Analysis of air quality using IoT with machine learning prediction

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Abstract. The Think speak technology is a dynamic field that seeks to engage ‘matters,’ human beings, and machines as whole and, making them a necessary part of the world wide web. The complete society is shifting toward industrialization and computerization, which may result in substantial environmental pollution. Deciding the air best is a top need of great importance. This paper offers the improvement of contamination global positioning frameworks with the organization of astute sensors. Checking the gas spillage stage from any piece of the globe can be finished by methods for a combination of enormous records to the Google Cloud through the networkers. Examination of the realities is improved accordingly permitting simplicity of following. Alarms might be caused if there should arise an occurrence of uncommon decay of air decent. The proposed approach discovers application in industry and also in the checking of brought about by like a fan, engines. This strategy utilizing the proposed framework is data set transferred to at long last pc and AI.

Keywords: Raspberry Pi, Air Quality, Machine Learning, Hazardous gases.

1. Introduction
With the blast of motorization and robotization, the mechanical insurgency has occurred in whole parts of the world. This has extended the living necessities of the average person. IoT has changed itself over to suit different fields to be specific home computerization, shrewd structures, sharp towns, and moreover prominently offering nearer to wellness observing. The idea of Industrial IoT (IIoT) got sufficient purposeful publicity with the presentation of mechanization. IIoT needs to end up being the most appreciated area of study since it focuses on the blast in productiveness and execution. The wide assortment of autos and machines has sped up to a twofold crease inside a range of twenty years. This thus antagonistically influenced the environmental factors by means of the blast in air and water contamination which finished in horrible effect in stimulating the presence of individuals. As in sync with the environmental factor’s surveys, due to splendid expansion in populace and businesses blast of ecological contaminations has improved every day. Hypersensitive inconveniences related to the throat; eyes are turning out to be not bizarre regardless of the age organizations. Heart issues, hypersensitivities, and bronchitis are the horrible results of contamination. The present circumstance offered to ascend to the need for savvy toxins GPS beacon. The focal point of air best checking and
ecological obligation is acquiring prominence. Traditional air contamination following can give right impacts by means of experimental assessment; notwithstanding, the assessment of the large realities gets confounded with sped up esteem. The Proposed Method offers an incredible response bringing the incentive down to in any event one/10.

2. Existing Method
The predictions of urban air pollution are having to deal with a disaster of large ecological monitoring data and complicated changes in atmospheric pollution. To enhance ecological administration resolution-making capacity, effective estimating methods have been needed to improve prediction accuracy and avoid grave contamination episodes [1]. A brand-new method is used to estimate contaminant elevated levels has also been created. This uses a variety of deep neural networks to assimilate enormous amounts of information [2]. This system is designed and engineered that implements a Neural Network Model as the bottom layer, extracting pre-processing data at the same time. To account for pollution's time derivative, the output layer uses a prolonged quick term reminiscence network [3]. These two deep neural networks start making up the whole system. The model is used to predict future particulate topic densities as a time series similar to performance optimization. Sooner or later, the estimation outcome will be connected to the outcomes of numerical models. The mannequin's validity and benefits are also evaluated [4].

In comparison with basic models, the experimental results demonstrate that it improves show considerably. Air pollution has taken a huge concentration involving men and women's everyday lives [5]. With the widening of reasons and groups of air pollutants, the challenge of pollutant awareness, it has a terrible effect on human life and everyday lifestyles all through episodes of severe air pollution [6]. Accordingly, it's basic to utilize environmentally investigating information to all the more suitably surmise city air contamination levels. Customary forecast techniques, for example, mathematical assessment and AI, are regularly utilized in this sort of expectation [7]. By and by, a couple of downsides of those strategies were as of late perceived as given beneath. For beginners, numerical prediction methods are mainly based on knowledge which has been compressed with the assist of past records or the nature of pollutant exchange [8].

3. Proposed Method
Destinations at developing the productiveness and execution of any undertaking, yet natural obligation should be the great part of the issue. Gas and petrochemical businesses. Utilize loads of individuals who work nonstop. These ventures have enormous siphons and boilers set up in which extraordinary sorts of compound responses related to refining happen. These responses bring about the emanation of assorted gases, various of which may moreover flip lethal while breathed in additional amount. Carbon dioxide, methane, and butane are various instances of gases that may even flip presence undermining whenever breathed in and can cause hearth and blasts. Wise sensors that could hit upon the presence of gases might be utilized to assuage the issue. The proposed paper targets dissecting the type of industry, examining the idea of approaches stressed and sorting out the opportunity of gas spillage. Notwithstanding gas spillage, fuel spillage can likewise be tended to. Potential focuses can be analysed and comparing sensors might be introduced which can uncover and report the information. The enormous data can be shipped off Google Cloud which empowers following via legitimate workforce from any piece of the globe. Starting preventive developments by utilizing cautions if there should arise an occurrence of any irregularities saw inside the got insights can keep the cherished existences of many. The creativity and perceptive of any industry ought to be to augment productiveness with ensured worker wellbeing and natural obligation. A machine for the genuine-time following is proposed via sending of keen sensors at explicit places of the business floor. The various sensors distinguish the degree of gas outflow, fuel spillage, heater temperature, etc. What's more, may send a notice to the ground director through Google Cloud. If there should be an occurrence of the identification of harmful gases, fuel spillage over the protected limit can help to avoid wounds.
Figure 1. Block diagram of the Proposed Method

Figure 1, addresses the general square outline of the proposed framework. A model essentially dependent on Raspberry Pi has been progressed based absolutely on the above idea for location and real-time checking of the mechanical ground. Detecting of various fuel levels can be made simple by utilizing gentle weight sensors that are adaptable and can be easily sent to stand-out places of the work floor. The model progressed for contaminations following fundamentally intends to hit upon smoke, carbon monoxide, LPG, methane, and so on, which might be observed utilizing the sensors MQ-2, MQ-5, and MQ-6 separately. The temperature of the boilers inside the gasp notwithstanding the dampness degree might be observed with the assistance of DHT-11. Consistent observation of the data is reasonable by utilizing gathering the huge realities to be had from the sensors and persistently bringing in inside the Google sheet. This is made feasible by utilizing presenting Raspberry Pi and IoT shield. The reasonable sensors can distinguish the gases and if the records got are found over the allowable limit pointers are started. IoT guard guarantees application-level security, the wellbeing of doors, and part contraptions. The Application Program Interface (API) fills in as an extension among Raspberry Pi and workers.

4. Methodology

In the proposed method, we use Gas sensor, Raspberry PI processor, Temperature sensor, Humidity sensor, LCD, LED and Exhaust fans these hardware modules are used. Gas sensor (MQ2, MQ5 and MQ6) are used to sense the various of gases like (carbon monoxide, methane etc..) are sense and send into the processor. The process of raspberry is to collect the sensor value and analyse. The analysed data will be uploaded to the cloud (Thingspeak cloud) using of API (Application Programming Interface) write key. By using read API key to retrieve the sensor data and apply into machine learning algorithm. The machine learning algorithm contains few past datasets. SVM (Support Vector Machine) algorithm is used for present sensor data and then the past dataset is given into the SVM algorithm to predict some value. Values like normal or abnormal, if condition is abnormal then the buzzer will be turned on to avoid any further issues.

5. Hardware Components

1. Raspberry Pi:
The Raspberry Pi was engineered with academic types of methodologies. This ultra-compact device was generated to be small and inexpensive, making it very easy to solve societal issues. We use Raspberry Pi 3 Model B for our venture. In the model B, you get a HDMI out, RCA video out, 2 USB ports, a SD card opening, an earphone jack, and an Ethernet port. The actual board has a large portion of a gigabyte of RAM, an installed ARM processor and it is a SOC (System on chip board). It comes outfitted with a 700 MHz, 512 MB of SDRAM and ARM1176JZF-S centre CPU. The USB 2.0 port of the raspberry pi pigs utilizes just outside information network choices. The Ethernet in the raspberry pi is the primary passage to interconnect with different gadgets and the web in model B. This draws its force from a miniature USB connector, with a base scope of 2.5 watts (500 MA). The illustrations, particular chip is intended to accelerate the control of picture estimations. This is in worked with Broadcom video centre IV link, that is valuable in the event that you need to run a game and video through your raspberry pi.

2. **Gas Sensor:**
   There are numerous sorts of Gas sensors however the MQ type gas sensors are ordinarily utilized and broadly well known. Here, we use MQ 2, MQ 5, and MQ 6 separately. These sensors are utilized to distinguish spillage of the unsafe gases like (Methane, Butane, LPG, Smoke, and Natural gas), to screen the air quality in businesses and office, and so on.

3. **Temperature sensor and humidity sensor:**
   A Temperature sensor is used to record, monitor, or signal temperature changes of the heat dissipated from the industrial object or system. A Humidity sensor is used for monitoring the humidity of the atmospheric air inside the industry.

For the experimental setup, we use DHT11 which is the basic and ultra-low-cost digital temperature and humidity sensor.

4. **Exhaust fan, LED, LCD and Buzzer:**
   The Exhaust fan is used in the setup for removal of excess heat dissipation of the industrial application or objects.

   Light Emitting Diode (LED) used for checking the normality and abnormality of the air quality by means values. We use two LEDs which is of two colours red and green.

   Liquid Crystal Display (LCD) used for displaying the values and status of the experimental setup. Here, we use 16*2 LCD Module.

   Buzzer is used for the repetition of beeps or works as a mini speaker, whenever there is an abnormality in the air quality.

6. **Software Mentioned**

1. **Thingspeak:**
   Thingspeak is a Web Service, an open IoT platform for monitoring our data online and also an IoT analytics platform service which collects and store sensor data in the cloud and develop IoT applications. Figure 2, explains diagrammatically about the process of the thingspeak interface with cloud. It works with all kind of programming languages, since it uses a REST API and HTTP. We can also perform online analysis of our data.
2. **Machine Learning (ML):**
Machine Learning (ML) is one of the variants of Artificial Intelligence (AI) and it is based on the idea that the machines should be given access and the authorization of the data, and to learn and explore themselves. Figure 3, gives us the interpretation of the ML. It enables a machine to an autonomous state, so that it could learn from the given and existing data to improve performance from experiences, and also to predict future instances without being explicitly programmed.

3. **Python:**
Python is an open-source programming and high-level language. It was made to be easy to read and powerful. It is also an interpreted language, so it can run python code on almost any kind of computer. The few syntax is derived from C programming language. In our module, we use Python 2.7.0 version which includes many features than the first released Python 3.1.
7. Conclusion
Contaminated air has an extreme impact on the metropolitan populace and proficient air contamination observing framework is needed for the present need. In this paper, we have recommended a complete air contamination checking framework which will expand the exhibition, unwavering quality, and decrease the expense significantly than recently proposed customary sensor network designs. In this work, a cloud-driven IoT middleware engineering is suggested that gets information from air contamination sensors as well as from existing climate sensors. Since a high connection amongst contaminations and climate boundaries is dictated by utilizing the Pearson relationship, hence, more than one information source is remembered for this work. Examinations mirrored that the chose factors were useful for the dependable expectation of the air contaminations list. Our proposed arrangement would be conveyed in the Middleware Layer of IoT design and its anticipated air contamination file would assist the concerned organizations with making a proper move to limit the contamination impact on the populace. While incorporating with climate markers can likewise give second layer expectation way to deal with precisely foresee the air contamination.

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