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Air Pollution Hotspot Detection and Identifying Source Trajectories Using IoT

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Abstract - **Currently, air pollution is a problem around the globe. India also has been agonized by this problem since ages. Earlier the government had signed COP21 agreement for shedding the carbon emissions 2025 onwards. In this regard, research has been done to identify the pollution hotspots, namely, carbon monoxide (CO) sulfur dioxide (SO2) and nitrogen oxides (NO+NO2), with the help of advanced data analysis techniques. The satellite data is provided by a histogram of the concentration of impurities, which is 90% of the surface area of focus. The sources of pollution particularly are related to the activities on the surface of the Earth. Satellite offers observations every day with a different spatial resolution. Of the jobs that explain how to extract data from the settings of the various parameters, satellites provide the ultimate results and a moderate spatial resolution, on the basis of the pollution information. Therefore, the information below will be useful for the analysis of the changes traced. The identification through the native methods are as follows:-**

1. Identifying Locality of hot spots.

2. Occurrence of these hot spots and trends over a period.

Keywords: IoT, Pollutants, Hotspot identification, tracking trajectories

I. INTRODUCTION

Air pollution occurs when harmful substances including particulates and biological molecules are introduced into Earth's atmosphere. The primary vision of the project is to identify the poisonous gases residing the in air and alert the user through a buzzer if the gases values exceed the threshold level and give the emergency alert remotely through Wi-Fi module.

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Arduino Has a microcontroller board based on ATmega328. It has 14 digital input / output pins (of which 6 can be used as PWM output), 6 analog input, 16 MHz ceramic resonator, USB connection, power jack, head of ICSP, and reset button. It contains everything needed to support a microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. Wi-Fi (Short for Wireless Fidelity) is a wireless technology that uses radio frequency to transmit data through the air. Wi-Fi has initial speeds of 1mbps to 2mbps. Wi-Fi transmits data in the frequency band of 2.4 GHz. It implements the concept of frequency division multiplexing technology. Range of Wi-Fi technology is 40-300 feet.In this project smoke sensor is used to sense the combustible gases and smoke levels in the air, gas sensor is used to detect the gas levels in the air. The output of the smoke, gas sensors are fed to the microcontroller. When the gas, smoke levels in the atmosphere exceeds the threshold value then buzzer beeps and sends the emergency alerts to the user through Wi-Fi remotely.

The features of the project are:

1. Provides Home or Industrial security.
2. Air pollution monitoring.
3. Highly sensitive
4. Low cost
5. Simple and Reliable.
6. User friendly

II. EXISTING SYSTEM

- There is no current system to monitor the air pollution. The pollution might affect the people in that area due to lack of statistics.
- It affects the ozone layer because the amounts of pollutants are not monitored properly and are unable to know the sources of these pollutants.
- This application is unavailable in GSM mobile.
- According to the existing system it is not much feasible for the people to view the amount of pollution which is prevailing in the locality.
- There is no specific level of indication about of the amount of pollution that has occurred. This is not handy and applicable for the people of a society. Less possibility for an early detection of any problem.

III. PROPOSED SYSTEM

With our technology, which in combination with the IoT is capable of providing you with information about the air pollution. In particular, our system is made up of gas and smoke sensors that provide the necessary information needed in order to assess the air pollution. This information is transmitted wirelessly via a Wi-Fi network on a computer system, which provides an interface that allows the user to observe the evolution of the species, pollution, over the course of time. To perform this intelligent task, Arduino development board is used, loaded with a program written in embedded 'C' language which evaluates the input and generates results hinting at the various levels of pollutants in the particular area.

An embedded system is a combination of hardware and software to perform a specific task. Some of the most important devices that are used in household products are microprocessors and microcontrollers. This is often referred to as general purpose processors as they simply have to take input, process it and output it. On the contrary, the micro-controller will not accept the data as input, but also manipulates it, it will work with a variety of devices, data, control, and, as the end result.

The project "Air Pollution Hotspot Detection &Identifying the Source Trajectories using IoT" using ATMEGA 328 Microcontroller is an exclusive project which is used to detect the SMOKE and gas levels in the air if any sensor value exceeds the threshold value the system gives the audible alert through buzzer and send the emergency intimation through Wi- Fi.

IV. METHODOLOGY

The main aim of this project is to detect the harmful gases present in the air and alert the user through buzzer if the gases values exceed the threshold level. Also this system sends the alert message to the user remotely through Wi-Fi module. The project uses gas, smoke sensors, Arduino, Esp8266 Wi-Fi module. Arduino is the main controlling device of the project to achieve the task, using embedded C language. The sensors detect the gas levels and relay it to the microcontroller which evaluates this data from time to time and analyzes any changes in the levels of the gases. If any abnormality is detected it alerts the user and passes the information regarding the harmful gas and its possible source.

A. Compilation and simulation steps:

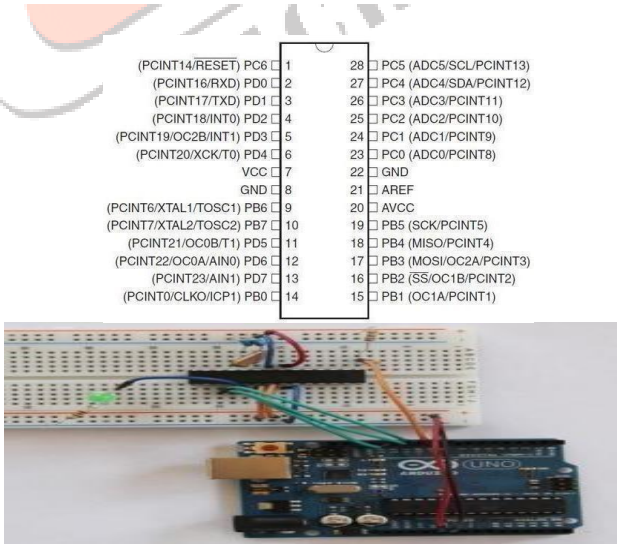
1 x Arduino on a Breadboard

1 x Arduino UNO

Connecting Wires Arduino IDE installed on your PC

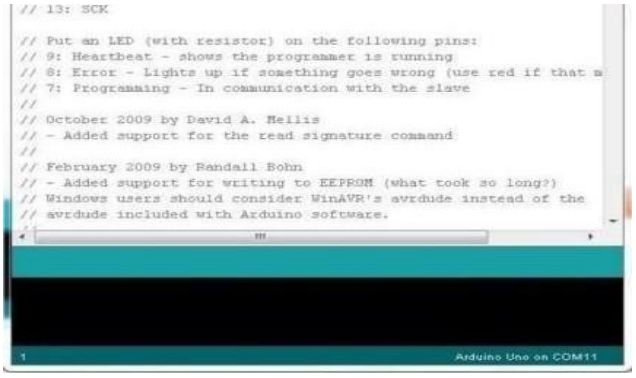
B. The Approach

We use the Arduino UNO to bootload the ATmega328 that is sitting on the Arduino-on-a- Breadboard. This is fairly straightforward having an ATmega328P-PU but needs an extra step for an ATmega328-PU.



Arduino Uno with Breadboard connections

C. ***Arduino UNO programming as an ISP***



Arduino UNO IDE Compiler

1. Open the Arduino IDE
2. Open the Arduino ISP
3. sketch (under File, Examples)
4. If you're using version 1.0 of the IDE:

D. ***Connect your ATmega328***

ATmega328 pin configuration

Now make connections of the ATmega to the UNO as given:

5 UNO 5v ---> ATmega pin 7(VCC)
6 UNO GND ---> ATmega pin 8 (GND)
7 UNO pin 10 ---> ATmega pin 1(RESET)
8 UNO pin 11 ---> ATmega pin 17(MOSI)
9 UNO pin 12 ---> ATmega pin 18(MISO)

E. ***ATmega328-PU workaround***

Each processor has its own signature, a code unique to that model. After you download the software, or even a translation of the outline of the Arduino IDE, make sure that the chip is selected and the type to which it is connected. Although the ATmega328-PU, which works the same as the ATmega328P-PU, it has a different signature, which is not

recognized by the Arduino IDE.

F. ***Bootload the ATmega328***

Bootloader initialization

Bootloader initalized succesfully

In the Arduino IDE, from the *Tools* menu:

- under the *Board* option choose *ArduinoUNO*
- within the *Serial Port* option make sure the apt port has been selected

V. RESULTS

The project "**Air Pollution Hotspot Detection &Identifying the Source Trajectories Using IoT**" was designed as a system which is capable of detecting the smoke and gas in the air and also automatically sends alert messages to android phone using WIFI module and alerts through Buzzer.

It is the integration of the features of all the hardware components used. The performance of each module is carefully developed and published, which has contributed to the best performance out of the engine block. Secondly, with the help of a highly-developed IP, as well as a growing technology the project has been successfully completed. Thus, the project has been successfully developed and tested.

This chapter presented validation and test cases that depict whether the proposed system meets all the conditions. It clarifies that the needs are tested. They also ensure that the system is error free and does not have any bugs, if any were present can be rectified by the developer. They try to analyze the whole system based on the inputs given, conditions specify and checking whether the expected result is obtained or not.

VI. CONCLUSION

From the test results we conclude that the project has delivered the expected output, the microcontroller and the sensors have coordinated and communicated the way they were intended to and produced the results which were relayed to the user through the wifi module to the mobile device. This project can be optimized with the future inclusion of the GSM module which can increase the scope of communication.

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