound.
- If the pollution in the air is less and is not exceed the range then we can't get any sound.
- A Rain sensor with nodes which doesn't collide with each other is placed in an area based on the temperature we get the values.
- Based on the humidity we can get the values through various sensors.

7. Conclusion

The smart way to monitor environment and air as well as sound pollution being a low cost but efficient and embedded system is presented in this paper. In the proposed architecture functions of different sensors and their working procedure were discussed. How they work, their functionality, their optimal uses and their data taking procedures and comparison with standard base data's are also discussed here. The noise and air pollution monitoring system was tested for monitoring the gas levels on different parts of the country. It also sent the sensor parameters to the data server. Our project device showed that it is effective and cheap and with some highly working sensors it can really be a reliable one to everybody and its data's will be a key to take some necessary steps for the betterment of the society as it will help to identify the affected area so that we can take early steps to reduce damages for the next generation.

7.1 Future Scope

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Our work can demonstrate vast opportunities to work on the device, on the app and also on the field using the device that we have worked with. The device can be used any time efficiently in different locations of a city and then research with the achieved data for that particular area in that city. The device can be updated with additional sensors that can sense data from the existence of other gases such as O2 and H2. These gases will provide the condition of the atmosphere and authority can take into further decisions accordingly. The sensors that we have been worked with can also be reset according to most recent time update. The android app which we have developed for turning on and off the device can be updated with newer features by implementing necessary codes. In future time, our device can be kept testing for checking whether the sensors still runs properly and give real time data. The webpage that we have designed, there is more opportunities to add options like related tables, pie chart, diagram that will be implemented by back-end programming(server side) so that those options can be visible to the administrator and user as well.

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