IOT Based Weather Monitoring and Prediction Using Linear Regression

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***Abstract*—**Today's the focus has been shifted towards intelligent technologies like IoT and Machine Learning. Many IoT hardware platforms are available for IoT implementations. ESP8266 chip is one of them. This paper implements the real time weather prediction system that can be used in number of applications like homes, industries, agriculture, stadiums etc. for predicting the weather information. The system utilizes a temperature and humidity sensor i.e. DHT11. The sensed data from the sensors are uploaded to a Blynk cloud server using NodeMCU and ESP8266 module. The data is also displayed on Blynk app which should be installed on a mobile phone. A linear regression model is used for setting up the machine learning environment. This model is trained using the pre- recorded values of sensor data. Further, NodeMCU records the data from sensors i.e. temperature, humidity and then the values are transferred to the Jupyter notebook that utilizes a python environment. This real time data is used to test the model and prediction is done for a particular value by blinking the led connected to NodeMCU.

Keywords*—NodeMCU, Jupiter Notebook, DHT11, Blynk app.*

I. INTRODUCTION

Will it rain and the match gets dismissed or will it be bright and sunny? How can it be determined that whether the conditions are suitable for conducting a cricket match or not?

The temperature is too high this summer, will it be rain or not? The answer to these types of questions is only given by the concept of machine learning in conjunction with IoT. To develop an IoT system, a thing is required which should be equipped with necessary sensors, actuators and a communication interface. The communication interface is needed to connect the thing to the internet that allows them to send the data to cloud or at remote machine for monitoring and also for analytics purpose. The thing can also receive the control information based on some analytics and take some actuating decision. In the proposed system, the things refer to the NodeMCU that includes firmware, which runs on the ESP8266 Wi-Fi SoC. The cloud refers to the Blynk platform for monitoring the data. The analytics refers to the machine learning algorithm i.e. a linear regression mathematical model. This model is trained with the pre-Recorded data values of temperature, humidity. Further, it is used for prediction.

II. LITERATURE REVIEW

Jitcha Shivang et al. developed a simulated system to predict weather condition of Indian subcontinent using Machine Learning. Data for training was collected from data.gov.in, ncdc.noaa.gov and UCI machine learning data repository. The system utilizes a linear regression algorithm for data training [1]. Zaheer Ullah Khan et al. utilized different information digging methods for expectation of climate determining including diverse groupings like K-Nearest Neighbor, Decision Trees. Among the order algorithms, decision tree has accomplished promising outcomes contrasted with different calculations. In this paper they have achieved an accuracy of 82% [2]. Siddharth S. et al. have utilized information mining strategy and Decision tree calculation to group climate parameters like least temperature and most extreme temperature as far as day, month and year [3]. Radhika et al. presented a paper on the use of Support Vector Machines for climate forecast. Time arrangement information of every day greatest temperature at an area was dissected to anticipate the most extreme temperature of the following day at that area dependent on the day by day most extreme temperatures for a range of past n days alluded to as request of the info.. Non straight relapse technique was utilized to prepare the SVM for this application [4]. Divya Chauhan et al. utilized information mining, an instrument that predicts practices and future patterns, enabling organizations to settle on proactive choices. This paper introduces the survey of data mining techniques for weather prediction and concentrates the advantage of utilizing it. The paper can be utilized to foresee meteorological information that is climate expectation. The paper gives a review of accessible writings of a few calculations utilized by various specialists to use different information mining methods for weather prediction [5]. After studying all the papers, it has been concluded that the training data is taken from some external source. But in this paper, all the data is measured in different conditions using a set of sensors. In this paper, DHT11 have been used that measures temperature, humidity.

III. COMPONENTS AND SOFTWARE REQUIRED

ESP12/NODE MCU (CP2102)

NodeMCU is an updated version of Arduino with inbuilt wifi chip as shown in Fig.1. It is cheaper than other modules performing the same function.

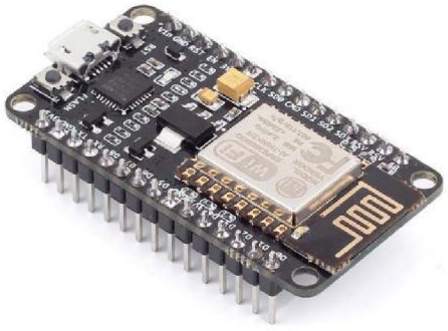


Fig.1. NodeMCU Board

DHT sensor

It is a module used for measuring temperature and humidity as shown in Fig. 2. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air's humidity and temperature.

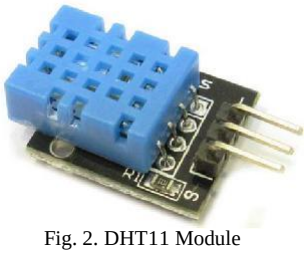


Fig. 2. DHT11 Module

Breadboard

It is typically a hand wired circuit using a pegboard with press in terminals. Wire wraps or hand soldered wires connect discrete components together. Connecting Wires/Jumpers are used to connect NodeMCU to the DHT11.

IV. SOFTWARE USED

The Arduino IDE (Integrated Development Environment) is the environment, where code is written, compiled and uploaded to the Arduino or Arduino compatible board. Blynk is an Internet of Things platform that lets the user to collect and store sensor data in the cloud.

Jupyter notebook is a very popular and flexible tool which helps put the code, output of the code and any kind of visualization or plot etc. in the same document.

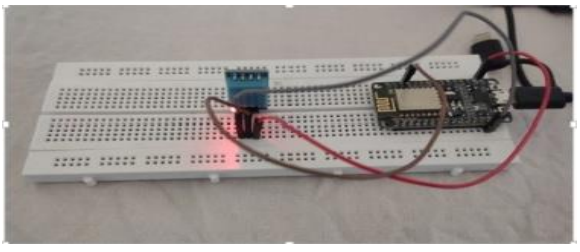


Fig.4. Circuit Diagram

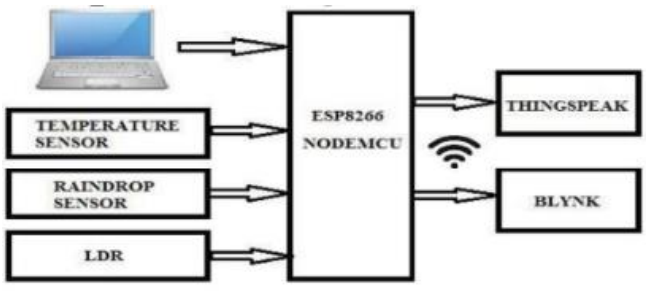


Fig. 1. Overall block diagram of the weather monitoring system

Fig.5. Schematic Diagram

IMPLENTATION

DHT11 sensor is connected with NodeMCU, which measure temperature, humidity is connected to digital I/O pins, GND and Vcc.

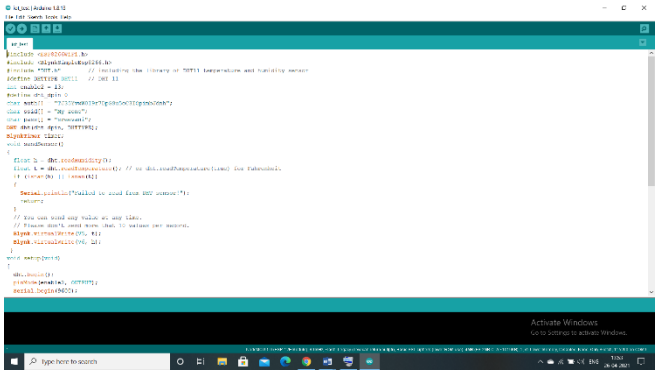


Fig.6 Arduino IDE

Arduino ide is used to Program NodeMCU to collect the sensor data and send it to Blynk app and there we can monitor the data.

6. Using NodeMCU data is sent to the Blynk cloud server (database) as shown in Fig 7. Further, in Blynk we can export the received data into a CSV file which contains all the information of data collected from the sensors. This recorded data in .CSV is used to train the machine learning algorithm. A model based on Linear Regression [8] in Jupyter Notebook (Python IDE) is used and trained with the pre-recorded values stored in the .csv file.

RESULTS

Fig 7. Data received at Blynk

Fig8. Temperature actual vs predicted values

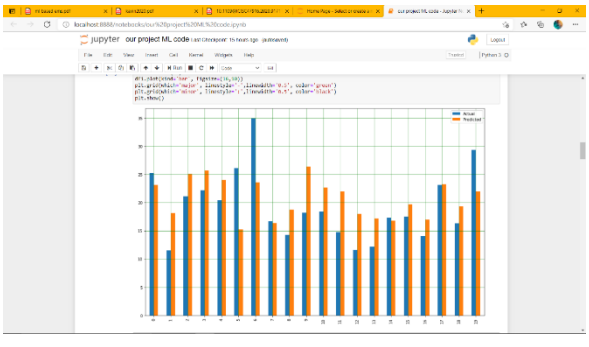
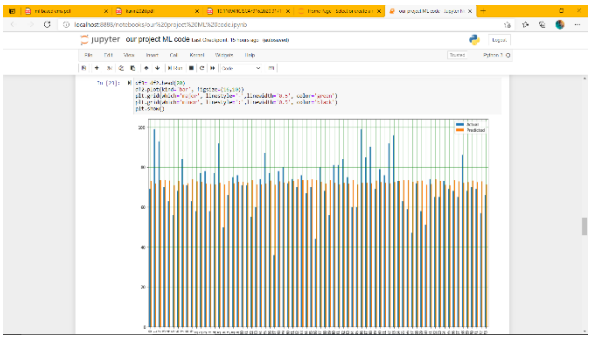


Fig 9. Humidity actual vs Predicted values



CONCLUSION

The real time weather prediction system presented in this paper has been developed around low cost IoT board and sensors. The temperature and humidity are some of important parameters that are monitored and uploaded on Blynk cloud. The system has been deployed in an indoor environment and values of the parameters have been recorded in Google spreadsheet .csv format. A Linear regression model has been used in Jupyter notebook environment that is trained with prerecorded values of parameters and used to predict the weather parameters in real time environment. The result of the model is also compared with the other works available in literature and the proposed system is slightly poor in terms of accuracy. Further, the system can be modified to be used at commercial level and have many applications in smart homes, buildings, sports, hospitals etc.

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