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Air pollution monitoring system in sugarcane factory using IOT

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ABSTRACT:

The abstract of an IOT-based air pollution monitoring system in a sugarcane factory would probably focus on the utilization of sensors to monitor different pollutants released during the processing of sugarcane. It would provide a comprehensive explanation of how IOT technology enables the collection and analysis of real-time data, thereby enabling proactive measures to reduce pollution levels. Furthermore, it may emphasize the advantages of this system in terms of promoting environmental sustainability, ensuring regulatory compliance, and enhancing overall operational efficiency within the factory.

Keywords: Internet of thing, Raspberry pi, Buzzer sensor

Introduction:

IOT, or Internet of Things, is a widely distributed network of intelligent devices ,“Smart devices are equipped with a combination of electronic sensors, software, and other technologies." Objects embedded with sensors, software, and other technologies, enabling them to connect and exchange data with other devices and systems over the internet, are referred to as "Things". Driven by factors like industrialization, population growth, and urbanization, air pollution is rising at an alarming rate. To combat this critical issue, we have developed and implemented a project to detect air pollutant gas levels.

Air pollution is a significant concern for all members of society. As air pollution levels rise, individuals face numerous health problems. Air pollution is also detrimental to living organisms. The primary factors contributing to air pollution include vehicle emissions and industrial activities. Both vehicles and industries are major contributors to air pollution, emitting harmful gases that endanger human health and degrade air quality. These noxious pollutants can cause allergic reactions, respiratory issues, and skin diseases. As the name suggests, this project is a monitoring system that utilizes raspberry pi technology based on IOT to monitor air pollution. The project focuses on monitoring both air pollution levels and air quality, providing individuals with valuable information about the air in their surroundings.

The Raspberry Pi is an affordable programmable computer equipped with a range of general-purpose input/output pins for connecting and managing external electronic devices, as well as for developing IOT solutions.

Methodology:

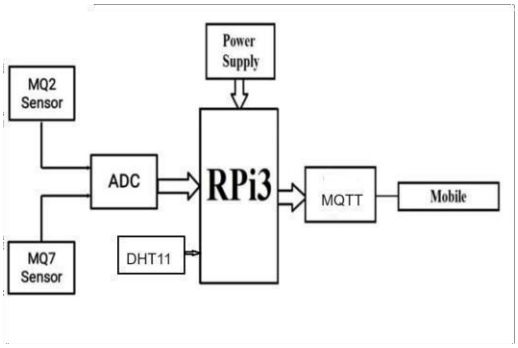

Figure1:Block diagram

The IOT technology based air pollution monitoring systems functionality is illustrated by the diagram using Raspberry Pi.In this project, the MQ2,Mq7 gas, and DHt11 sensors are employed. These sensors serve as analog sensors and are connected to an ADC(Analog-to-digital Converter).The ADC is

then connected to the Raspberry pi. The raspberry pi is powered by a dedicated power supply. The output of raspberry pi is transmitted to a mobile device using

MQTT(message queuing telemetry transport)IOT platform, enabling graphical monitoring. The MQTT can be utilized on mobile device through an internetapplication, allowing remote operation from any location.

System Description:

1. **MQ2 sensor:** It is robust gas sensor that capable of detecting various gases such as LPG, alcohol, propane, hydrogen, methane, and carbon monoxide. It offer both analog and digital output, making it suitable for use as both an analog and digital sensor. The gas senor has working rangeof 200 to 10000PPM.

2. **MQ7 sensor:** The device is extremely responsive to carbon monoxide sensor. It boasts a rapid response time, affordability, stability, and a long lifespan. This gas sensor operates within a working range of 20 to 2000 PPM.

3. **Raspberry pi :** It function as a compact, autonomous computing device. Regarded as one of the most popular miniature computers, it boasts a remarkably small size. This device is versatile, capable of facilitating electronic project programming and HD video playback. Programming languages such as c, c++, python, java, and ruby can be employed for coding purpose. Additionally, it operates on its own distinct operating system known as Raspbian.

4. **DHT11 sensor:** The DHT11 sensor is widely utilized for measuring temperature and humidity. A temperature and humidity sensor can be paired with an 8-bit microcontroller to transmit the measured values as serial data.

Models:

1. **Data collection:** The dataset comprises 9357 instances of hourly averaged responses obtained from a set of 5 metal oxide chemical sensors that are integrated into an Air Quality Chemical Multisensor Device. This device was positioned in a highly polluted area within an Italian city, specifically at road level. This dataset represents the longest freely available record (one year, March 2004 - February 2005) of air quality sensor responses in real-world conditions. It includes data from chemical sensor devices alongside hourly ground truth concentrations of CO, Non-Methane Hydrocarbons, Benzene, Total Nitrogen Oxides (NOx), and Nitrogen Dioxide (NO2) measured by a co-located reference analyzer.

2. **Data preprocess**: In machine learning for predicting air quality in a sugarcane factory, data preprocessing is crucial. This preparatory step ensures the data's suitability for machine learning models. It involves cleaning and normalizing the data, selecting relevant features, handling missing values and anomalies, and potentially applying data transformations. Finally, the data is split into training, validation, and testing

   sets for mode This step guarantees that the data is
   appropriate for machine learning models. The data should be divided into training,

validation, and testing sets to assess and compare the models. Common preprocessing tasks may involve.

- Data cleaning: Data cleansing involves eliminating duplicate or unnecessary data, filling in any missing values, and ensuring data formats are standardized.
    - Missing value imputation: Missing value imputation addresses the issue of missing data by replacing them with estimates, such as the average value of the feature or a prediction from another model.
    - Data scaling: Missing value imputation, a crucial step in data preparation, involves replacing missing entries with suitable estimates. These estimates can be the feature's mean, a prediction from another model, or other appropriate methods.
    - Feature selection: Feature selection involves choosing the most important features to improve prediction accuracy, which can be
- achieved through methods like Recursive Feature Elimination or Principal Component Analysis.
- Data transformation: Data transformation is requires converting data into a machine learning-friendly format, which may involve techniques like one-hot encoding or logarithmic transformation for skewed features.

1. Building and training of Xg boost: For machine learning in this study, the Gradient Boosting Decision Tree (GBDT) algorithm was chosen due to its versatility. Unlike logistic regression, which is restricted to linear relationships, GBDT excels at a wider range of regression tasks, including non-linear ones. Additionally, it can handle binary classification problems. The GBDT algorithm works by iteratively combining multiple decision trees to reach a final prediction. XGBoost is an efficient implementation of GBDT that takes advantage of software and hardware optimization techniques. It delivers superior results while utilizing fewer computing resources compared to other methods. XGBoost employs parallelized implementation for sequential tree building, and to improve runtime, the loop order is changed by initializing through a global scan of all instances and sorting using parallel threads.

2. Air quality prediction: To predict air quality in a sugarcane factory, our model will leverage sensor data and employ the XGBoost algorithm for forecasting.

Objective:

1. Our goal is to provide a tool for everyone to check air quality levels in their neighbourhood.
2. The aim is to create and execute a project that can identify the quantity of gases present in the atmosphere.
3. The goal is to establish an automated system that effectively mitigates air pollution.
4. The objective is to develop a cost-effective automated system for monitoring air pollution.

Result:

Hardware:

Figure 2:Hardware Things

Output:

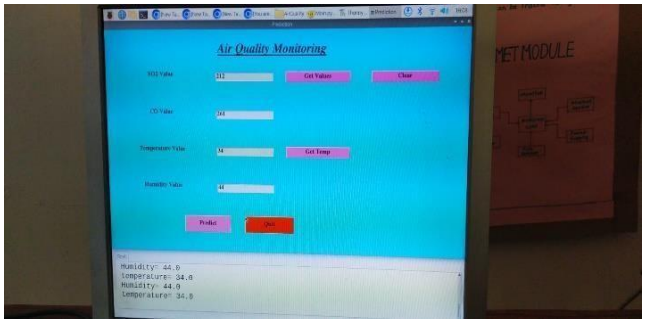

Figure 3: Predicated Air Quality

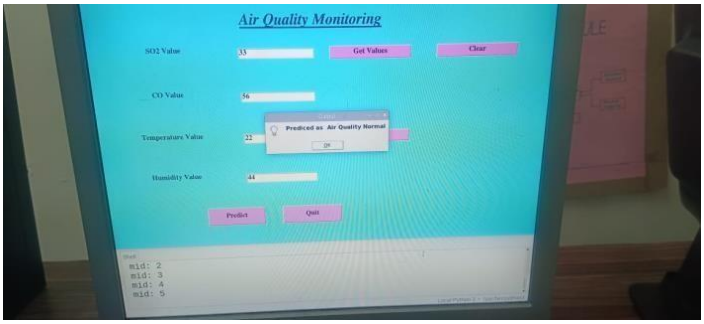

Figure 4: Predicated Air Quality is Normal

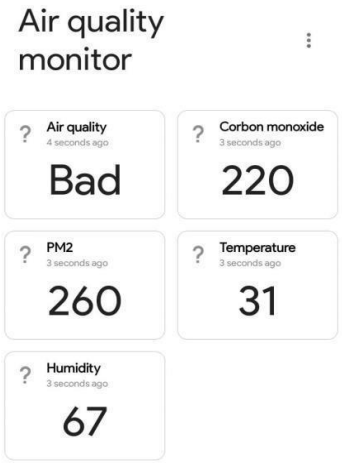

Figure 5:Message displayed in mobile

Conclusion:

Integrating IoT technology offers several advantages for air quality monitoring in sugarcane factories, including real-time data accuracy, process optimization, and cost efficiency. application of the methodology chart for IOT-enabled air pollution monitoring in sugarcane factories brings about substantial benefits in terms of real-time monitoring, worker health, and safety.

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