IOT Based Smart Agriculture Automation System

Abstract: Agriculture have a vital role in the development of a country, it has been discovered in recent studies and surveys that we need to increase our food production to 2x times. As the development in the agricultural field has been immobile over the past few years thus it is required to contrivance new technologies in this field to boost food production. This system presents a smart farming technique in a limited area by using sensor nodes like temperature & humidity sensor, weather apis, climate monitoring sensor and soil moisture sensor. This system is developed in such a way to keep the cost minimal and provide a simple basic platform to monitor the parameters for growth of crops through the internet using IOT. The aim of this paper is to make people understand the use of evolving IOT network and smart agriculture system using automation. All of this is installed using an Internet of Things framework. In this IoT based smart agriculture, a system is created to monitor the farmland and fields with the help of sensors, which senses components like temperature, weather, light, humidity, soil moisture, etc., then, automate the irrigation system and allow farmers to monitor their field conditions from anywhere, anytime through IoT Platform.

OVERVIEW

This system allows the user viz. a farmer to analyse the data collected from the sensors on his/her farm and access the data from anywhere in the world using IBM Cloud services and also get Real-time weather data of the location of the farm. The motors can be controlled directly from the web UI thus allowing the farmer to take care of the farm from anywhere at anytime, provided an internet connection. Food is one of the three basic essential human needs and the farmers needs to meet the demand for food. However, as the world's population grows, the agricultural industry is confronted with numerous challenges. Changes in weather and the environment also have a significant effect on the agriculture industry. The industry has turned to technology to boost productivity to meet the growing food demand. Thus this system provides an overall solution to the problems faced by farmers in their day to day lives.

PURPOSE

In this IOT based smart agriculture, a system is formed to monitor the fields with the help of sensors, which senses weather components like temperature, light, humidity, soil moisture, etc. Then, automate the irrigation system and allow farmers to monitor their field conditions from anywhere through IoT Analytics Platform. Using this system farmers can monitor their farms and agriculture activities from anywhere in the world. Smart farming based on IoT technologies enables **growers and farmers to reduce waste and enhance productivity ranging from the quantity of fertilizer utilized** to the number of journeys the farm vehicles have made, and enabling efficient utilization of resources such as water, electricity, etc.

LITERATURE SURVEY

EXISTING PROBLEMS:

High Hardware Costs

Presently, farmers rely on a sparsely distributed network of sensors to gather data on farm conditions. In addition to the physical constraints of these sensors, they are expensive. As a result, farmers continue relying on less advanced farming technologies which limits their productivity.

Limited resources and time

The role of IoT in agriculture is very important, though the integration of smart technology in this area takes place in the context of a constantly changing environment and lack of time. New technologies and ideas should be proposed to increase the efficiency of the existing systems.

Design and durability

Any IoT system used in agriculture should be able to handle not only connectivity, but the conditions of outdoor spaces. The design should be done including all the intruments and equipments required for the functioning of the agriculture system. The system should be capable of overcoming all the harsh conditions (including weather and climate change).

PROPOSED SOLUTIONS

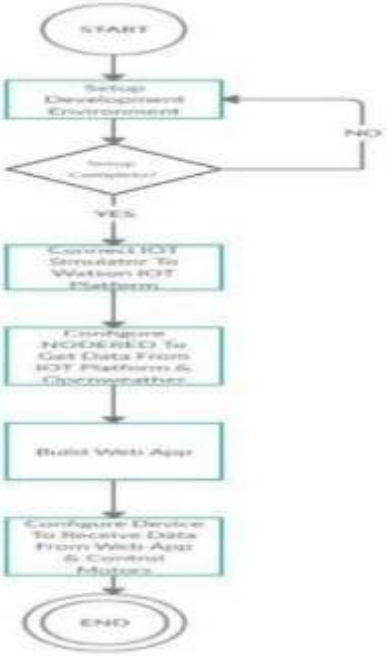
This IOT model solves the problems mentioned above.

1. It is cost effective, farmers don't need huge amount of money to establish this system as it is affordable and handy. They just need a system and an internet connection to monitor their farms from anywhere and anytime.

2. It hardly took me few days to create this model and hence it is time saving and requires limited resources to meet the requirements of the farmers. On the bright side, in response to these conditions, this progressive project emerge. It includes new resources and technologies which can save the time and bring fruitful results.

3. It doesn't consist of complicated designs and structures, you just need the basic knowledge of node red and you are good to go. It includes all the necessary designing and intruments to increase the durability of the system and to overcome all the existing problems.

Flow Chart



HARDWARE AND SOFTWARE DESIGNING-

1. NODE-RED:

Node-RED is a programming tool for wiring together hardware devices, APIs and online services. Primarily, it is a visual tool designed for the Internet of Things, but it can also be used for other applications to very quickly assemble flows of various services. Node-RED is a visual programming tool aimed at connecting hardware devices, APIs and online services in alternative ways, without the need for traditional programming experience. The software provides a browser-based editor that makes it easy to wire together flows using the wide range of nodes in the palette that can be deployed to its run-time in a single-click.

2. WATSON IOT SENSOR SIMULATOR:

The IBM Watson Internet of Things Platform contains a device simulator that can be used to post data without a real device being connected. This includes temperature, humidity and object temperature. IBM Watson IoT Platform is **a managed, cloud-hosted service designed to make it simple to derive value from your Internet of Things devices**. STMicroelectronics is an IBM Partner and provides development platforms allowing users to develop applications with direct connection to the IBM Watson IoT platform.

3. IBM CLOUD:

The hub of the IBM IoT approach; set up and manage your connected devices so your apps can access live and historical data. Use the secure APIs of IBM Cloud to connect your apps with data from your devices. Create applications within IBM Cloud, another cloud or your own servers to interpret data. IBM Cloud is a suite of cloud computing services from IBM that offers both platform as a service (PaaS) and infrastructure as a service (IaaS). With IBM Cloud IaaS,

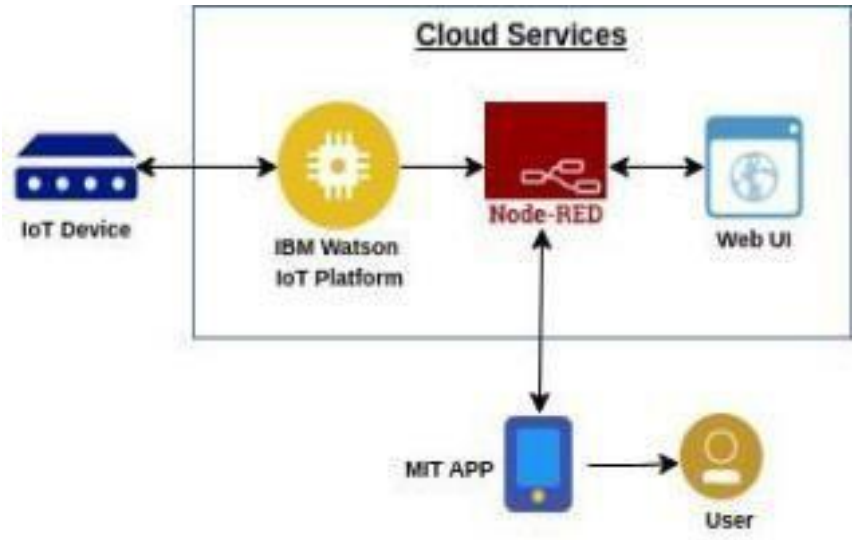
organizations can **deploy and access virtualized IT resources -- such as compute power, storage and networking -- over the internet**.

4. OPEN WEATHER MAP- WEATHER API:

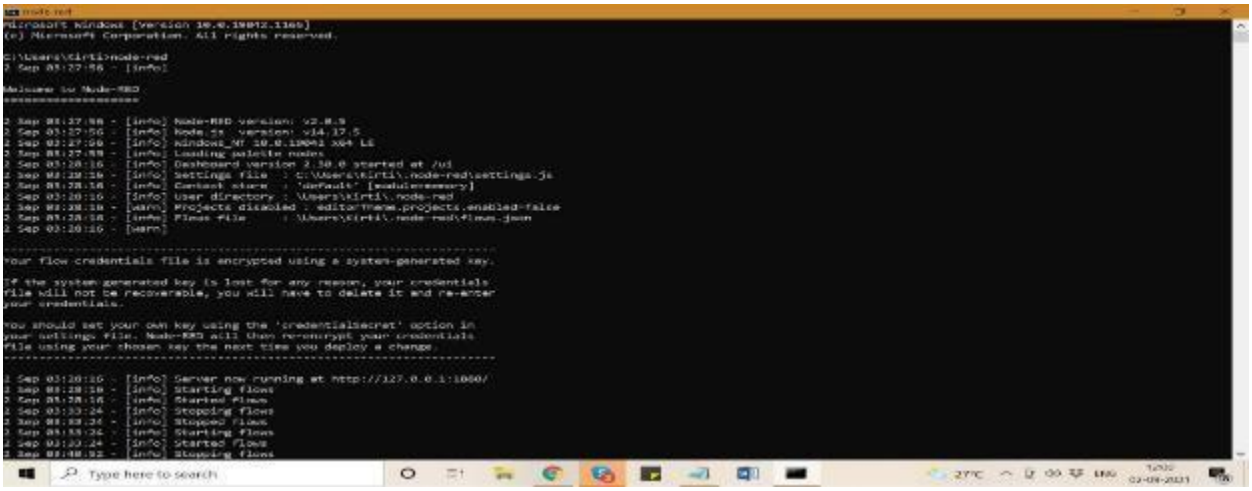
OpenWeather is a team of IT experts and data scientists that has been practising deep weather data science since 2014, for each point on the globe. **Open Weather Map** is the most famous API to get Current weather and forecasts in your city with their open API.

THEORETICAL ANALYSIS

BLOCK DIAGRAM

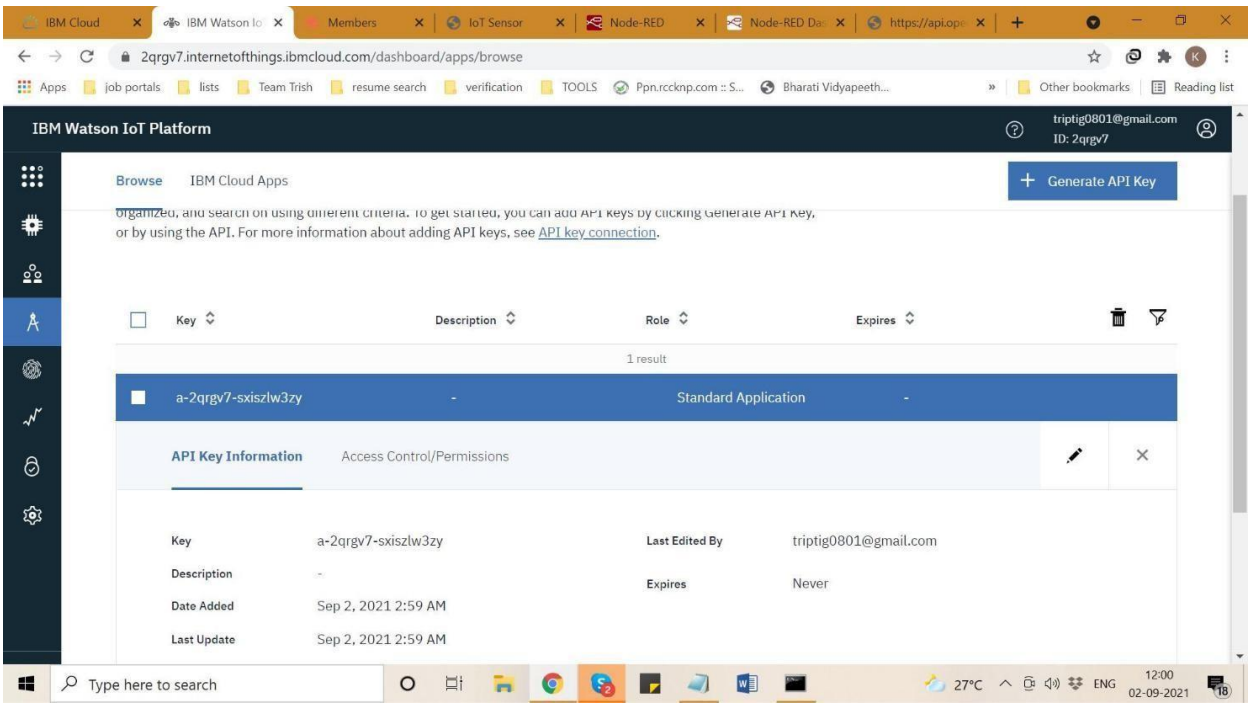


EXPERIMENTAL INVESTIGATION

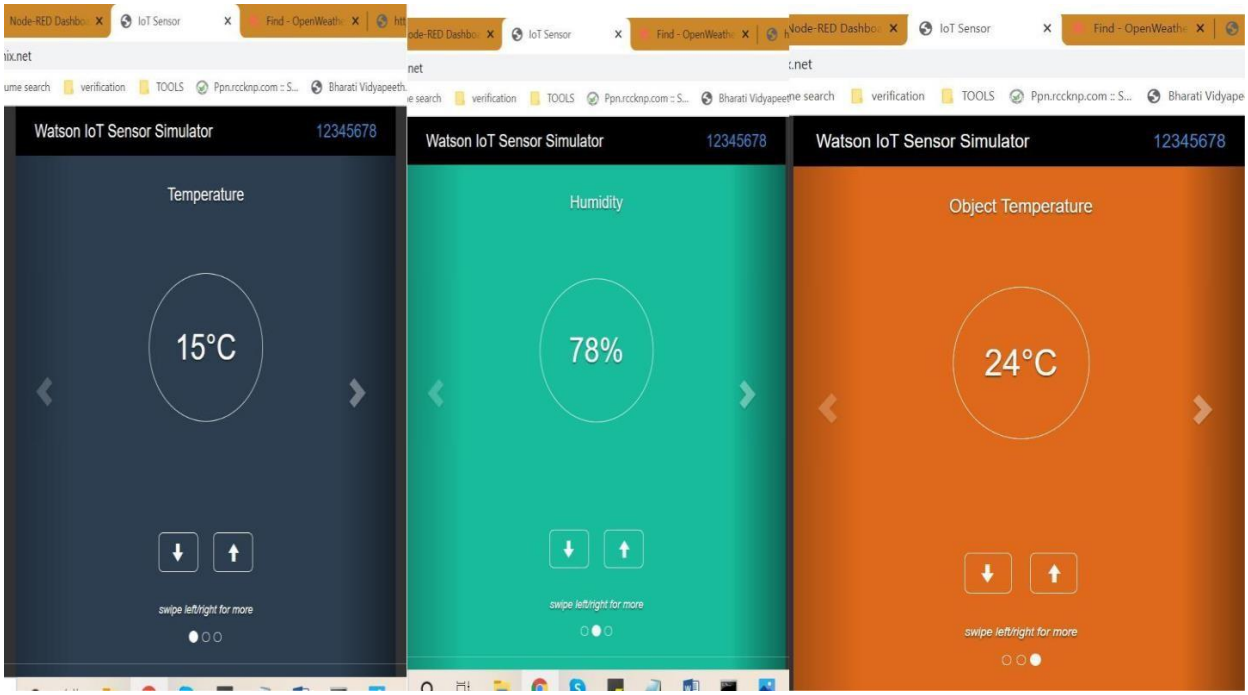


FIRST OF ALL I INSTALLED AND RUN NODE-RED IN MY SYSTEM.

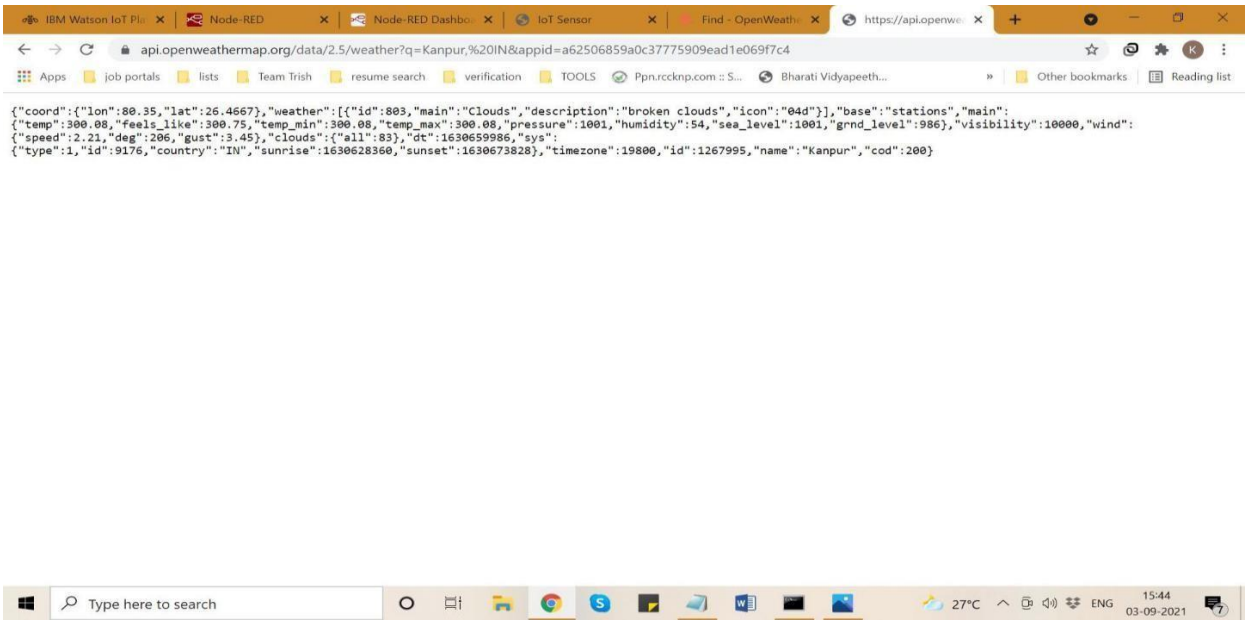
Node-RED is a visual programming tool aimed at connecting hardware devices, APIs and online services in alternative ways, without the need for traditional programming experience. The software provides a browser-based editor that makes it easy to wire together flows using the wide range of nodes in the palette that can be deployed to its run-time in a single-click.Although the concept of flows, nodes & palettes may sound unfamiliar, Node-RED makes programming simple by using a visual representation of code in blocks with lines between them.



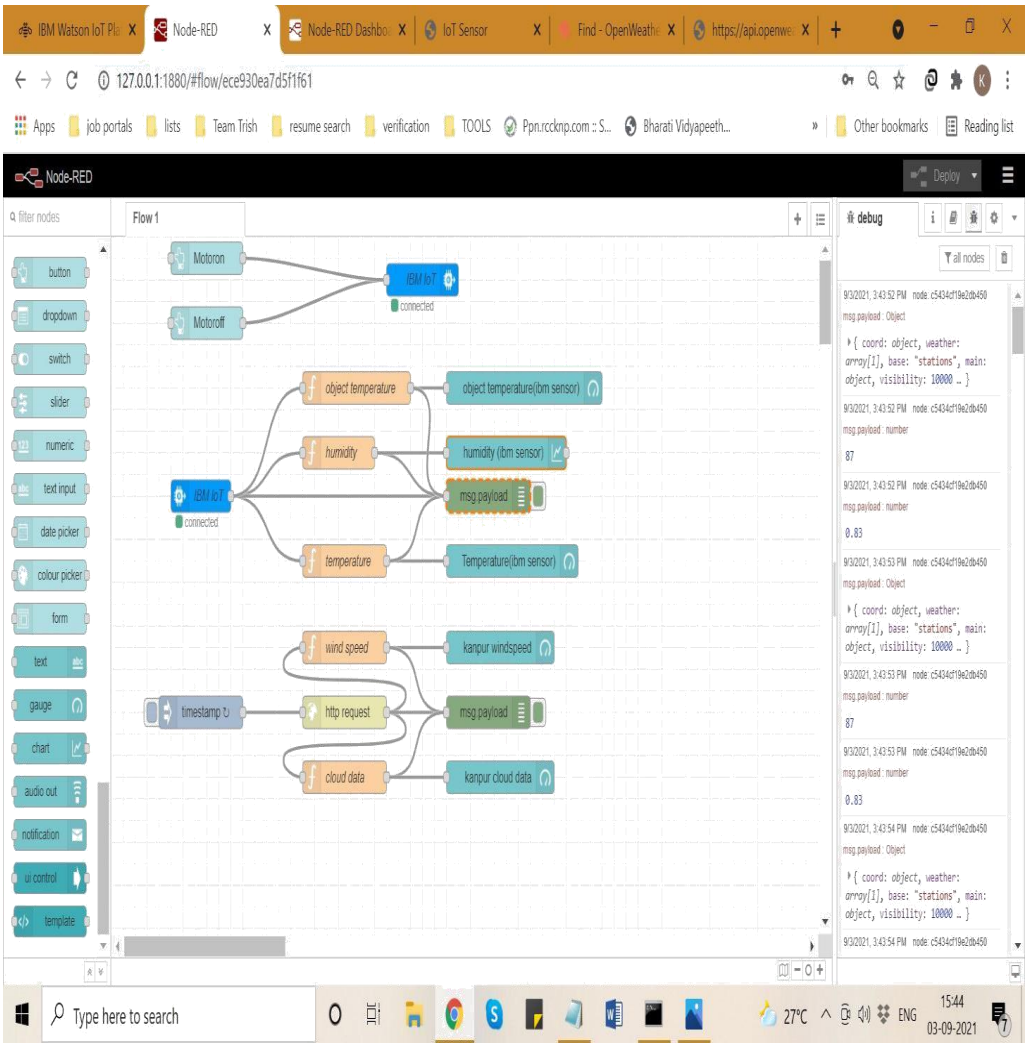
Then I logged in to ibm Watson iot platform and generated the API key for my raspberrypi device .



Later, I connected watson iot sensor simulator with my raspberrypi device using the api data to record the temperatur,humidity and object temperature .



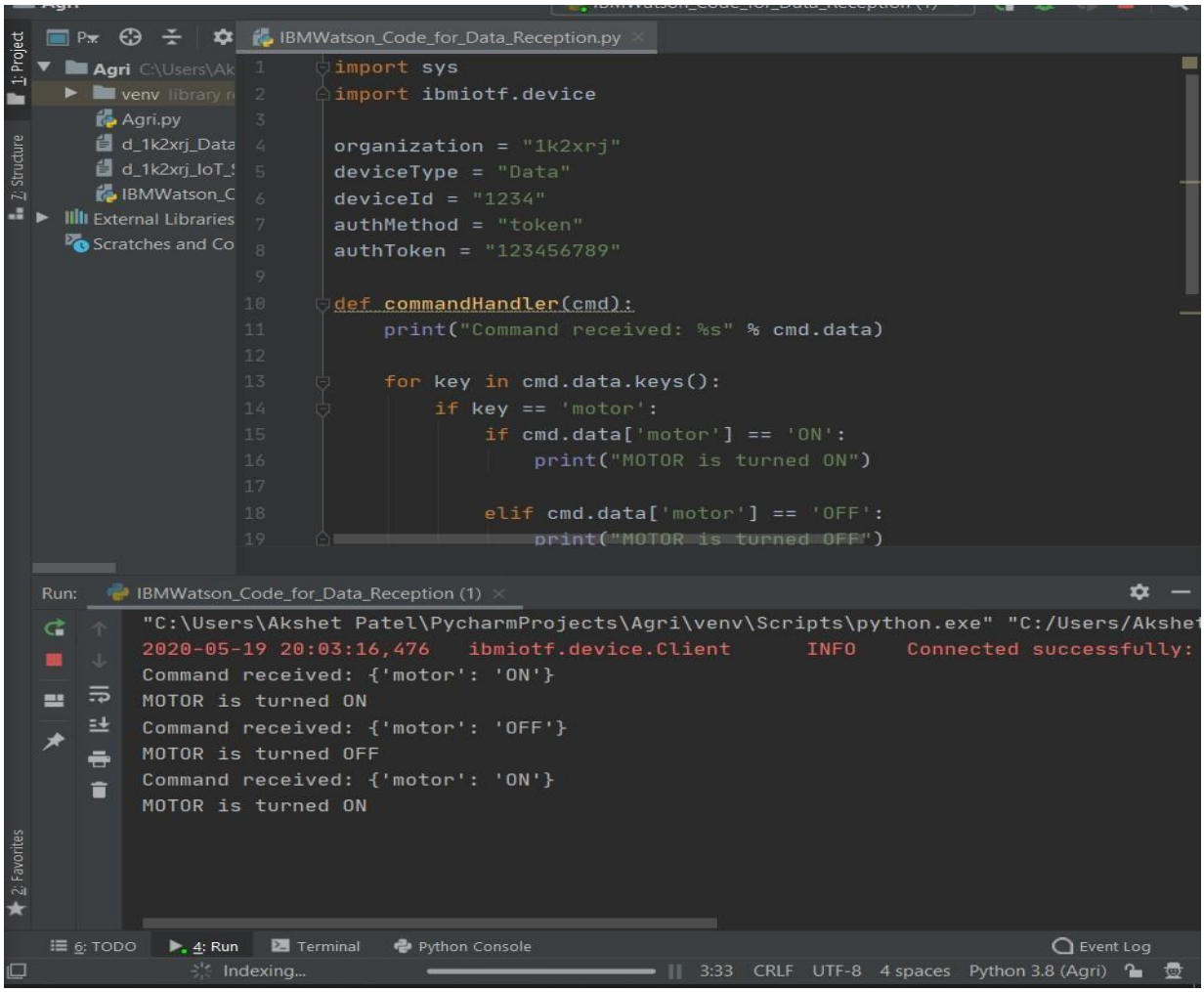
Then I logged into the open weather api application and generated the necessary weather data of my city (kanpur).



The first package you will need to install is the Node-RED dashboard, this module adds nodes which allow us to easily create a live data dashboard.

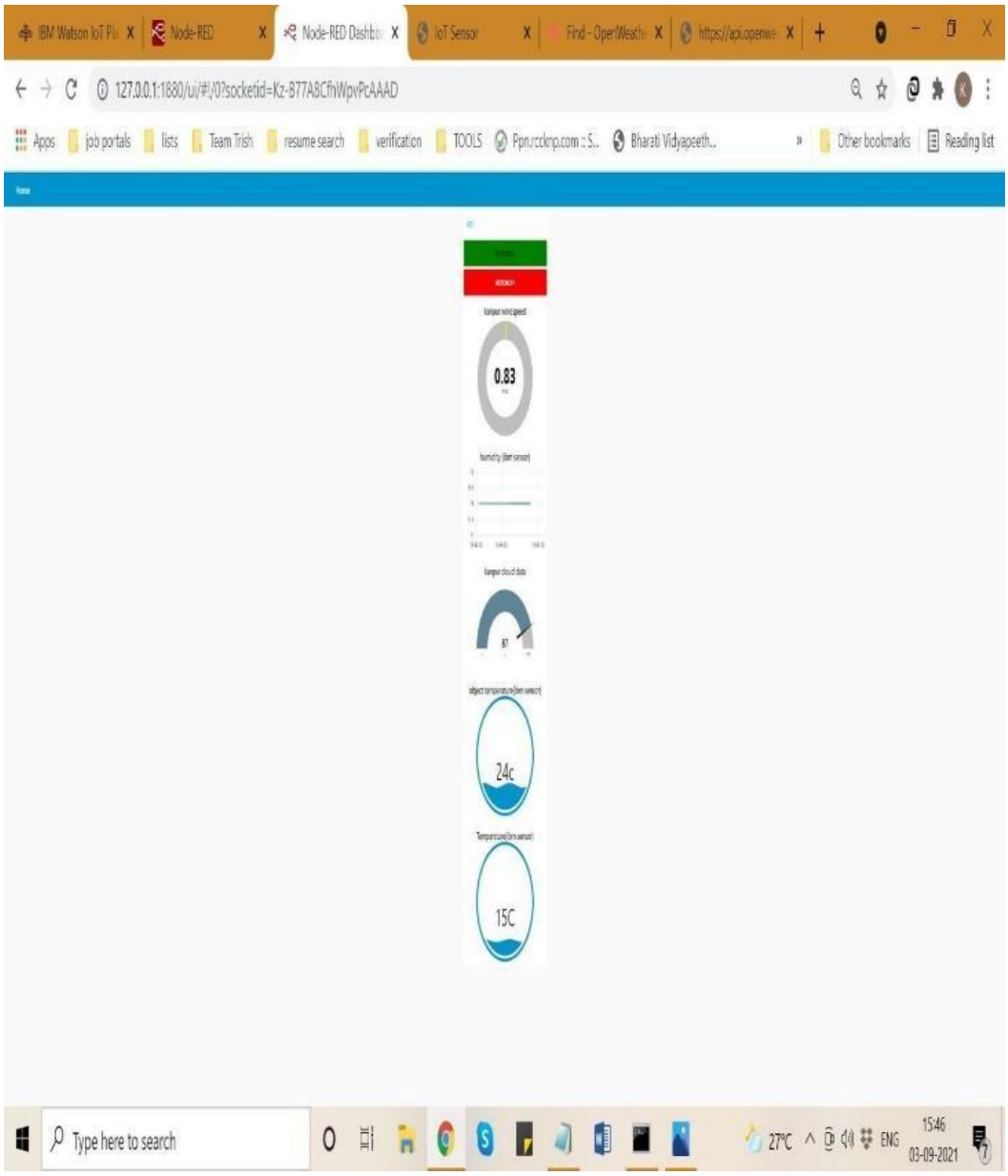
I connected all the necessary nodes in node-red pallete as shown above and entered the required codes and values in each function node to get the desired output and dashboard output.

Given below is a source code for reference of the necessary code required to switch on/off the motor.



RESULT

This is how my dashboard looks like-



ADVANTAGES-

- Increased Production.
- Water Conservation.
- Real-Time Data and Production Insight.
- Lowered Operation Costs.
- Increased Quality of Production.
- Accurate Farm and Field Evaluation.
- Improved Livestock Farming.
- Reduced Environmental Footprint**.**

DISADVANTAGES-

- The smart agriculture needs availability of internet continuously. Rural part of most of the developing countries do not fulfil this requirement. Moreover internet connection is slower.
- The smart farming based equipments require farmers to understand and learn the use of technology. This

is major challange in adopting smart agriculture farming at large scale across the countries.

APPLICATIONS-
Monitoring of climate conditions.
Crop management.
Cattle monitoring and management.
Agricultural drones.
End-to-end farm management systems.
Controling the hardware.
Motor controlling system.
The maintenance.
Supervising the farming activities.
Water control system.

CONCLUSION

The focus on smarter, better, and more efficient crop growing methodologies is required in order to meet the growing food demand of the increasing world population in the face of the ever-shrinking arable land. The development of new methods of improving crop yield and handling, one can readily see currently: technology-weaned, innovative younger people adopting farming as a profession, agriculture as a means for independence from fossil fuels, tracking the crop growth, safety and nutrition labelling, partnerships between growers, suppliers, and retailers and buyers.

IoT is beneficial because it makes our work easy and is very less time-consuming. Lets, take in to account the smartphones we use, has made our lives so easy and our a lot of work can be done in just fingertips. IoT has easied the lives of humans. Imagine a hospital connected with all the smart devices.

Due to various technological advancements and users' ability to connect technologies such as smartphones with household computers, the future of IoT is virtually limitless. Wi-Fi has allowed people and machines to communicate on land, in the air, and at sea. As we approach the Fourth Industrial Revolution, both businesses and governments must have ethics in mind (Pye, 2014). Since there will be too much data flowing from device to device, technology protection will need to expand at the same rate as bandwidth to keep up with demand. Governments would undoubtedly have to make difficult choices about how far the private sector can go in terms of robotics and data sharing. The prospects are exciting; productivity will rise, and incredible things will result from global connectivity.

FUTURE SCOPE

Smart farming based on IOT technologies enables growers and farmers to **reduce waste** and enhance productivity ranging from the quantity of fertilizer utilized to the number of journeys the farm vehicles have made, and enabling efficient utilization of resources such as water, electricity, etc.
We can create mobile application to track the activities.
We can install devices and sensors like drones and cameras to cover the full area of the farm. IoT has proved to be one of the best tools for the healthcare industry. It helps provide advanced healthcare facilities to patients, doctors, and researchers. These facilities include smart diagnosis, wearable devices for tracking health, patient management, and many more.
India's IoT investments are projected to **reach $15 billion by 2021 from** $5 billion in 2019, according to a Zinnov report, and the global IoT market is projected to grow from over $170 billion in 2017 to over $560 billion by 2022 according to a report by Markets And Markets.
A career in IoT is quite promising for those who have **innovative thinking and creative abilities** and are looking for an exciting work environment, professional development, and higher compensations that IT professionals. The Internet of Things (IoT) is a network of physical objects (or "things") that are connected with sensors, apps, and other technology to communicate and exchange data with other devices and systems over the Internet. The prospects for IoT in the future are endless. Increased network mobility, advanced artificial intelligence (AI), and the ability to deploy, automate, orchestrate, and defend complex use cases at hyper-scale would drive advancements in the industrial Internet. In this blog, we brief you on the IoT, why IoT is needed, how IoT works, the future scope of IoT in healthcare, the agriculture and automotive industry, and the IoT opportunities in the market.