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IOT Based Industrial Air Pollution Monitoring System And Controlling System Using Electrostatic Precipitator

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ABSTRACT— Air pollution is one of the most concerning fact of todays world. Among all the man-made pollution, air pollution poses a serious threat for health. It affects human body through breathing and since this pollution is barely visible in eye, a monitoring system is necessary to stay cautious. This is the motivation behind our work so that government and citizens can stay aware of the air they are breathing. Our objective is to provide a system to measure Air Quality using gas sensors. We proposed a model where the monitoring devices are connected through IoT technology. Our work is significant for a modeling where the authority wants a full monitoring on pollution and also the citizens want to stay concerned about the air quality. The potential application of our work is for industries where pollution level is relatively higher. This system can directly impact on the pollution control because when it is possible to monitor pre cisely, it is also possible to prevent pollution.

Keywords— Air Pollution Monitoring, Air Pollution Control, Design,, GPS, IOT Module, MQ-135 Gas Sensor, Industrial Ventilation, Collectors.

I. INTRODUCTION

Considering the daily newspapers and any other electronic or print media, a devastating news which is spreading day by day is people are becoming sick and the climate is changing such a way that it has become miserable for living of people. From the aspect from top to bottom, every people are suffering the curse of climate change. The main reason for the climate change and people health is air pollution. It has brought changes in climate like global warming, global dimming, over raining, drought, storms, acid rain, foggy weather etc. The living things on earth and under water are suffering many problems like change in life due to lack of proper facilities of life. Air is the most useful thing for each and every living thing.. Researching on this serious issue this systems main purpose was to estimate the quality of air for people and any other living thing which exist on earth. Very important to know for our living is that how much safe we are now and how the weather and climate has changed. for air pollution and it will sustain sound. This system indicate the surrounding air quality.

Recently, IoT based wireless networks have been tested in various applications. The proposed patient IoT monitoring system would be beneficial. A server and android app have been developed to know the statistics because now a days almost everyone has an android operating device and acces to internet.

II. LITERATURE SURVEY

1)Paper --Amir Hossein and Ali Reza Rahmati,"Industrial Air Pollution Control", Year 2019, Volume: 9

In this Paper Ambient air contaminants have different adverse effects on human health, environment and structures. Some pollutions are more toxic and have unfavorable effects on workers and public health, for example, cyanide/Isocyanide vapor produced in some processes or in burning of polyurethane compounds, which is a toxic gas that can kill or cause harms impossible to reverse. It is so necessary that air pollutants will be controlled and treatment will be provided for the workers and public who are exposed or exhausted to the environment. Industrial ventilation (general ventilation, dilution ventilation, and local exhaust ventilation) is an appropriate system to control indoor air pollutions. Local exhaust ventilation (LEV) has different segments such as hoods, fittings, collectors (air cleaners), stacks, and fans that could collect and treat indoor and outdoor air contaminants.

2)Paper --Divyam Madaan, Radhika Dua, Prerana Mukherjee, "Real Time Attention based Long Short-

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Term Memory Networks for Air Pollution Forecasting", Year: 2019.

In this paper, Approximately 95% of the world's population live in places with unsafe air which leads to serious health hazards for people worldwide. Monitoring and preserving air quality has become one of the most essential activities in many industrial and urban areas today. In view of increasingly alarming environmental pollution problems due to rapid urbanization, ambient air pollution prediction is becoming extremely important. This paper presents an online real time air pollution prediction system at five prominent locations in Delhi utilizing the past historic air quality and meteorological data. We propose a novel end to end sequential modeling framework to predict the air quality by estimating the concentration levels for various pollutants (nitrogen dioxide (NO2), particulate matter (PM2.5 and PM10) and thereby classifying the threat level for them in the next 24 hours.

3)Paper-- Mladen Korunoski, Biljana Risteska Stojkoska, Kire Trivodaliev Ss. Cyril and Methodius University, "IOT Solution for Intelligent Air Pollution Prediction and Visualization". Year 2019.

In this paper Using deep learning techniques, the system provides predictions for future pollution levels as well as times to reaching alarming thresholds. The whole system is encompassed in a fast, easy to use web service and a client that visually renders the system responses. The system is built and tested on data for the city of Skopje. Although the spatial resolution of the system data is low, the results are satisfactory and promising. Since the system can be seamlessly deployed on an Internet of Things sensing architecture, the improved data spatial resolution will improve performance.

4)Paper-- Dr. B.Ravi Subrahmanyam, Dr. Avanish Gautam, Dr. Prabhakar Tiwari, "Air Purification System for Street Level Air Pollution", Year: 2018.

This Paper described decreasing the pollution level is now the main aim for many. Pollution is in many forms; almost every natural thing is now affected by the term pollution. Not only land, water, air, but each and every thing belongs to the planet is now in danger levels of pollution. Already human civilizations woke up to reduce this danger but are not into many things one of such is air. Air pollution is one of the hardest challenges to the humans as it is beyond our hand limits. So there must be a technology for that to decrease the alarming levels of air pollution. The discussed method also aims to bring the increased levels of pollution back to the bottom. In this method the air is being purified by the use of distilled water only, without the use of any synthetic material and/or chemical substance.

5)Paper--Prof. Rani V Kanpur, Prof. A. L. Vallikanna, Hindustan Institute of Technology and Science Chennai, India "Air Pollution Monitoring System using Internet Pollution Sensors". Year: 2020.

In this paper the urban societies are running into fast growth, and an overriding portion of the realm's population almost similar to be in built-up societies in the forthcoming generation. Because of the rapid progressions in India, the count of automobiles improved. Besides a few built-up sectors, the automobile count also wrinkled. Motorized automobiles are ace of the primary causes of contamination in the atmosphere. Contamination released from the motorized automobiles is mostly the source of contamination is directly released in the atmosphere as if they occur various biochemical responses amid pollutants it also pollutes the atmosphere this is labeled as secondary pollution. Once the air is infected it is appropriately high, then it grades grave implications, it can even demise the result in a few cases. Additionally, this contamination distresses the public in heart and lung diseases. The work is proposed to monitor the air pollutants in the air and generates the advanced alerts by forecasting the pollution level in the city. It is designed with the various gases that emerge from automobile pollution affecting urban areas.

III. PROBLEM FORMULATION

The weakness in recent years in coping with precipitator problems, both from maintenance and performance standpoint, is the lack of knowledge and understanding of the effects of the process on the conditions that can occur in the collector. Of special importance is the effect of start-up and shutdown procedures of the process on present and future troubles of the precipitator. Gas temperature and moisture levels can affect hopper evacuation conditions. Seasonal and daily ambient temperature variations must be considered. Raw material variations should be closely monitored. Batch operations will impose potential for hopper difficulties. While we can all agree that it is too much to expect for an installation to be 100% free of breakdowns, repetitive failures should not be considered normal. For example, the pattern of where wire electrodes fail can point out potential causes.

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IV. BLOCK DIAGRAM

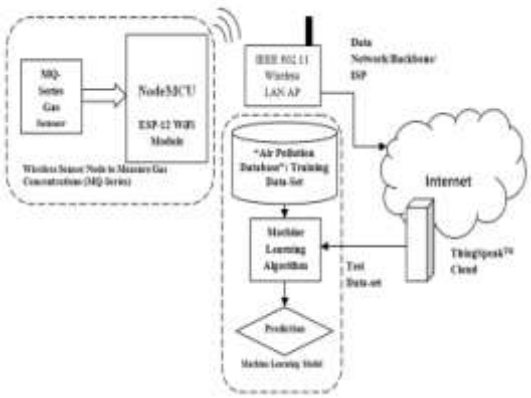

Fig. 1. Block Diagram of proposd IoT based Air Pollution Monitoring System

A. MQ-135 Gas Sensor

The MQ-135 Gas sensors are used in air quality control equipments and are suitable for detecting or measuring of NH3, NOx, Alcohol, Benzene, Smoke, CO2. The MQ-135 sensor module comes with a Digital Pin which makes this sensor to operate even without a mi crocontroller and that comes in handy when you are only trying to detect one particular gas. If you need to measure the gases in PPM the analog pin need to be used. The analog pin is TTL driven and works on 5V and so can be used with most common microcontrollers. If you are looking for a sensor to detect or measure common air quality gases such as CO2, Smoke, NH3, NOx, Alcohol, Benzene then this sensor might be the right choice.

Fig. 2. MQ-135 Gas Sensor

B. Temperature Sensor

This is a sensor used to measure temperature. The LM35 series are precision integrated circuit temperature sensors, whose output voltage is more precisely linear than the temperature at Celsius (centigrade) than thermistors. It is sealed and does not oxidize. No need to increase the output voltage.

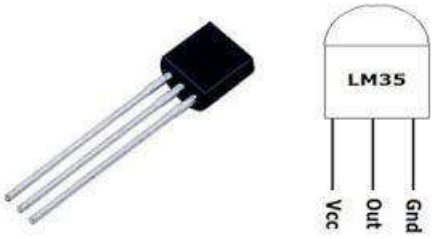

Fig. 3. Temperature Sensor

C. 16*2 LCD

This is a very important tool in embedded systems. It is used to display the required information. Pixels are mostly used for flexibility.

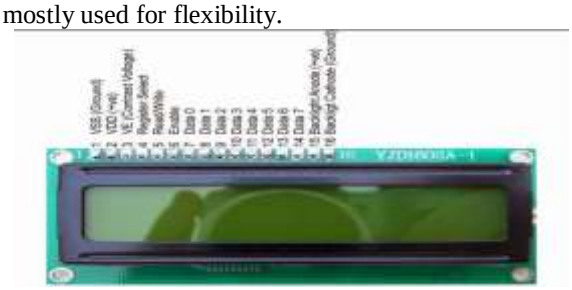

Fig. 4. 16*2 LCD Display

D. ESP-12E-WIFI Module

ESP-12E is a miniture Wi-Fi module present in the market and is used for establishing a wireless network connection for microcontroller or processor

Fig. 5. ESP-12E-WIFI Module

E. MMD9206M IOT Module

The MDM9206 LTE modem is designed as a global multi-mode connectivity solution and purpose-built to provide reliable, optimized cellular connectivity for the next-generation of IoT products and services requiring low bandwidth and years of battery-life. The MDM9206 narrowband multi-mode LTE modem combines the high reliability, low latency, and voice support of LTE Cat-M1 (eMTC) with the extended coverage and delay tolerance of Cat NB-1 (NB-IoT), engineered to allow device manufacturers to support ultra-low power

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consumption and cost-optimized solutions that cover full range of low data rate IoT applications.

V. CIRCUIT DIAGRAM

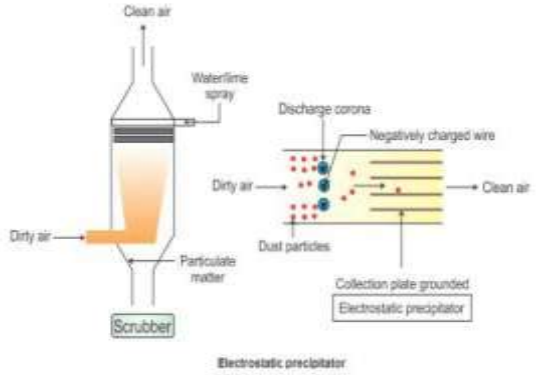

Fig. 6. Electrostatic Precipitator

The health hazard potential of an airborne substance is characterized by the threshold limit value (TLV). TLV refers to the airborne concentration of a substance. It represents the conditions that under which it is believed that nearly all workers may be exposed day after day without adverse health effects. The ventilation systems used in industrial plants are of two kinds. The "supply" system is used to supply air to a work space. The "exhaust" system is used to remove the contaminants which are generated by an operation to maintain a healthful work environment. A supply system is usually used in conjunction with a general exhaust system to replace the air exhausted. Local exhaust ventilation systems operate on the principle of capturing toxic contaminants at or near its source. It is the preferred method of control because it is more effective and compared to high flow rate general or dilution exhaust requirements, the smaller exhaust flow rate results in lower heating or cooling load costs.

VI. FEATURE SCOPE

It can demonstrate vast opportunities to work on the de vice, 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.

VII. CONCLUSION

The smart way to monitor environment as well as air pollution being a low cost but efficient and embedded system is presented in this model. 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 are also discussed here. 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 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.

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