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PREDICTING AND MONITORING AIR AND WEATHER QUALITY INDEX USING MACHINE LEARNING

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Abstract

Many plants suffer everyday because of abnormal weather conditions. Here, we deploy an idea to predict and monitor the air and weather quality, and to give some notifications about the air and weather quality along with some plant suggestions beforehand itself. This idea will help the farmer to know about the weather before, accordingly they can plan their work for that day. The system leverages Machine learning and Deep learning helps improving the accuracy of the output. The previous year data are collected, by using that data we will be predicting various parameters like air quality for the next few days/hours. This information about the prediction will be displayed in a GUI interface along with suitable crop for that.

Key words: machine learning, deep learning, prediction, air quality, weather, GUI, sensors

Introduction

At present, technology has evolved and we can see drastic improvement in every field of technology. But, this growth of technology has still not proven its worth in agriculture. In India where agriculture is the backbone of its economy, people still depend on less efficient and ancient methods and this resulted in major revenue loss. This is primarily due to the reason that either the plants doesn't get adequate Amount of resources or gets excess than required and also due to improper supervision Or human error. We came across some of the previously proposed models during research but they didn't take one factor into consideration, which is that an average farmer cannot afford high priced equipments. While going through the recent trend, we can notice that the climatic conditions have gone through a drastic change. We either get higher or lower rainfall than expected and farmers are unplanned for this situation. Due this condition, farmers are the most affected. Hence, it is necessary to predict and estimate the air and weather quality beforehand. So our proposed idea is to build a software in which one deployment will estimate the amount of wanted and unwanted particles present in surrounding in real time. The amount of temperature/humidity in surrounding will noted. The farmer can further can predict the air quality by using the GUI. We use machine learning and deep learning to develop a low cost reliable system. This system will also predict the condition and estimates which kind of plant is suitable for the particular area or land.

Hardware / Software Requirements

A. Software components

1. Python: Python is known for its more number of library functions. With the help of these library functions, we model the system.[3]
2. Tensorflow: A python implementation of this library is to be installed for implementing this library and the predictive analysis tasks. [1]
3. Pandas: This library function is a powerful data structure for data analysis, time series and statistics.
4. Tinkercad: Tinkercad is an online based design platform developed by Autodesk, for designing 3D models, circuits and codes for simulation at a free of cost.

B. Hardware Components

1. Arduino board: It is an open source based platform on easy to use hardware.[10] Arduino boards are able to read inputs – gas sensor and temperature sensor; and turn it into an output – publishing something online. [3]

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Fig 1: Arduino Board

2. Gas sensor: MQ-135 is a gas sensor, is a cheap but efficient way to identify the air quality. It will sense the presence of unwanted gas and give air quality index as output. [1]

Fig 2: Gas Sensor MQ135

3. Temperature & Humidity sensor: Here DHT-11 is used. This sensor will detect the temperature and humidity amount contained in the air and the nearby area. [3]

Fig 3: Temperature-Humidity Sensor DHT-11

4. Pressure Sensor: BMP180 is the pressure sensor. This sensor will detect the atmospheric pressure and give the output in hPa.

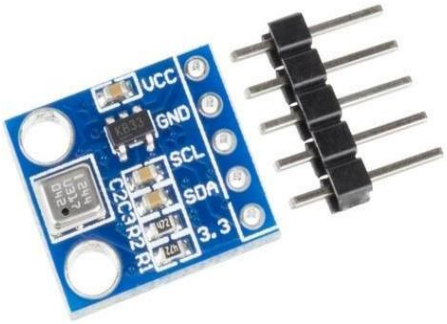

Fig 4: Pressure Sensor BMP180

Proposed Model

The proposed system here uses Arduino as a micro-controller interface for sensors. The temperature & humidity, pressure and air quality sensors are connected with the arduino. The sensors collects the values of different parameters and these values are stored and analyzed. With the stored values, we use regression techniques to predict the further upcoming values and check with the required index for a specific plant. If any mismatch of the predicted, the user is alerted through GUI helping them to take necessary action beforehand avoiding any loss.

ALGORITHM USED:

In this model we use three algorithm two is from machine learning (SVM and Linear regression) and the other from deep learning (tensorflow).

1. SVM: SVM is abbreviated as Support Vector Machine and it is used for classification and regression problems. The primary purpose of SVM is to create a boundary which will segregate into classes. By using the classes, the data point can be added to the appropriate division later.

First, the svm library function from scikit learn package is imported and a classifier object called the support vector classifier is created by using argument kernel as svr() function. To get to know about the performance of the algorithm, the collected [11]dataset is divided into train data and test data. Then, the dataset is fitted into the algorithm by means of fit() and predict() method is used for the purpose of prediction. By analyzing the predicted data, the accuracy is obtained.

2. Tensorflow: The tensorflow function allows simple development of estimation through various devices ranging from computer to mobile and yet smaller ones also. It comes strong support from deep learning.

A sequential() model is appropriate here for a plain stack of layers where each has one input and one output. To put sequential(), we increment (by using add()) the model when there is a need for it and dense() function is used for implementing that operation. After defining the model by sequential(), now we are ready to compile the model, which will create a python object.

3. Linear Regression: This algorithm is a straight method for describing the relationship between two variables. These models computes the coefficients which are being used in the representation with the data.

In this system, we are first importing the linear regression from scikit-learn (sklearn) library package and fitting that to our dataset. After fitting, we use predict method of the linear regression to predict the next set of values for the readings which we gave as train data.

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ARCHITECTURE DIAGRAM

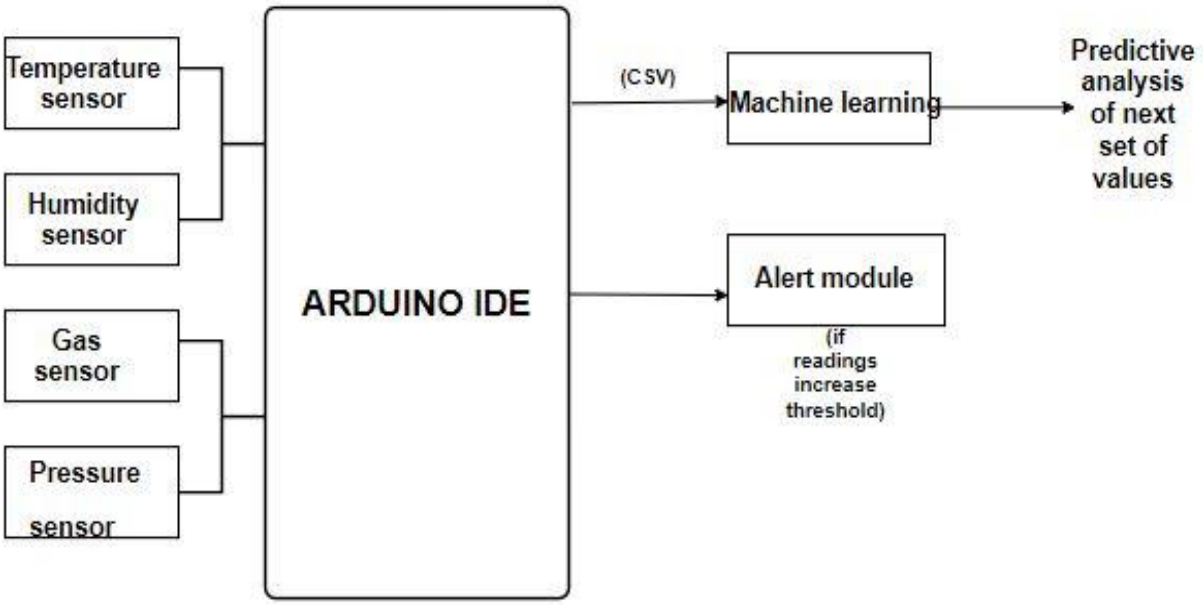

Fig 5: Architecture diagram

The required sensors that is, temperature sensor, humidity sensor, air quality gas sensor and pressure sensor all these sensors are interfaced to the microcontroller used here. The output is then forwarded to machine learning module for further predictive analysis. In case of short circuit, we can add another Arduino, which is also efficient way to get the desired output.

Future Scope

In near future, the computers will be able to sense soil kind and seed type by simply analyzing the image. This advancement in computer technology can be used to find any hindrances in the farm such as finding the weeds which is being the reason for plant damage. In future, we can also fabricate the PCB dedicated specially for our idea to make it waterproof with suitable protective cases. This will result in reduction of cost and improvement in efficiency.

Conclusion

The solution which we have developed is affordable and contributes to smart farming. The success of this project is dependent in its cost, efficiency and its working in real time situation. All the stored values will be analyzed and the next readings will be predicted using regression technique. By the use of graph analysis which matches the predicted values with the required index, the user can take some precautions. It also aims at providing the farmer some suggestions about plants based on the air and weather quality that we predicted.

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