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Internet of Things based hazardous Gas detection in power plants: A theoretical framework

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Abstract-As most of the power production in today's world mainly relies on power plants, it becomes more considerate for its safety. It is necessary that good safety systems are to be implemented in places of education and work. As use of toxic gases is tremendously increasing day by day, it becomes difficult to control the hazardous gases. This work modifies the existing safety model installed in power plants and it can also be used in industries. The system existing before was based on microcontroller based toxic gas detecting and alerting system and IOT based LPG and Propane gases monitoring system in industries. The developing system will have a complete monitoring system of Nitrogen Oxide and Sculpture Dioxide which is IOT based. The analysis and monitoring of gases, intimation to the boiler operator can be done with the help of Wedgies. Already a database of critical limit of gases has been fed into the system and the controller monitors the gases dynamically and makes a decision and ultimately precedes the control action if needed. The Pollution Control Board can also be benefited by receiving the alert message when exceeds its critical level. This may also reduce the effect of "Green House Effect".

Keywords: *Pollution control in Power Plants, IOT, GIS, Green House Effect*

1. INTRODUCTION

We are living in this world, which is contaminated by pollution and adulteration .Already the environment is polluted as much as it can. So we are in the urge to protect our environment in order to protect from further pollution. Water, air and soil are the major things affected by pollution. Out of these, Air pollution is the most significant thing to control immediately since it will affect the human lives adversely. By identifying the color, taste and odor of water, we can identify whether the water is polluted or not. But air pollution cannot be identified with color or taste or by odor. So it is the next necessary condition to consider. Safety and control measures must be taken in areas which release hazardous gases into atmosphere. Since the sources of air pollution are growing, the hazardous gases should be measure and control if exceeds the prohibited level. But the current systems available are not portable and are costly and difficult to implement. A PIC 16F877 Microcontroller is used here to compare the measured gas level values emitted and to provide the control action. An IOT based monitoring system is implemented in Power Plants to send messages to the operator of the boiler about the level of the gases emitted and to provide the alert message if it exceeds the limited level. The hazardous gases like Nitrogen Oxide (NOx) and Sculpture Dioxide (SO_2) are the two significant gases emitted from a Power Plant. If Nitrogen oxide exceeds 0.0169 µg/cm per day and Sculpture Dioxide exceeds 0.0135 µg/cm^2 per day,then an alarm will be generated and the alert message will be sent to the operator as well as the Pollution Control Board in order to take the necessary control action. By this system, the level of hazardous gas emitted can be monitored time to time. This method can also be implemented by the government in order to measure the concentration of gases present in the atmosphere generally. The endangering of human lives can be prohibited by using this method [1 – 7].

2. SYSTEM DESCRIPTION

The system mainly focuses Thermal power plants where the coal is burnt and unwanted gases are released into the atmosphere. Mainly Thermal power plants release Nitrogen oxide and Sulphur Dioxide into the atmosphere which endangers the human lives. Chimney is the place in power plants where the gases get exhausted. So a Gas Sensor is placed in the Chimney. This sensor senses the released gases restlessly and with the help of signal conditioning unit, it converts the sensed value into corresponding voltage. An

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Operational Amplifier which acts an Comparator has a reference voltage which is the voltage value corresponding to the gas limit per day which should not be exceeded. Therefore it compares the measured value with the reference value and the resulting voltage is recorded into a database or else a PIC 16F877 Microcontroller is used to compare the measured gas level values emitted. The measured gas value can also be displayed in the LCD display. If the value exceeds the limited value, then an alarm will be generated by the microcontroller. Two gas sensors should be placed over the chimney in

3. BLOCK DIAGRAM

An integrated gas sensor can be used to detect both the gases or else individual sensors for both SO_2 and NO_x can be used at the source. The sensed data acquisition is done by Arduino or PIC Microcontroller or Raspberry Pi. These devices acquire data from sensors and send these data into Wi-Fi or Bluetooth or through GSM at the transmitting end. These data are received by the receivers which may be Wi-Fi or Bluetooth or GSM at the receiving end. These data should be sending without any loss so that perfect communication exists between them. These received data are sent to the Gateway. Gateway is the place where order to produce a differential value .If a gas sensor failed to work, then the other one will do in spite of the failed one. A mobile app will be created in an android phone to display the measured values and a free SMS ping to display the alert message when it exceeds the limited value.

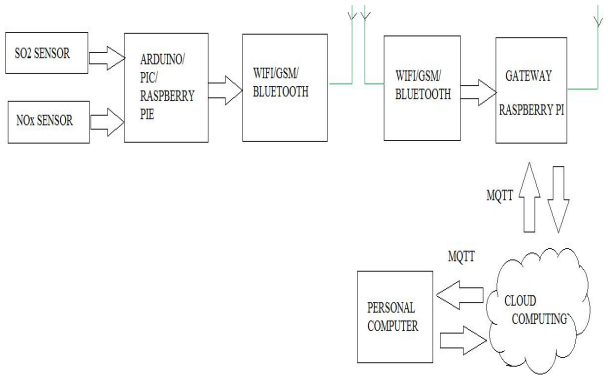

Figure 1. Schematic structure of Gas Sensor architecture

The evaluation and processing of data occurs. Here the acquired data is compared with the threshold value. If the value exceeds, an alert message along with the measured value is sent. These values are sent to the Cloud for computing through MQTT. Message Queuing Telemetry Transport (MQTT) used to send the data safely without any tracking. Therefore these data are sent and updated in the cloud so that the data can be accessed anytime and anywhere. From the cloud, the data is accessed by using a personal computer or by using an android mobile phone. An alert message can also be provided to the operator in case of any danger. The Pollution Control Board can also monitor the level of gases exhausted.

4. CONCLUSION

An IOT based system for hazardous gas detection has been implemented in power plants; here only two gases (SO_2 and NO_X) have been detected. The gas sensors and the critical level of the respective gas should be known, and then this system can be implemented for detecting various gases in industrial areas and power plants, which avoids endangering of human lives. This system provides quick response rate and the diffusion of the critical situation can be made faster than the manual methods.

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