A

PROJECT REPORT ON

ANALYSE IOT SENSOR DATA WITH MACHINE LEARNING

Submitted By

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Under The Guidance Of

Analyze IoT Sensor Data With Machine Learning

1. Introduction

1.1 overview

IoT and big data have already become household words and people are becoming increasingly interested in how to effectively use enormous amounts of collected data. Meanwhile, the third boom of artificial intelligence has emerged, and relevant technologies including machine learning are evolving rapidly. Machine learning has revolutionized the way we use to experience the web[4]. With a well-diversified repertoire of real-life implications, ranging from web search recommendation to financial predictions, it hasnt left any stone unturned. The raw sensor data doesent do much good if it is not analysed and used for future purposes. This project focuses on extracting the temperature sensor data from the iot sensor and analysing it using machine learning model to predict if the temperature data is having a normal or abnormal value. The machine earning model will learn from the dataset provided and also from the values continously generated from the sensor.

1.2 purpose

The purpose of this project is to enhance the system security and avoid any accidents, fire incidents due to excessive temperatures. Also the predictions from the machine learning model can be used to control the home appliences using the iot sensor data and machine learning predictions. Example it the temperature in the room gets above certain value the required utilities can be turned on to reduce the temperature. Incorporating machine learning model will help us to analyse our daily usage patterns and take appropriate actions depending upon the past experience.

2. Literature survey

2.1 Existing problem

Nowadays we generally see that iot devices are used to fetch the sensor data and it is given to mcu which is conventionally programmed to do a perticular task for a perticular sensor value. But everything or every action cannot be programmed in the mcu. It becomes difficult to programm if we take into consideration multiple factors deciding the control action. Example Sometimes we need the different output for various variable input conditions. Example if we want the ac to be turned on only if the temperature is beyond 22 and if fan is off and if ac is not used for more than 1 hour on that day and any other condition and if we have multiple of such usage patterns for various equipments , then it would be difficult to program these usage patterns using conventionsal meathod.

2.2 Proposed solution

In this project we are proposing a solution to the above problem. Insted of using the conventional coding we are implementing the machine learning model to first learn the usage patterns of a perticular environments and once it has learned it will take decisions on its own weather to turn on the ac or not depending upon the past experiences of turning on the ac. In this way we are avoiding complex coding and getting advance functionality from the machine learning model. This project simply shows only one input variable ie temperature and one output variable ie weather it is normal or not. The machine learning model can surely be trained to recognise more than one input variable and gives the corresponding output action.
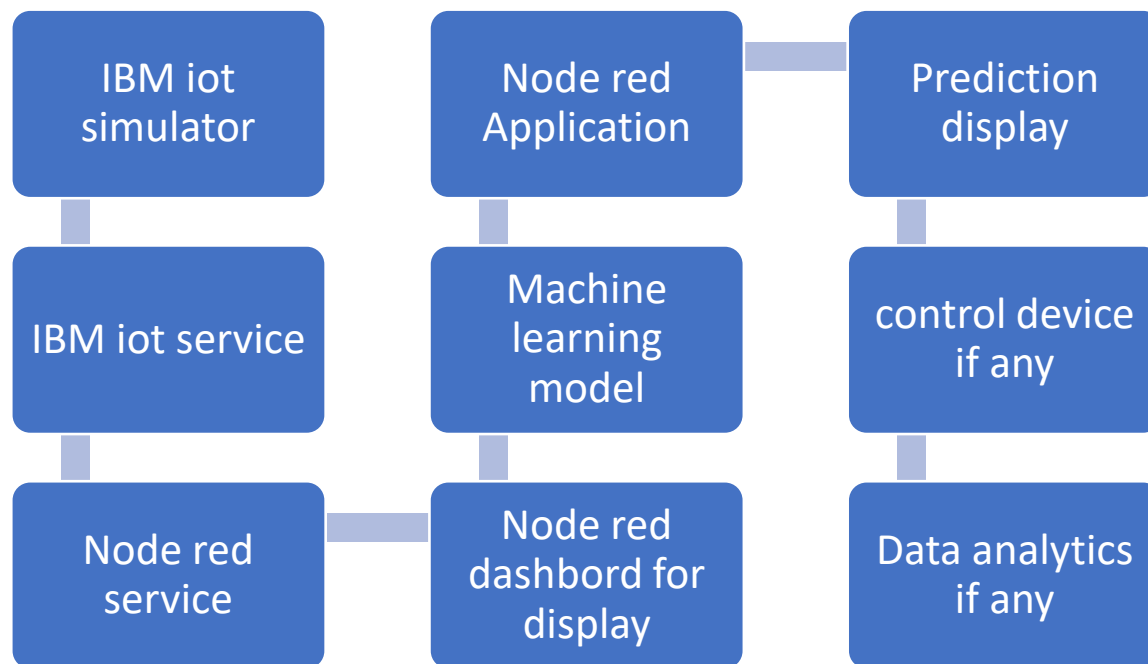
3. Theoritical analysis

3.1 Block diagram
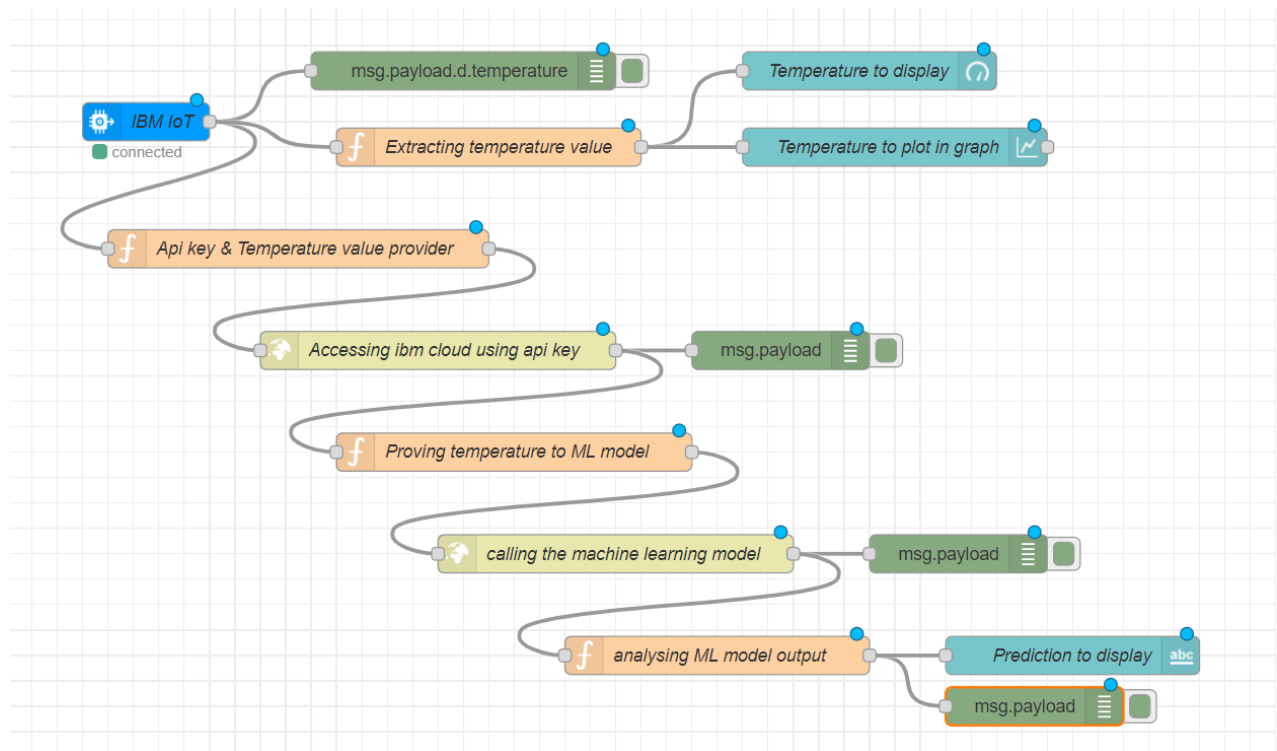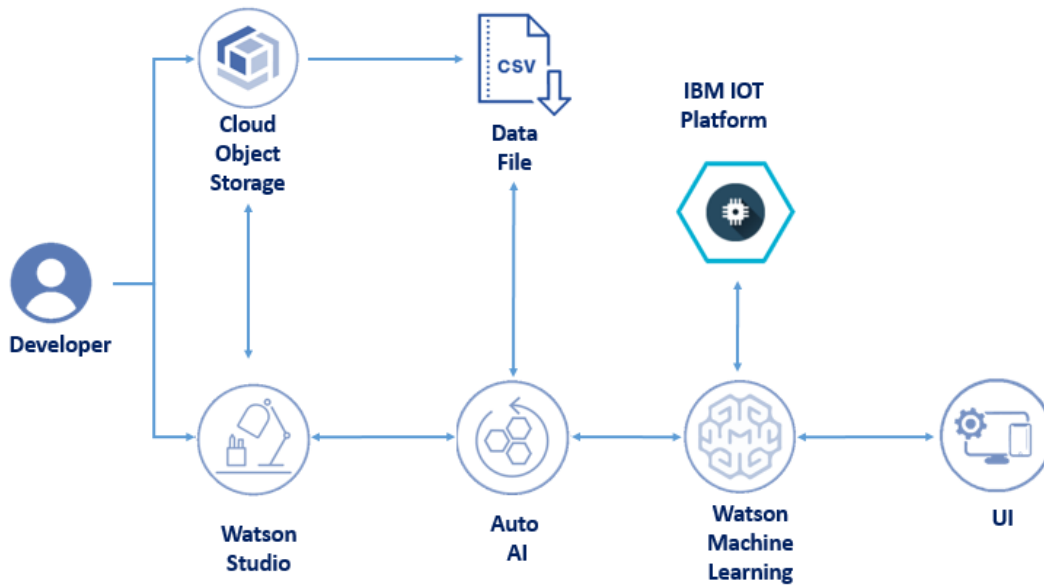
3.2 Hardware and software designing

For this project where mostly using the IBM cloud services. This includes IBM Watson iot service , IBM watson studio for machine learning model building and node red service for web application building. First of all we will connect the iot temperature sensor to the ibm iot service so that we will have continous temperature data avilable. For the sake of this project we will be using ibm iot simulator to simulate the temperature sensor. We have created ibm iot service, ibm watson studio services in the ibm cloud. In the ibm iot service we have created a virtual device anmed "Apnode" of type "nodemcu". Then ibm iot platform provides credentials for this device which can be used for running the simulation or for sending the simulated data to the web application.

Then we have built a machine learning model using auto ai experiment in the watson studio using machine learning instant. The model was proved with temperature datasheet which specified which temperature is normal and which is not. This datasheet was given to the machine learning model to learn and automatically create an algorithm from the available values. When is the model was completed it was deployed to the deployment space which has its own api environment which can be used by any web application by providing API keys and URL and the web application can use the machine learning model . so we are going to export this machine learning model to our node red web application by adding API key. Also we will be integrating our ibm iot service with node red weeb application so that we will recieve the temperature sensor values directly on the node red application. These values will then be provided to the machine lesrning model there itself and the model will give its prediction whether the temperature is normal or not. And the prediction will be shown on the node red web application. Furthur this prediction can be used for carrying out specific task.

4. Flowchart

```
IBM iot            Node red            Prediction
simulator          Application         display

IBM iot service    Machine            control device
                   learning           if any
                   model

Node red           Node red           Data analytics
service            dashbord for        if any
                   display
```

5. Result

After all the designing part Everything is working fine. The ibm iot simulator sent its temperature data to the ibm iot service and to the node red application. Then the node red application successfully accessed the machine learning model using the api key and http request and also recieved the prediction of the machine learning model. Thw node red application analysed the prediction and successfully displayed the prediction on the node red dashboard. Also the dashboard shows the current temperature in the form of gauge and line chart on the node red web application.

We tested the project for various values of temperature and the project is providing its intended fuction successfully.

Final project

Temperature

53
units
0   100
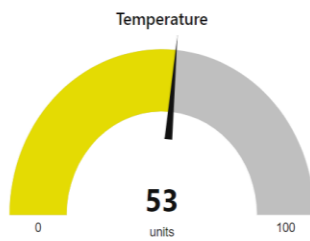
Temperature

Prediction **Temperature is beyond limits**
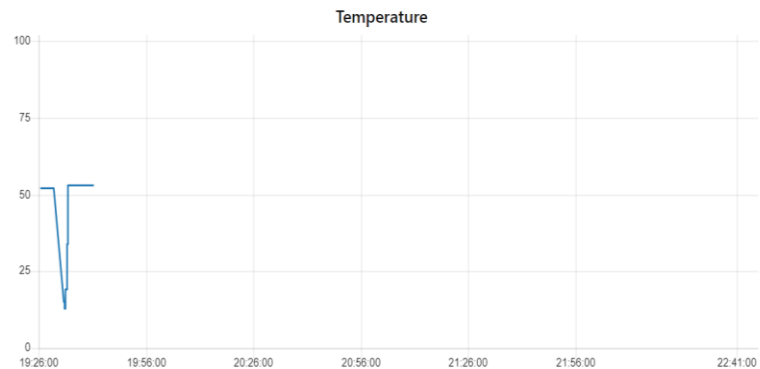
6.1 Advantages

1.No human intervention needed for decision making.

2.Handles multi dimentional and multi variety data.

3.Easily identifies trends and patterns

4.Continuous Improvement

5.Wide Applications

6.2 Disadvantages

With all those advantages to its powerfulness and popularity, Machine Learning isn't perfect. The following factors serve to limit it:

1. Data Acquisition

Machine Learning requires massive data sets to train on, and these should be inclusive/unbiased, and of good quality. There can also be times where they must wait for new data to be generated.

2. Time and Resources

ML needs enough time to let the algorithms learn and develop enough to fulfill their purpose with a considerable amount of accuracy and relevancy. It also needs massive resources to function. This can mean additional requirements of computer power for you.

3. Interpretation of Results

Another major challenge is the ability to accurately interpret results generated by the algorithms. You must also carefully choose the algorithms for your purpose.

4. High error-susceptibility

Machine Learning is autonomous but highly susceptible to errors. Suppose you train an algorithm with data sets small enough to not be inclusive. You end up with biased predictions coming from a biased training set. This leads to irrelevant advertisements being displayed to customers. In the case of ML, such blunders can set off a chain of errors that can go undetected for long periods of time. And when they do get noticed, it takes quite some time to recognize the source of the issue, and even longer to correct it.

7. Applications

1.Contol and monitor hosehold energy consumption based on interrnal temperature.

2. Fire avoiding at workplace or any industry

3.Cold storage temp monitoring and analysis

4. Weather prediction

5.Solar power generation prediction.

8. Conclusion:

We have presented an approach combining the iot and machine learning mechanism to predict the normalcy of temperature inside working environment or house. The prediction of temperature automatically avoids any safety hazards possible due to overheating or any system malfuctions due to temperature overshoot or undershoots. It allows the user to set the desired normal temperature range on his own or the machine learning model learns user choices of temperature and sets to that temperature automatically.

9. Future scope

In future this project can be extended to trigger an alarm if the temperature goes beyond specified limits which will alert the user. Also it can be used to control the temperature controllers automatically and maintain the temperature within limits.

10. Bibilography

https://cloud.ibm.com/docs

https://nodered.org/docs/

https://nodered.org/