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Change point Detection using IoT Time series Data

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ABSTRACT –The project entitled "Change point detection using IoT time series data ", aims at coming up with the ideas of detecting weather which is suitable for growth of plants, predicting the weather for furthermore operations. This project provides an end-to-end solution right from detecting the suitable real time weather to the factors affecting the growth of plants, fluctuations in the weather conditions and such others.

Key Words: IoT, time series data, real time

I. INTRODUCTION

IoT is one of the evolving field in science. Many researches are going on in this field. Applying IoT in time series data is a bigger challenge. Time series data can be defined as the series of data points listed in order according to the time. It can be analysed at regular intervals of time and based on the standardized analysis prediction can be made. This is know as IoT time series data analysis.

There should be proper sensors and actuators in order to sense the environment, capture the data, to arrive on a conclusion and finally for the analysis of the data. This analysis can be used for predicting the weather, to understand the plant growth and act accordingly and such others.

The model is trained by the data which are pre recorded with the aspects like humidity, temperature, rain etc

II. LITERATURE SURVEY

We have come across a lot many papers and journals in the field of time series data and change point detection.

Through these journals and conference papers we came to know that there is no model made which detects the change point or abrupt changes especially in the real time data. There were a lot of papers regarding the same subjects and it gave a lot of ideas in different dimensions about the same topic.

We referred many papers like Bayesian methods for multiple change point detection with reduced communications and many other journal papers.

III. METHODOLOGY

The technologies we are implementing in this project are IOT, Machine Learning. We have also used two different platforms namely Blynk and ThingSpeak.

1)Blynk platform:

This application is very helpful in visualising the results directly through phone and we can get the notification in our phone through sensors connected.

2]ThingSpeak:

This software is very helpful in plotting the graph and getting the results in laptop or PCs. In this software we can check the readings which are obtained from the sensors.

Different sensors needed are:

1]ESP 32:

ESP 32 is low cost, low power system sensor and which is of high use.It is integrated with wifi and

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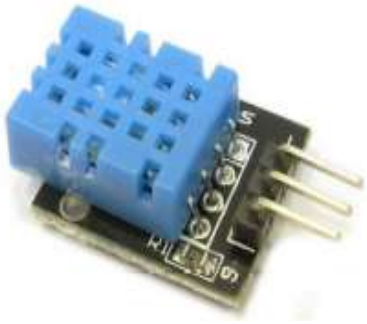
also with dual mode Bluetooth. It also has built in antenna switches.

2]DHT 11:



DHT 11 is a most commonly used sensor which is used to measure temperature and humidity.It has a dedicated NTC to measure temperature.

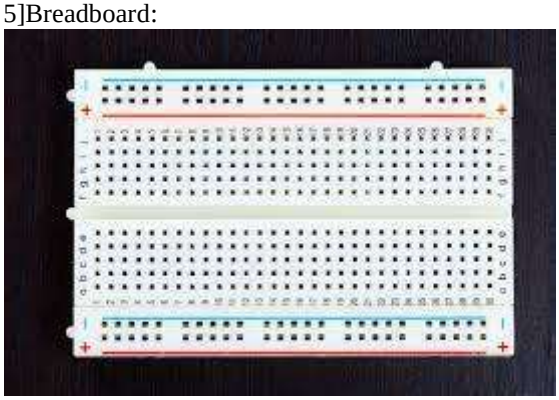
3]Rain sensor:

Rain sensor as the name says used to detect rain and it is also a commonly used sensor among most of the real time data reading sensors.

4]BMP 180:

This sensor is of the series BMPXXX. This is used to measure atmospheric pressure. It is a high precesion sensor.

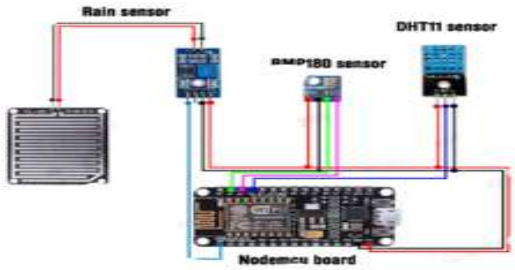
5]Breadboard:



Breadboard is rectangular in shape and it is a major component which is used to make most of the sensors connected. Wirings can be used to achieve the same.

IV. IMPLEMENTATION

The circuit diagram is as shown in the figure. All the sensors are connected accordingly and proper connections are made so that it can read the proper readings. Here it is very important to setup properly since we are taking the real time data and analysing the same.



Now connections are made according to the circuit and through ThingSpeak platform we can take the real time readings of temperature, pressure, humidity and rain. Several readings are recorded and also the graph is plotted for the same.

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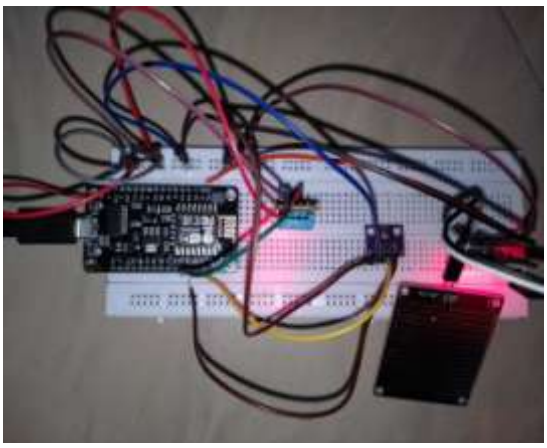


And also we have Blynk platform through which we can see the data directly through our phones. We just have to install the application in the phone and make the circuit connected to it and we can get the readings sitting in anywhere in this world. This is the major advantage.

And also we are using machine learning part here to know the obtained results are accurate or not. So using Naïve Bayes algorithm we tried to predict the accuracy.

Naïve Bayes algorithm is a classification algorithm. It is based on applying Bayes theorem. And it is about the assumptions between the features.

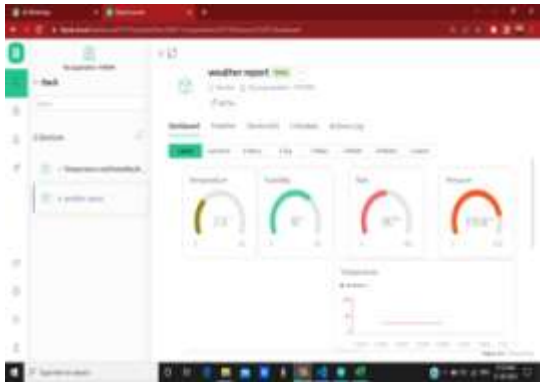
We have recorded the real time data for all the sensors for 24 hours and obtained the data and we have used Naïve Bayes algorithm to check the accuracy.

The above figure shows the implementation of Naïve Bayes algorithm using python libraries.

V. RESULT

The above figure shows the abrupt changes in the real time data obtained.

Even the above picture shows the change point detection of the data.



The above picture shows the real time data reading in Blynk platform. The same thing is seen through our smartphones if connected.

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```
Accuracy: 0.7469879518072289
F1 Score: 0.7469879518072289
Cnfusion Matrix: [[ 7  0  0  0  0  0  0  0]
 [ 0  3  0  0  0  0  0  0]
 [ 0  1  4  0  5  0  0  5]
 [ 0  0  0 18  2  0  0  0]
 [ 0  0  0  0  3  0  0  0]
 [ 0  0  0  0  0  5  0  0]
 [ 4  0  0  0  0  0 13  0]
 [ 4  0  0  0  0  0  0  9]]
```

The above one is the snapshot of the accuracy of the recorded real time data that we have got using the Naïve Bayes algorithm.

These are the results that we have obtained through our project and the snapshots are put accordingly. Several change points can be detected from the graphs obtained.

VI. FUTURE SCOPE

Change point detection can be carried out further for plants which is very helpful in detecting the weather and if any variations are present certain actions could be carried out.

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