SMART AGRICULTURE SYSTEM BASED ON IOT

by

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A project report submitted to

SMARTINTERNZ

in partial fulfilment of the requirements for the internship titlte

Smart Agriculture system based on IoT - SB19539

MAY 2020

ABSTRACT

Farming is backbone of economy and it is the fundamental method for occupation.

Most of the cultivation cannot be productive only by physical activities so have to be handled by innovative technologies. Therefore, we use IOT innovation to address this. The IOT allows the objects to be sensed or controlled for more direct integration of physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefits in addition to reduced human intervention.

Smart farming is a concept quickly catching on in the agricultural basis. Offering high-precision crop control, useful data collection, and automated farming techniques, there are clearly many advantages a networked farm has to offer. IOT modernization helps in assembly information on circumstances like climate, dampness, temperature and fruitfulness of soil.

TABLE OF CONTENTS

1. INTRODUCTION

Improving farm productivity requires crop performance to be understood and forecasted under a wide variety of environmental, soil, fertilization, and irrigation conditions. Productivity of a farm can be enhanced by determining which crop variety has produced the greatest yield under similar soil, climate, fertilization, and irrigation conditions**.** Increased crop productivity is urgently needed, and it is the cornerstone of any solution for meeting food shortage and farm profitability problems. Smart farming involves the use of the Internet of Things (IoT) related to address these challenges via the electronic monitoring of crops, as well as related environmental, soil, fertilization, and irrigation conditions. Such monitoring data can be then be analyzed to identify which crops and specific crop varieties can best meet the productivity targets of any particular farm around the world.

What is smart agriculture?

Smart agriculture technology is the use of IOT which connects devices with the sensor and performing task such as getting reading and making decision according to it .It helps in the temperature, humidity, Ph scale management.

- The farmer can also get the real time weather forecasting data by using external platforms like Open Weather API.
- Farmer is provided a mobile app using which he can monitor the temperature, humidity and soil moisture parameters along with weather forecasting details.
- Based on all the parameters he can water his crop by controlling the motors using the mobile application.
- Even if the farmer is not present near his crop he can water his crop by controlling the motors using the mobile application from anywhere.
- Here we are using the Online IOT simulator for getting the Temperature, Humidity and Soil Moisture values.

1.1 Objective

- Allows a bring-your-own IoT sensor principle , i.e., permits effortless integration and use of virtually any IoT device, including commercially available sensors, cameras, weather stations, etc. This reduces sensor installation and maintenance costs, while providing for easy upgrade to newer and more advanced sensors.
- Supports scalable data analytics that can continuously process large crop performance data.
- Offers do-it-yourself tools that allow plant farmers/growers to analyze and visualize plant performance data.

1.2 Necessity

- The project is very much useful for the farmers, organizations or individuals running plant nurseries to automatically turn the pumping motor ON and OFF on sensing the moisture content of the soil.
- The advantage of using this method is to reduce human intervention and still ensure proper irrigation.
- This project is a very low cost and an innovative system to know the desired characteristics from a remote place.

2. PROJECT REQUIREMENTS

- IOT application Development
- IOT Cloud Platform
- Python IDE
- Open Weather API

Watson, IBM- Watson Decision, an AI-based service, provides an agriculture platform that aims to improve harvests, sustainability, and quality of smart agriculture using modern technology and IoT .In this way, IBM leverages its experience, data and AI services to help the farmers make better decisions facilities and capabilities in AI, IoT, and cloud computing to create a high-tech resource that targets the complete ecosystem, from farm to fork.

Open Weather API – Open Weather provides weather and satellite data worldwide. Open Weather collects and processes raw data from a variety of sources, and gives its customers access to the data archive. These are Application Programming Interfaces that allow you to connect to large databases of **weather** forecast and historical information.

Python IDE - IDE stands for Integrated Development Environment. It's a coding tool which allows you to write, test, and debug your code in an easier way.In this project we will use python 3.8 version.

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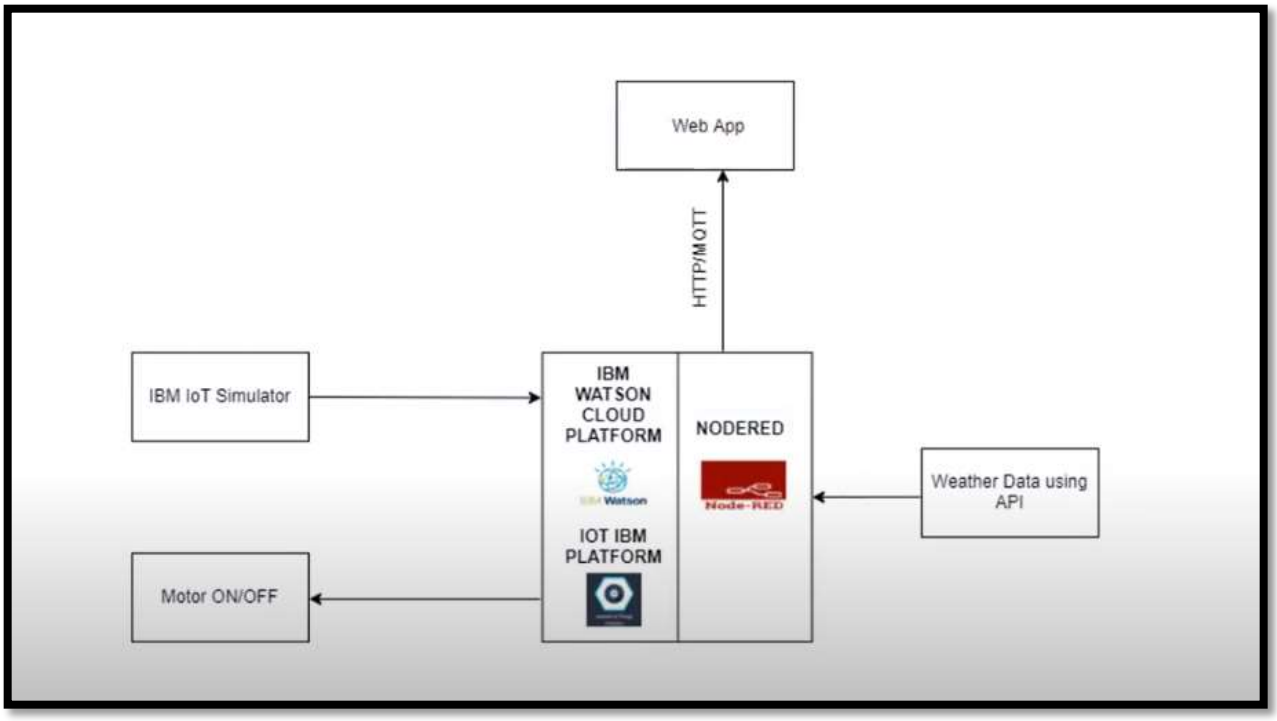
3. ARCHITECTURE



3.1 Methodology:

As seen from above diagram that instead of using hardware/electronic devices such as Arduino ,sensors or development boards here we are using an open source IBM Watson cloud to create a device/gateway which will receive the data from the IBM Iot simulator (developed by IBM which has temperature, humidity and object temperature simulator) . Now IBM Watson cloud have IBM Iot platform which will receive that data and will display it in the Web App.

In case farmer wants to know the data of the farm while physically being unavailable then for that Open Weather data using API will send the current data of that place to the node red platform.(Nodered is nothing but a web interface which will be having some prebuilt nodes developed in backend of json).

That data will also be displayed in Web App. Even if the farmer is not present near his crop he can water his crop by controlling the motors using the mobile application from anywhere by getting suitable values for temperature and humidity.
This is the basic idea behind the project.

4. IMPLEMENTATION

Below steps will provide the clear understanding of the project-

- First create the IBM cloud account.

- After that install the Nodered locally in Windows . For this download and install the latest version of Node.js from Node.js home page. Then open the command prompt and execute the following command
  npm install -g --unsafe-perm node-red to install Node-RED. Now open the url in which your server is running which will direct you to node red platform.

- Now to create a device in IBM Watson IOT Platform-

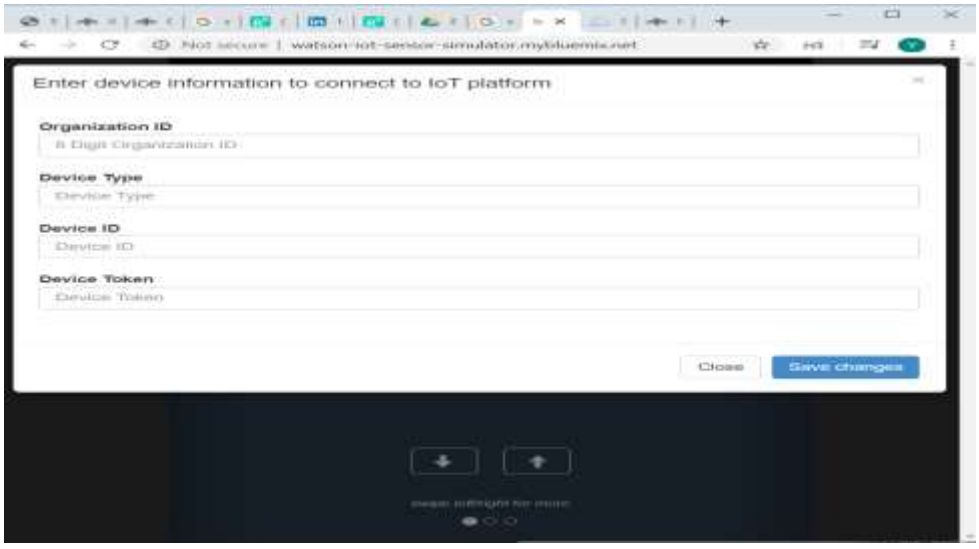
  1)Open ibm cloud account.Go to catalog and search internet of things platform then select region as London and click on create.

  2) Go to the Device Types tab and click on Add Device Type Button on top right. Enter the name of Device Type. Provide the name of the Device Type. And Click on Next. Then Add the Device Information. It is Optional. Click on Next.

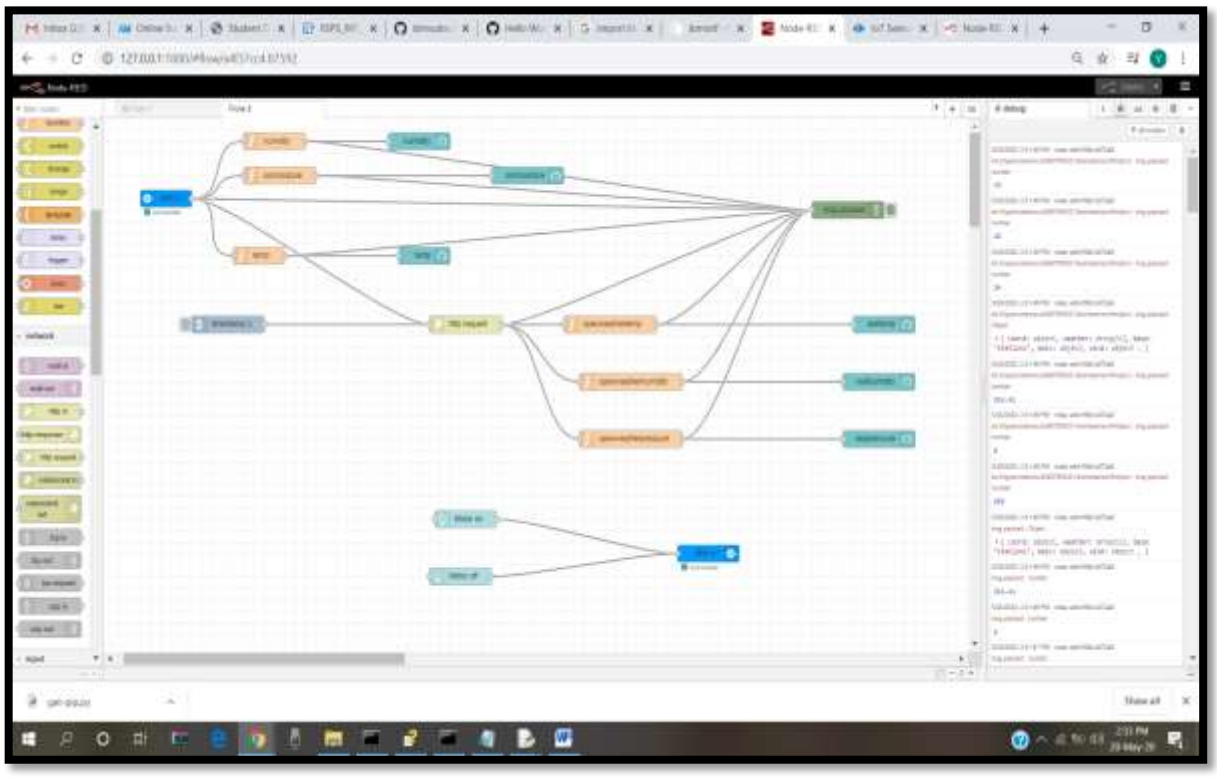
  3) Once all this is done you have registered the Device Type successfully. Now add the Device, by clicking on the "Register Devices" button. Enter any Device ID. Click on Next.

  4) Now enter your own Authentication Token. Click on Next. Click on Done.The Device credentials will be displayed just copy paste it to notepad. Device Type and Device Id created successfully.

- Connect the IOT simulator to Watson IOT platform. Open the Iot simulator, Fill the above details.(organization id is the id displayed on top right corner of nodered platform). Click save changes and simulator will be connected.



- Now make the required flow in nodered and install the required nodes in your nodered using manage pallete and by configuring it properly.



- Connect to your IBM IOT Device to get the simulator data which will be displayed in the debug section of nodered.

- Create an account in open weather API and configure your open weather API

platform. Copy the API key and destination from your platform paste it in the url **api.openweathermap.org/data/2.5/weather?q={city name}&appid={your api key}.** Then while using http request node paste this url to configure it. This will receive the weather forecasting data from open weather API using Http requests.

- Configure the nodes to display the weather parameter which we got from IOT simulator and open weather API in UI using gauge node by installing nodered-dashboard in manage pallete. Also create buttons and send command to IOT platform using button node in dashboard and by configuring it. Web ui can be opened by entering the odered platform url and then adding/ui into it.

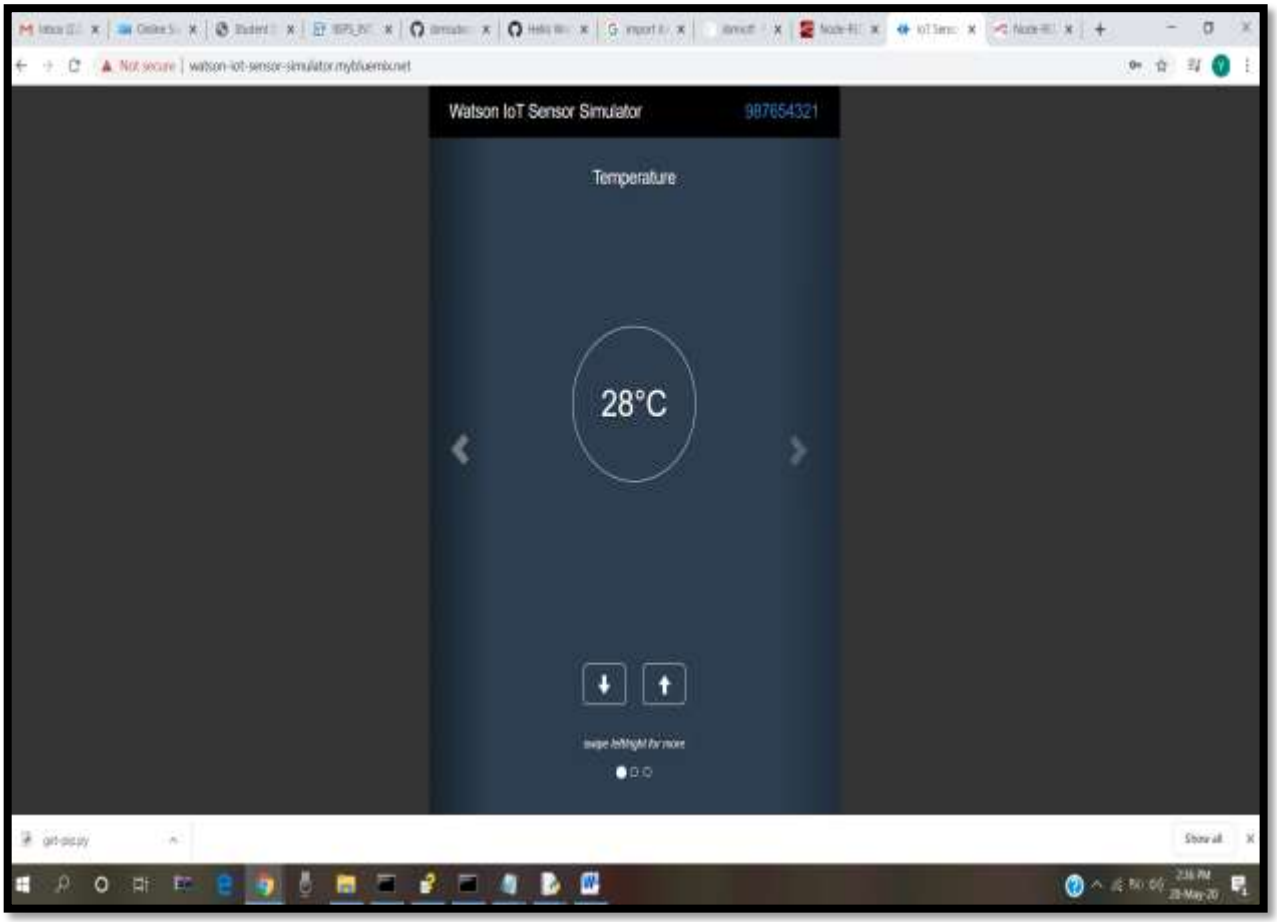
- Install python ide. Import ibmiotf application and then write the desired code by using device credentials to receive motor on/off commands.

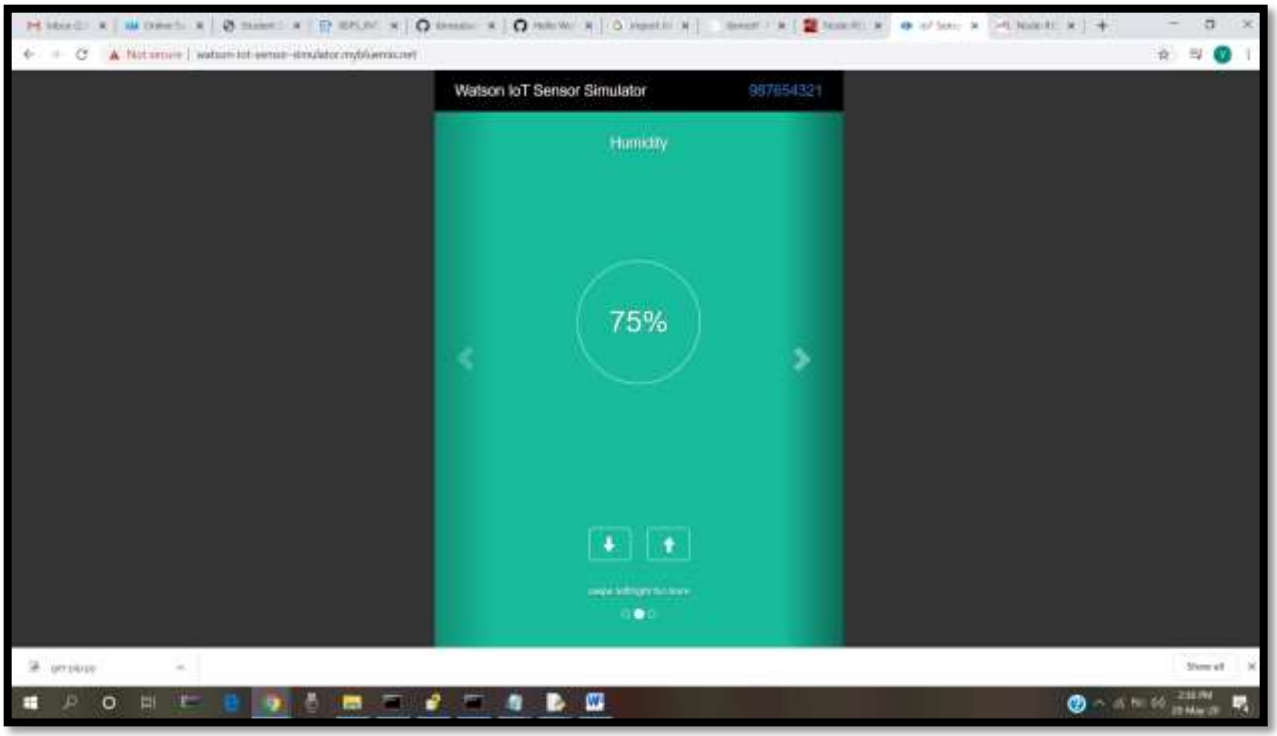
Additional things to do:

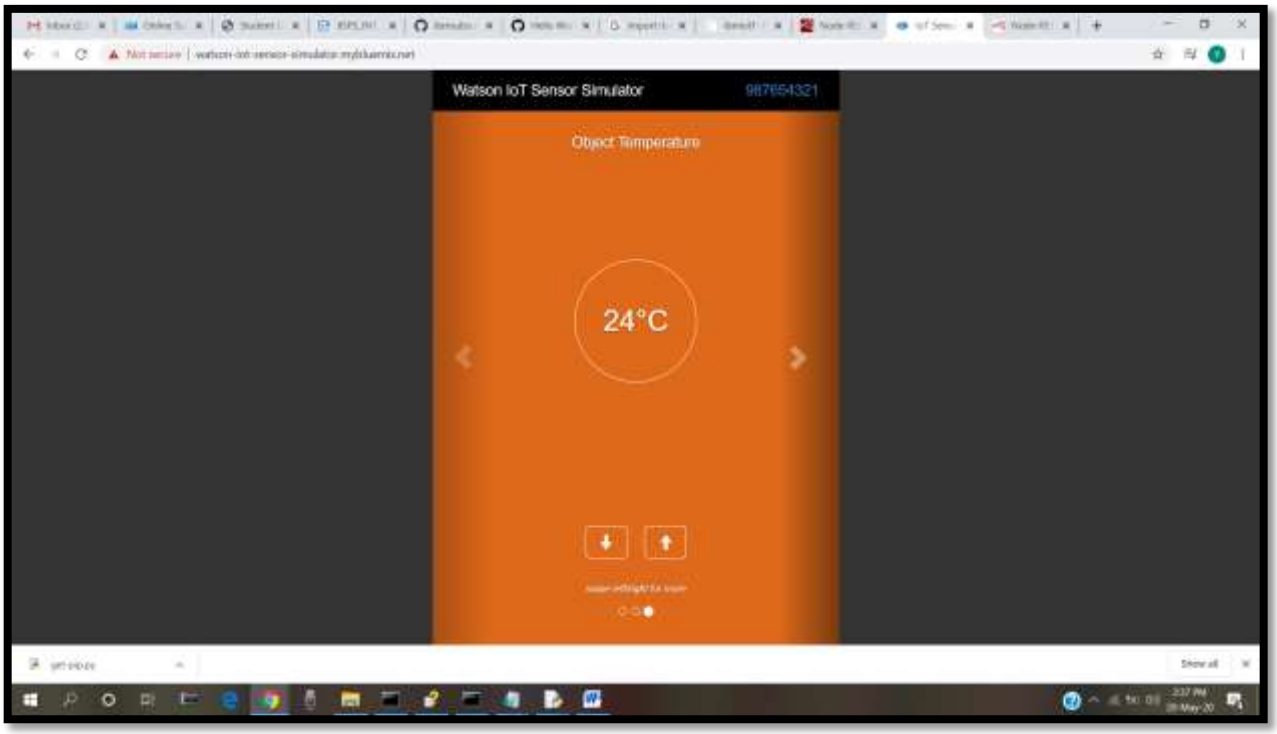
- We can run the simulation in iot platform to get the random values regarding other information.
- Also in the board section we can create a chart and display the values received from iot sensor.

5. Evaluation results

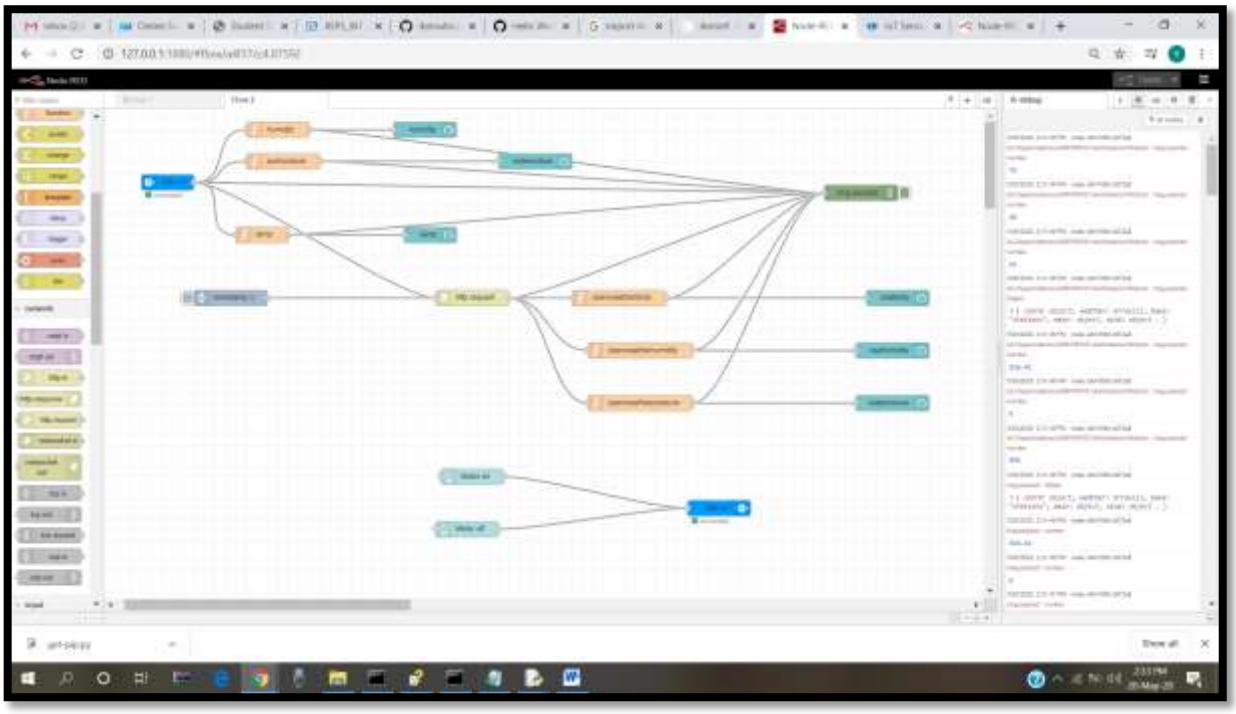
Watson IOT sensor simulator



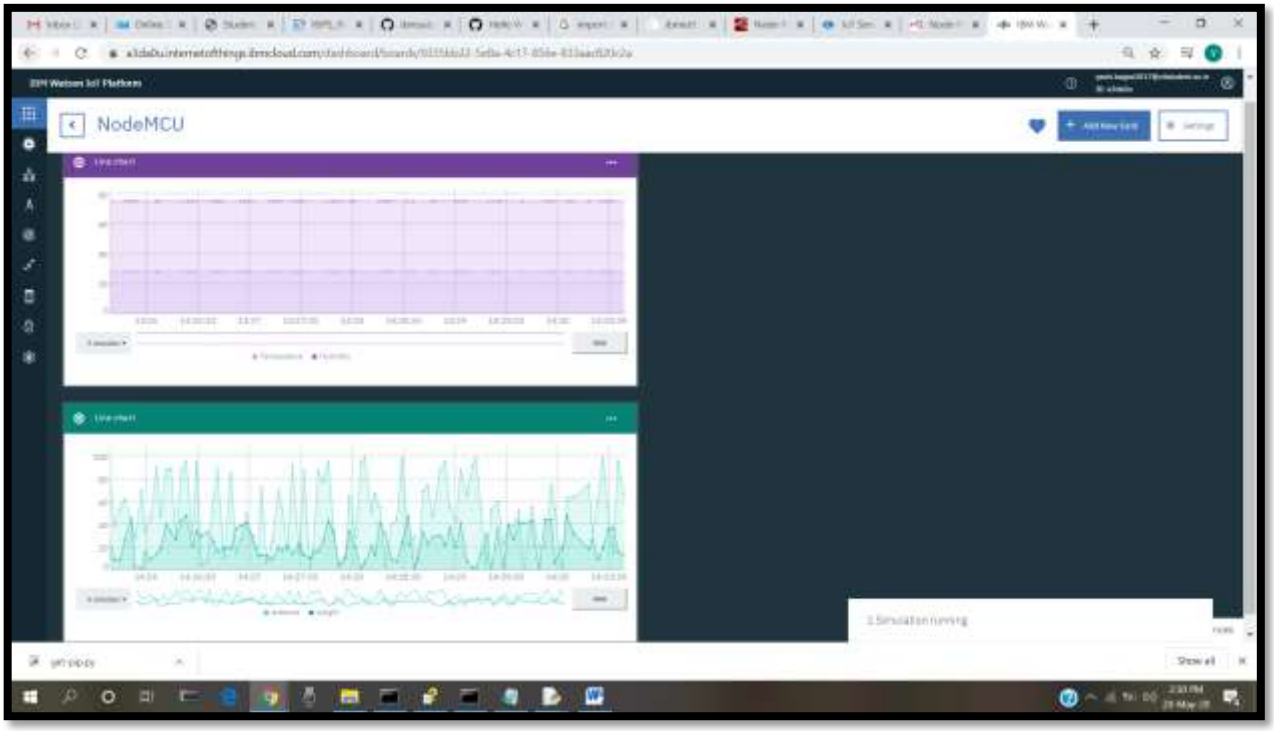

Watson IoT Sensor Simulator
987654321
Humidity
75%


Watson IoT Sensor Simulator
987654321
Object Temperature
24°C

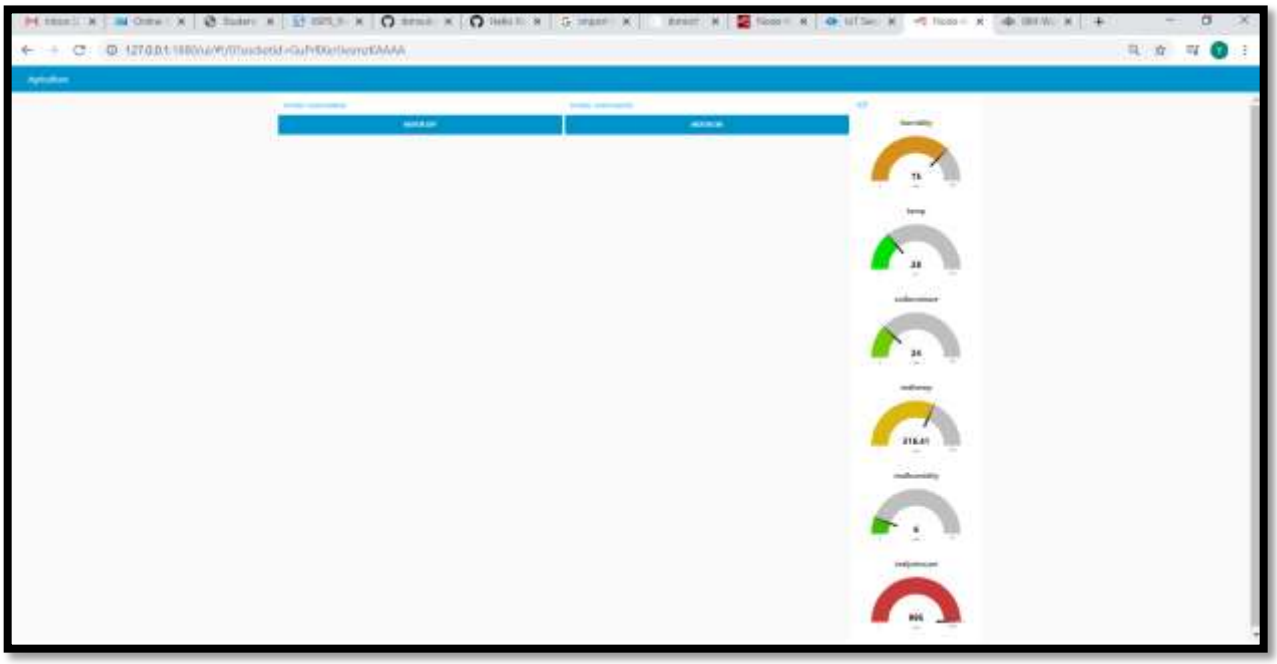
Nodered Flow:



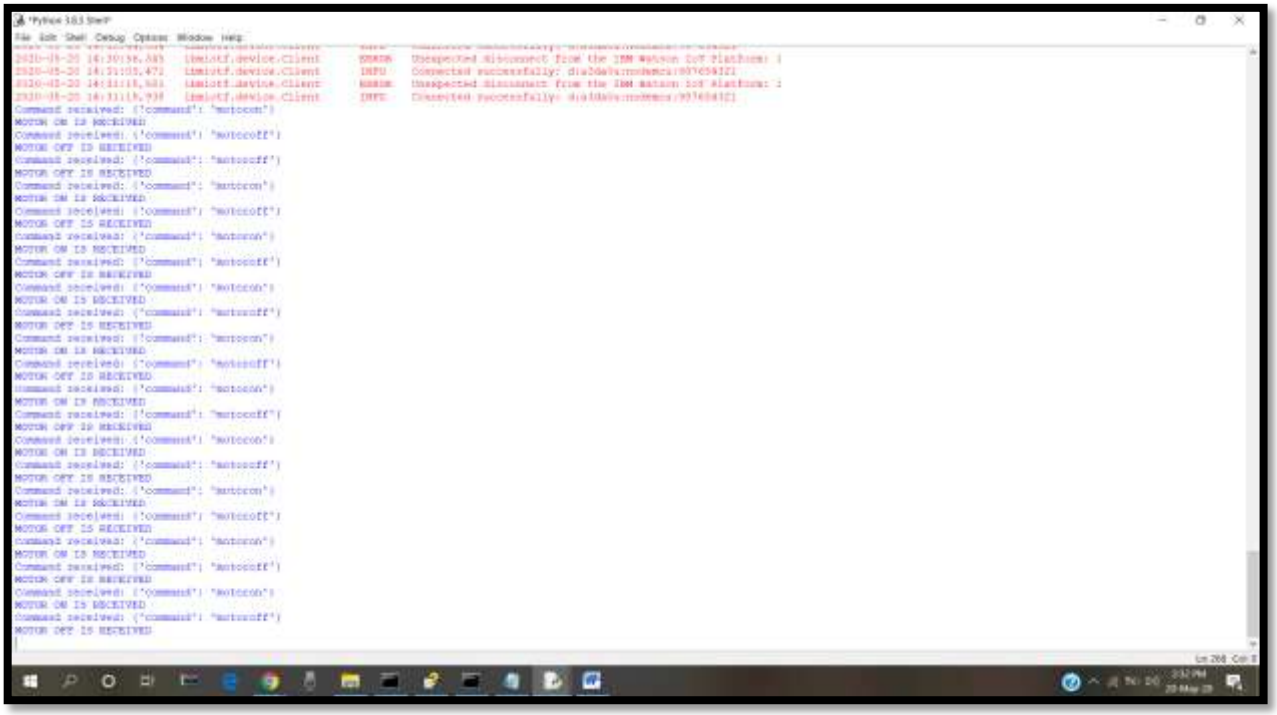
Graph of data and simulation using board in IOT platform



Web UI displaying IOT sensor simulater values and also open weather API values with motor ON/OFF commands



Python code output:



6. Lessons Learned

Below is a summary of our experience and lessons learnt from building a system for smart farming.

Support for virtually any IoT device: The key challenge that we faced in developing the Smart FarmNet platform was managing the plethora of Internet of Things devices. Our solution was to focus on developing common interfaces (API) and consistent representation of sensors and their data using semantic web technologies and thus moving away from the traditional packaged hardware/software solutions**.**

Provide rapid analysis of data in real-time: One fundamental challenge that underpinned most IoT platforms was in their ability to perform fast analysis of data over a large number of sensor data streams. By employing real-time statistical data analysis, the SmartFarmNet platform was able to achieve this objective.

Do-it-yourself approach for visualisation and analysis of data: The design objective of SmartFarmNet was to empower its users by providing standard tools combined with a flexible and powerful API. By employing a do-it-yourself approach, SmartFarmNet has reached a wider set of users and enabled them to collect crop performance data with any sensor(s). The ability for a farmer to explore and analyse crop growth data using simple selection based on familiar concepts such as crop phenotype, treatment, etc., was very useful in breaking many barriers to the SmartFarmNet uptake.

7. Conclusion

In this project, we presented SmartAgriculture, a pioneering effort in building a scalable sensor data acquisition, analysis, and visualization platform for smart farming applications, based on the Internet of Things. We presented the architectural design of the platform that aims to support virtually any IoT devices, allow rapid ingestion and visualization of IoT data using IBM IOT Cloud and provide a virtual laboratory environment for visualization and sharing of study data. The proposed SmartAgriculture uses a unique and novel real-time statistical analysis approach that enables near real-time responses to user queries.

Through evaluation using actual farming data, we validated the elasticity and scalability of the platform.

8. References

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