GLA UNIVERSITY MATHURA

Weather Forecast using IoT and Machine Learning

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Abstract: As we know that real time weather forecasts are a major problem. In ancient times weather forecasts such as Temperature, pressure, humidity, and rainfall were measured through real time sensors and satellite image processing. In this project model we try to integrate the So in this solution, we solved the following problems:-

- Temperature
- Humidity
- Rainfall
- Atmospheric Pressure
- Wind Direction
- Wind Speed

1. INTRODUCTION

Weather forecasting is the application of science and technology to predict the state of the atmosphere for a given location. Ancient weather forecasting methods usually relied on observed patterns of events, also termed pattern recognition. For example, it might be observed that if the sunset was particularly red, the following day often brought fair weather. However, not all of these predictions prove reliable. Here this system will predict weather based on parameters such as temperature, humidity, wind speed, wind direction and rainfall value.

We are connecting the IoT sensors and collecting the following value in Google Sheets.

Wind Direction   Wind Speed   Atmospheric Temperature   Atmospheric Pressure   rainfall value

After this, take Historical data with this and we make a Prediction Machine Learning Model to predict the mentioned values. Later on we implement this ML Model with Time Series analysis for predicting the weather for continuous time. As a ML Model we use SVM (support vector machine) Algorithm.

We also used other Machine Learning techniques to check the Model Accuracy and performance. We only used that Algorithm that best fit in our ML Model.

2. BASIC CONCEPT

To build this project we used some IoT sensors and SVM machine learning techniques. In this project we collect the weather parameter values like temperature, humidity, wind direction, wind speed and atmospheric pressure. We used corresponding sensors, collected the value on Google sheet, stored in RStudio framework, we made svm machine learning techniques to process data and build weather prediction models.

3. Flowchart
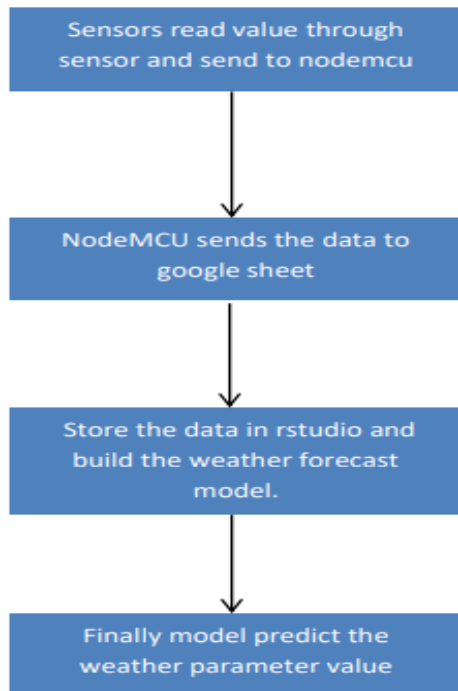
Algorithm

Step-1: Connect DHT 11, BME180, rainfall, wind direction and wind speed sensor to NodeMCU.

Step–2: Upload corresponding code into NodeMCU and connect the corresponding hardware.

Step–3: Check whether NodeMCU sends the data on Google sheet or not successfully.

Step–4: Store the data on RStudio Step-5: Take historical data and prepared that for model building

**Step-6:** Make an SVM machine learning model by using processed historical data.

Step-7: Test model by using real time data that collected through the sensors

Step-8: Now predict all weather values by trained Model.

Step-9: Check model accuracy, if weather accuracy is not better than try to use different machine learning techniques.

Step-10: Build user interface for results.

4. Hardware & Software working Prototype
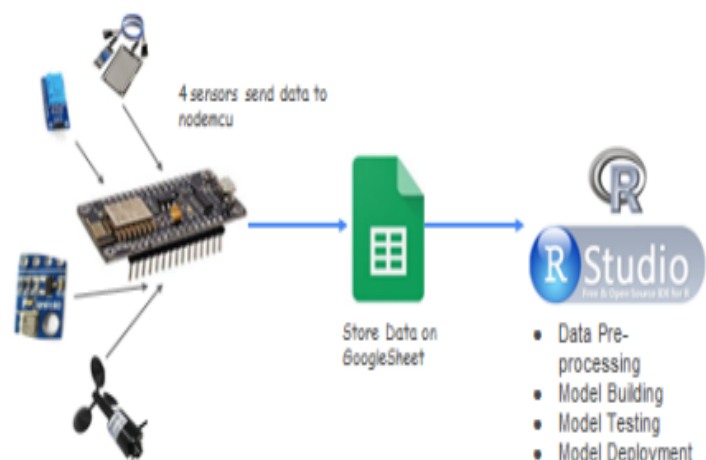
This is the abstract working prototype of the mode in which hardware sends the data about weather like humidity, temperature, wind direction and speed to google sheet. Later on we access that data in RStudio for data processing and model building to summarize and predict the weather forecast.

4.0 REQUIREMENTS

4.1 HARDWARE REQUIRED:

For fulfilling the purpose of this solution the following hardware is required as mentioned in figure

1. NodeMCU
2. Wind direction and Wind Sensor
3. DHT11
4. Barometer
5. Rainfall Sensor
6. Breadboard
7. Jumper wire

4.2 SOFTWARE REQUIRED

1. RStudio
2. Google Sheets
3. R
4. SVM ML technique

4.3 SYSTEM ARCHITECTURE

5.0 COST ESTIMATION

As we know Cost Estimation is the process to calculate the overall budget that is required to build a successful project. By considering this we calculate the cost of the project on the basis of required hardware in the project, software cost, electricity cost, internet cost, installation, and maintenance cost. So these are the parameters to find out the overall budget of the project.

5.1 HARDWARE COST

We try to get the hardware cost at minimal rate. We also consider the life span of the hardwares.

This Project cost is mentioned in the image below.

S.N	Name of Components	Unit price	Total
1	NodeMCU	218.00	218.00(1x)
1	Wind Dir. & Speed Sensor	4799.00	4799.00(1x)
2	DHT11	125.00	125.00(1x)
3	Barometer	54.00	54.00(1x)
4	Rainfall Sensor	99.00	99.00(1x)
5	breadboard	65.00	65.00(1x)
6	Jumper wire	49.00	147.00(1x)
	Estimated Cost(Rs)	5408.00	5507.00

This cost may be vary because of vendor hardware price

5.2 OVERALL ESTIMATION

Overall project cost measure by considering the different use cases like for hardware cost, software cost, internet cost, maintenance cost etc. so total cost of the project given below in table.

S.N	Components	Monthly	Yearly
1	Hardware	--	5507.00
2	Software/cloud	0.00	0.00
3	internet	200.00	2400.00
4	Electricity	--	--
5	Installation	--	--
6	Maintenance	--	--
7	Deployment	--	--
	Total		7907.00

6.0 USE CASES AND BENEFITS

- **Anyone** can easily find out Weather conditions by using this system.
- This Model or System helps to predict the weather of **Tourist place**. So the management team makes decisions about the tourist.
- This system is also helpful to effective control of the **Sports.**
- This system can be used in Air **Traffic** such as **flight**
- As we see, crops of **farmers destroy** usually due to high rainfall, storms etc, through this system so farmers update itself to prevent the crops.
- In **Marine** and **Forestry** this system is very helpful.
- **Military** and **Navy** also take advantage of this system.

CONCLUSION

Our intention of this project work was to establish a flexible, economical, easily configurable, and most importantly, a portable system that can solve our weather forecast problem. It is a robust system and small in size. Our proposed system for weather forecast prediction comes under the field of the Internet of Things (IoT). Our main objective was to design a smart system for predicting the weather condition like predicting the temperature, humidity, rainfall etc.. by using the reinforcement machine learning technique we increase the performance of the system. This model is very useful in several areas such as in agriculture, sports, tourist places, Air traffic, marine and forestry and manufacturing industries in cloudy regions. This project is very cheap and accurate.

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