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FIRE ACCIDENT ALERT SYSTEM

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Abstract

In India fire accident causes arethe most widespread cause of damage for both people and property. In this project, Fire Accident Alert System is designed using Internet of Thingsto preventlives from fire andsending the emergency alert message to a particular person or fire station with the required information. The system is designed using Carbon monoxide (MQ-7), Carbon dioxide (MQ-135), Temperature (DHT-11), Smog (MQ-2), Infrared(IR).These Sensors connected with Arduino to get theaccuraterequired information about the fire accident in a particular surrounding.

This project is aboutcalculating the condition in a particular area as there is any occurrence of fire accidents andrecognises the conditions in an encompassing as fire, no fire, and might be fire. This classification is performed using the K-Nearest Neighbours (K-NN) and Decision tree AI calculations in Python. A few situations were recorded in the analysis for training. If any accident occurs the alert message will be sent to the fire station with the required information that they need. The alert message will send to the registered and nearest fire station using GSM module.

Keywords : Internet of Things,Temperature measurement,Fire,Arduino Sensors, K-Nearest Neighbours and Decision tree.

1.INTRODUCTION

Fireaccident in a particular area occurs mainly due to unnoticed leakage of gas or high voltage supply of electricity or careless of a person. Fire accidents are the major cause of death in a particular area or industrybecause of absence of programmed crisis fire ready framework [1],[2].These days there is no minimal effort automatic emergency fire accident alerting system [3] available at building to provide emergency alerts message to the fire station. For this reason, a Fire accident alert system [4]-[6]utilizing Internet of Things is proposed to identify the fire conditions precisely at a specific structure.

IoT may be a combination of things or gadgets to make anappropriate association for a particular application [7]-[11]. The most of the segments of IoT are square measure sensor and actuator,Arduino/Raspberry is the platform of wireless modules for IoT. IoT provides solution for many problems to its users, like fire observance, fall detection for older, pollution observance, automatic transportation systems, sensible home, energy regeneration, flood detection, sensible agriculture, and lots of localization of devices [12],[13]. The IoT principles are applied to fire accident zone detects the varied prospects for entirely new ways in which to stop fire. This chiefly use temperature sensing element (DHT-11), smoke sensing element (MQ-2), greenhouse gas sensing element (MQ-135), Infrared sensing element (IR) and CO sensing element (MQ-7) to gather

knowledge when there isno fire, may be fire and fire condition rises in an exceedingly particular area or industry. When grouping the training data for every type of situation andthe analysis is completed withsupervised machine learning techniques, like K-NN algorithmic rule [14]-[18] and Decision tree algorithmic rule[19],[20]. When there is firein a particular area, the new sensing element takes the square measure recorded and classified according to the 3 conditions. If fire condition is in potential of fireplace, then associate alert message is shipped to the registered mobile variety and therefore the firehouse for emergency alert with the desired data.

The main motivation of the project is to introduce the fireplace alert system to avoid the fireplace occurring in several resident areas and industries. several works are wiped out this space exploitation Machine Learning and IoT[1],[2],[4]-[6]. However, coming up with an inexpensive hearth accident alert system are going to be additional helpful for the people.

2. METHODOLOGY

1. Machine Learning Techniques

Machine Learning is a study of computer algorithm that improve the process automatically by the experience or by the given data. We can build the models by Machine Learning algorithms with the help of sample data which results sample model (Training data). Through the different trail runs we will be obtained different results. This data is called as Testing data.

1) K-NN Algorithm: K-Nearest Neighbours is on among the Machine Learning algorithms which is based on the Supervised Learning Technique in IoT analysis. This can be used for Classification and Regression but mostly it is used for the problems associated with classification. It stores all the necessary data and classifies a new data point based on the similarity. It is also called as Lazy Leaner algorithm because it does not learn from the training dataset immediately.

Euclidean distance

$$d(A, B) = \sqrt{\sum (A_i - B_i)^2}$$

where $\sum$ is i=0 to m.

Manhattan distance

$$\mathbf{d(A, B) = \sum |A_i - B_i|}$$

where $\sum$ is i=0 to m.

2. Decision Tree:

Decision Tree algorithmic program belongs to the supervised learning techniques in IoT analysis. Rather than supervised learning algorithms, the decision tree algorithmic program will be utilized for resolution of each regression and grouping issuesas well. The objective of employing a call Tree is to frame an instructing model that may use to anticipate the class or cost of the objective variable by learning easy call rules construed from thepast data(training information). In call Trees, for forseeinga category label for a record wetend to start from the premise of the tree,wetend to analyse the estimations of the basis attributes with the record's attribute. On the premise of correlation, we have a tendency to follow the branch love that cost andleap to ensuing node.

Information Gain is a factual property that measures how well a given trait isolates the training examples as per their objective classification.

Information Gain = H(Target) − H(Target, Attributes)

Where, IG is the Information Gain and H is the Entropy.

Gini Index works with the categorical target variable "Success" or "Failure". It performs only Binary splits.

$$\mathbf{Gini=1-\sum(p_i)^2}$$

Where$\sum$ is i=0 to m, m is the number of modules and pi is the probability.

2. Training Data for the Fire accident alert system

The training data has the data occurring of thethreeconditionswithin associate atmosphere just in case of fireplace. within the experimentprocess, we have a tendency to generate a dataset by simulating a fireplace and takethree goodish things under consideration, i.e., fire, no fireand may be fireplace. The accumulation of information is finished by takingfour parts under consideration victimisation the sensors. The tactile information provides what extend carbon monoxide (CO),dioxide (CO2) smoke, and temperature is blessed inside theenvironment under totally various things. These simulations are irregular inorder to understand an extra numerous dataset. We compilea dataset with twenty thousandexamples.Thedata of each individualsimulation is compiled to assess matters at spans theenvironment. The dataset is utilized in the learning technique within horribly specific environments and conditions. MongoDBis used to store the data of all conditions established within the spaceenvironment.

3.Information for the Fire Service men

After the fire accident occur the SMS will be sent to the nearest fire station with the required information. The information that will be send to the fire men are the count of the people who stuck inside the building using the bidirectional infrared sensor(IR), GPS location of the building and the amount of carbon dioxide. The alert message will be sent by the GSM module using Python programming.

3. DESIGN OF FIRE ACCIDENT ALERT SYSTEM

1. Collection of Data

The proposed system utilizes CO, CO_2, Temperature, Smog sensors for collecting and grouping the informationaccording to the conditions.

1) **CO_2 sensor** is used to measure the quality of air in the area.

2) **CO sensor** is the device used to measure the CO level in the atmosphere.

3) **Smog sensor** is one that detects the measurement level of smoke and fog.

4) **Temperaturesensor** is used to measure the humidity and temperatureof the surrounding.

5) **Infrared sensor** is used to calculate the number of people entering and exiting the building.

The reading data in the module are taken in the regular interval of time for an instance ten seconds. These data are stored in the database according to the three conditions.

The complete data are retrieving from the database.This dataset will beconverted into a .CSV file, which is used as a dataset for further processing.

2.Training

The training of the model are achieved by the two supervised machine learning algorithm. The algorithms are K-NN and Decision tree. We train the model with python programming that generates the new dataset. This model maps the input to target the classification, that will categorise the new information.

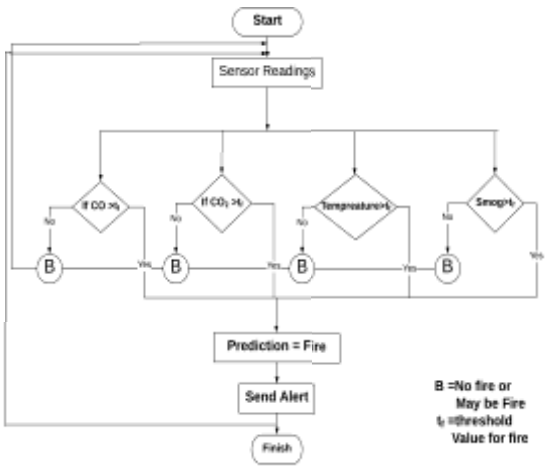
3. Classification of new data

Classification is a managed learning approach during which the AI model gains from the data input given thereto (i.e., preparing dataset) so utilizes this learning to arrange the groundbreaking perceptions. The new data comprises the estimations of the CO, CO2, temperature and smoke, which can go about as associate degree contribution to the AI model. The model predicts whether the new informationis in class fire, no fire and might be fire (i.e., arranged marks). For example, the new information will be as [11, 1036, 400, 200].

4.Alert System

An alert system has a Python programming module, which is able to be referred to as automatically whenever the machine learning model (K-NN or decision tree) predicts a new input data asfireplace. Here, an alert will be mechanically sent to the registered number of the peopleand fireplace interference department.

5.Flowchart of Fire accident alert system



Where **t1** is the threshold value of the fire and **B** is the no fire.

4.RESULT

Performance of K-NN and Decision algorithm:

Condition	Precision	Recall	F1 score	Mean error
Fire	1.0	1.2	1.0	1.1
May be fire	0.93	0.92	0.92	0.92
No fire	0.84	0.84	0.84	0.84

Precision: It is the positive prognostic price and in other name it is the relevant fraction instance between the retrieved instances.

Recall: It is the sensitivity parameter and alsocalled the relevant fraction instances gathered from the entire relevant instances.

F1 Score: it's used for measure accuracy. It's the mean value of preciseness and recall.

Atable whichindicates the K-value with the minimum error rate is furnished below. Here, we end up with a conclusion that theK-value with minimum error should be considered for better prediction.

5.CONCLUSION

In this paper, an Internet of Things essentially based fire mishap alert system is planned to thwart individuals from fireplace by giving AN alarm message within the emergency. This examination recognizes the conditions during a close as fire, no fire, and might be fireplace. This arrangement is performed abuse the K-Nearest Neighbours and Decision tree AI calculations in Python. The outcomes show that K-NN and Decision tree shows an exactness of fire occurs severally. Therefore, we tend tore prepared to demonstrate that K-NN gives a lot of exactness and accuracy in police examination fireplace per the produced dataset. Subsequently, this approach is utilized for classifying and assumingfireplace conditions emerge, a security message is dispatched to the enrolled mobile range. This low worth framework will be an obviously better goal for police investigation fire within the emergency reception.Within the future, we will utilize a great deal of analytical approaches to settle on the least difficult techniques for larger datasets. We will also utilize distributed atmosphere for this to extend the measurability of the system and style acompletely automatic device byincluding GSM module.

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