SMART AGRICULTURE SYSTEM BASED ON IoT
Project Report

1. ABSTRACT

Internet of Things (IoT) technology has brought revolution to each and every field of common man's life by making everything smart and intelligent. IoT refers to a network of things which make a self-configuring network. The development of Intelligent Smart Farming IoT based devices is day by day turning the face of agriculture production by not only enhancing it but also making it cost-effective and reducing wastage. The aim / objective of this report is to propose IoT based Smart Farming System assisting farmers in getting Live Data (Temperature, Soil Moisture) for efficient environment monitoring which will enable them to increase their overall yield and quality of products. In general the smart agriculture system based on IoT is can be created in various ways using arduino, physical development boards, and sensors and actuators.

Here we are creating a Web App which can be used by any farmer in user friendly way. The farmer is able to get the live updates of weather parameters such as temperature and humidity which are considered as major factors in farming field. Through this web app they can also able to operate motor i.e they can turn on or off the motor whenever required. The farmer can operate the motor without his presence in the field. This web app provides an advantage and can be utilized for farming in this growing technology and population. The additional benifit is the farmer can take precautions based on the weather parameters.

2. INTRODUCTION

Initially we should have to know about few topics to some extent in order to get a clear idea regarding regarding the project "Smart agriculture system based on IoT". We should have to know about Internet of things, IBM cloud platform because using this platform here we are developing a Web App. Later under IBM cloud platform we have several features out of which here we are using node-red platform to build an UI(user interface) and we will be creating IoT device using IoT platform present in IBM cloud. Later we should know about the Watson simulator and its use and how it can be used and finally about the open weather API which gives the live data of city to any person remotely.

2.1 Internet of things:

Internet of things IOT consists of two words Internet and Things .The term things in IOT refers to various IOT devices having unique identities and have capabilities to perform remote sensing, actuating and live monitoring of certain sort of data. IOT devices are also enable to have live exchange of data with other connected devices and application either directly or indirectly , or collected data from other devices and process the data and send the data to various servers. The other term internet is define as Global communication Network connecting Trillions of computers across the planets enabling sharing of information .Thus the IOT can be define as :"A dynamic Global Network Infrastructure with self configuring capabilities based on standard and inter operable communication to protocol where physical and virtual things

have identities, physical attributes ,and virtual personalities and use intelligent interfaces and are seamlessly integrated into the information network ,often communicate data associated with user and their environment." An ideal IoT device consists of various interfaces for making connectivity to other devices which can either be wired or wireless.

Any IoT based device consists of following components:

• I/O interface for Sensors.

• Interface for connecting to Internet.

• Interface for Memory and Storage.

• Interface for Audio/Video.

IoT devices can be of various forms like wearable sensors, smart watches, IoT smart home monitoring, IoT intelligent transport systems, IoT smart health devices etc.

2.2 IBM cloud platform

The IBM® cloud platform combines platform as a service (PaaS) with infrastructure as a service (IaaS) to provide an integrated experience. The platform scales and supports both small development teams and organizations, and large enterprise businesses. Globally deployed across data centres around the world, the solution you build on IBM Cloud™ spins up fast and performs reliably in a tested and supported environment you can trust. The platform is built to support your needs whether it's working only in the public cloud or taking advantage of a multi-cloud deployment model. With our open-source technologies, such as Kubernetes, Red Hat OpenShift, and a full range of compute options, including virtual machines, containers, bare metal, and serverless, you have as much control and flexibility as you need to support workloads in your hybrid environment. You can deploy cloud-native apps while also ensuring workload portability. Whether you need to migrate apps to the cloud, modernize your existing apps by using cloud services, ensure data resiliency against regional failure, or leverage new paradigms and deployment topologies to innovate and build your cloud-native apps, the platform's open architecture is built to accommodate your use case.

2.3 Node-Red

Node-RED is a flow-based programming tool, originally developed by IBM's Emerging Technology Services team and now a part of the JS Foundation. Invented by J. Paul Morrison in the 1970s, flow-based programming is a way of describing an application's behaviour as a network of black-boxes, or "nodes" as they are called in Node-RED. Each node has a well-defined purpose; it is given some data, it does something with that data and then it passes that data on. The network is responsible for the flow of data between the nodes. It is a model that lends itself very well to a visual representation and makes it more accessible to a wider range of users. If someone can break down a problem into discrete steps they can look at a flow and get a sense of what it is doing; without having to understand the individual lines of code within each node. Node-RED consists of a Node.js based runtime that you point a web browser at to access the flow editor. Within the browser you create your application by dragging nodes from your palette into a workspace and start to wire them together. With a single click, the application is deployed back to the runtime where it is run. The palette of nodes can be easily extended by installing new nodes created by the community and the flows you create can be easily shared as JSON files.

2.4 OpenWeatherMap API

OpenWeatherMap is one of the leading digital weather information providers. It is a small IT company, established in 2014 by a group of engineers and experts in Big Data, data processing, and satellite imagery processing. The headquarters is in the UK, office is established in the USA, and the development team in Latvia (EU).

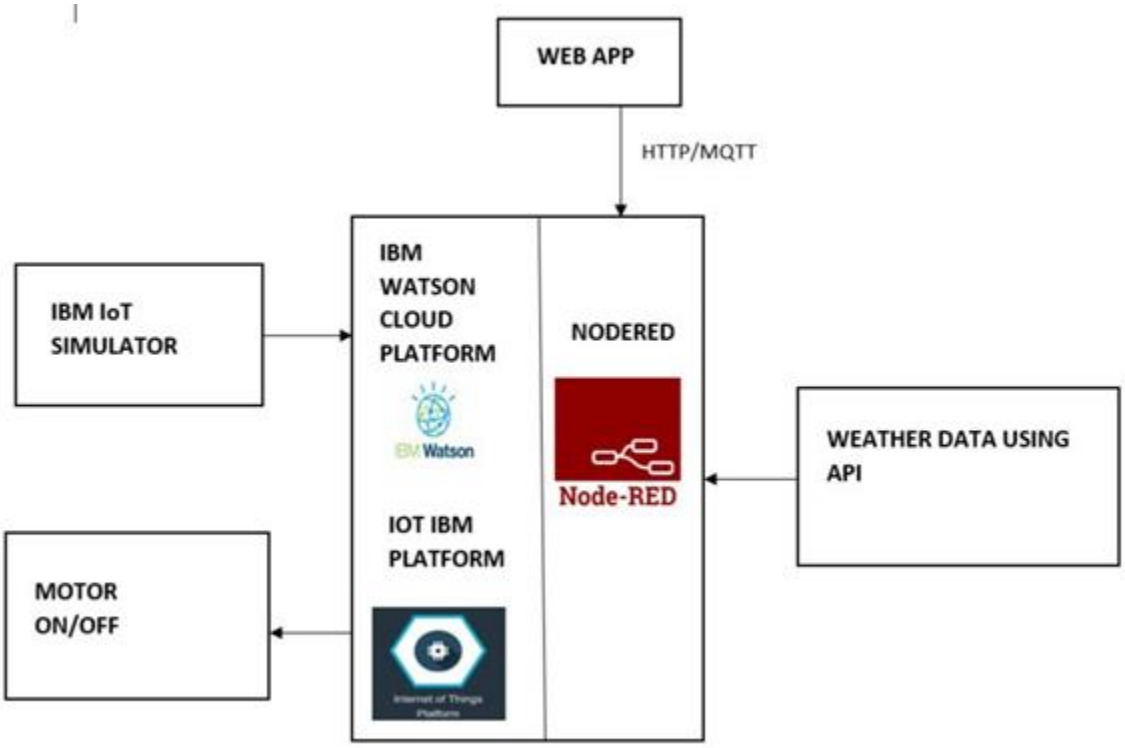
OpenWeatherMap provides the following advantages to the users

- **Weather data is open:** current weather, forecasts, maps with precipitations, wind, clouds, data from weather stations are available through APIs, maps and other products.
- **Coverage is global:** weather data is available for any geographic location.
- **Weather model:** own model of weather forecast calculation, WRF model for regions + global models.
- **Advanced technologies for a competitive price:** due to Big Data technology costs of production and support are cheap, a price for a user is affordable.

3. OVERVIEW OF PROJECT

IoT based SMART FARMING SYSTEM is regarded as IoT gadget focusing on Live Monitoring of Environmental data in terms of Temperature, Moisture and other types depending on the sensors integrated with it. The system provides the concept of "Plug & Sense" in which farmers can directly implement smart farming by as such putting the System on the field and getting Live Data feeds on various devices like Smart Phones, Tablets etc. and the data generated via sensors can be easily shared and viewed by agriculture consultants anywhere remotely via Cloud Computing technology integration. The system also enables analysis of various sorts of data via Big Data Analytics from time to time.

3.1 Block diagram

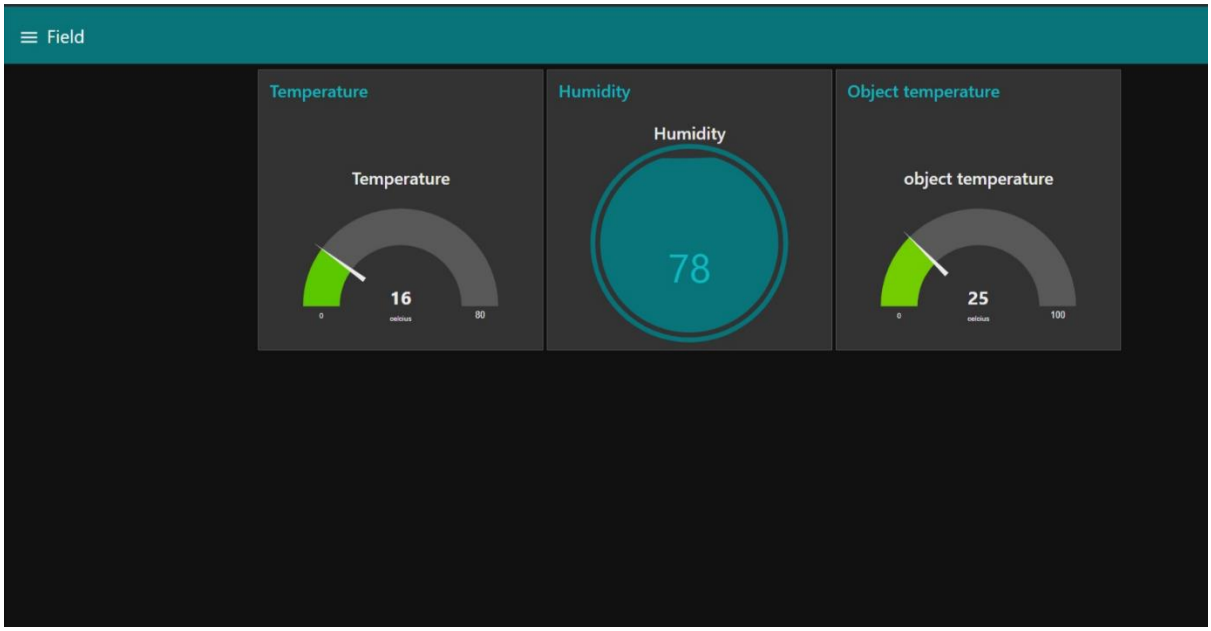


In the above block diagram can be taken as a reference in order to complete the project. Here it can be explained as initially we will be creating a device using IoT IBM platform and device credentials is to be saved for the further use, later we will connect the device to Watson IoT simulator using the device credentials. Now we should have to install the required IBM IoT node in our node-red flow later on we should have to configures the nodes in such a way that we should have to get the simulator data in the UI which has been created. The next step to be followed is we should have to check that our device is properly connected or not in IoT platform, later we should have to create an account in OpenWeatherMaps and should have to generate API key and should have to get the weather data of any city of our preference. After getting the data, in node-red flow we should have to configure nodes and here we will be using HTTP protocol to retrieve the data. Now we are ready to display simulator data and live weather data of a city. The next step to be followed is to creating buttons which are used to control the motor. The motor status command to be displayed in the UI by setting the required notes, next we will be writing a python code where it displays the motor command which is being pressed by the user.

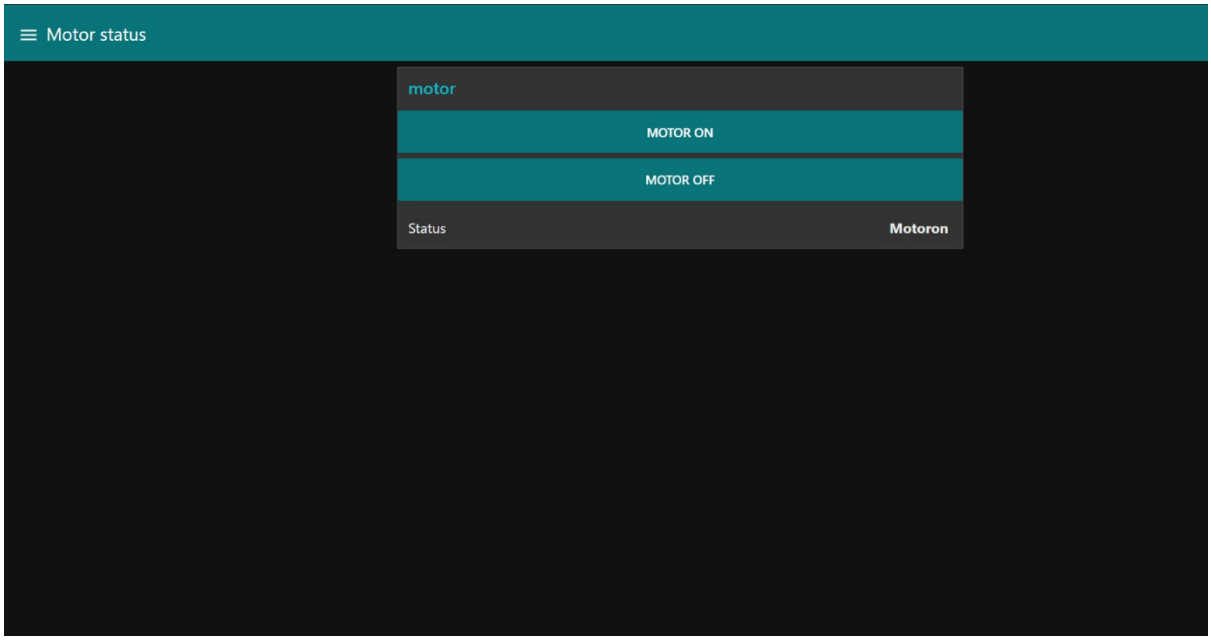
4. RESULTS

The below pictures indicate the results obtained after completing all the steps

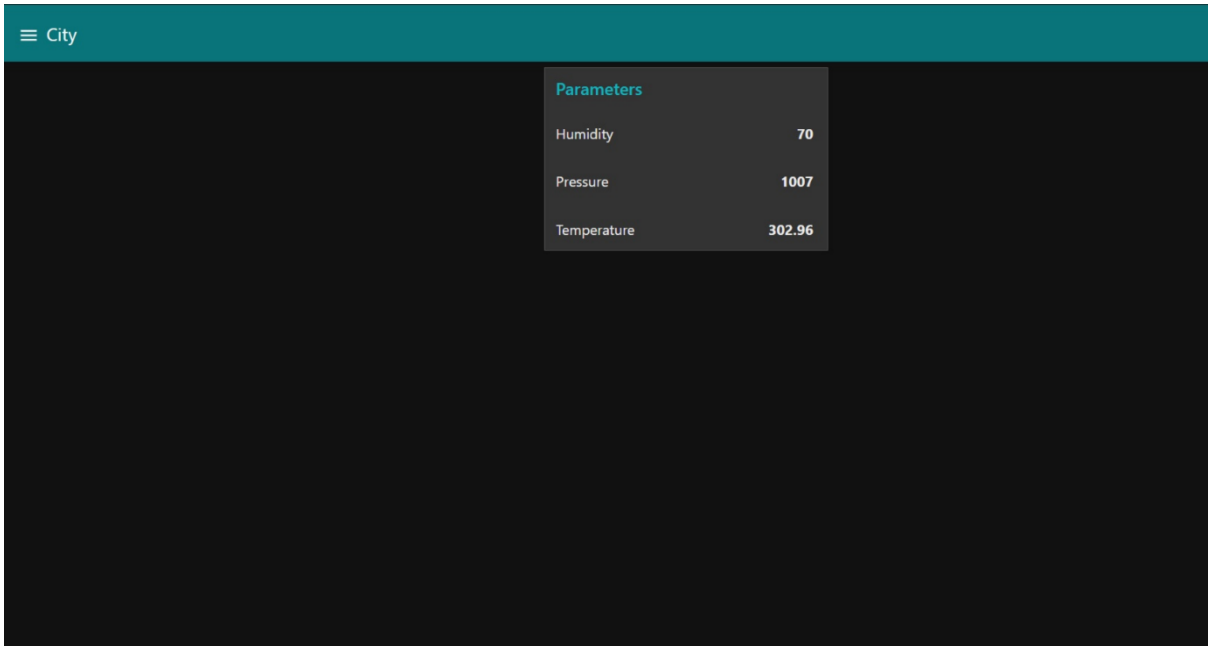
1. Below shows the details which are obtained from IoT simulator



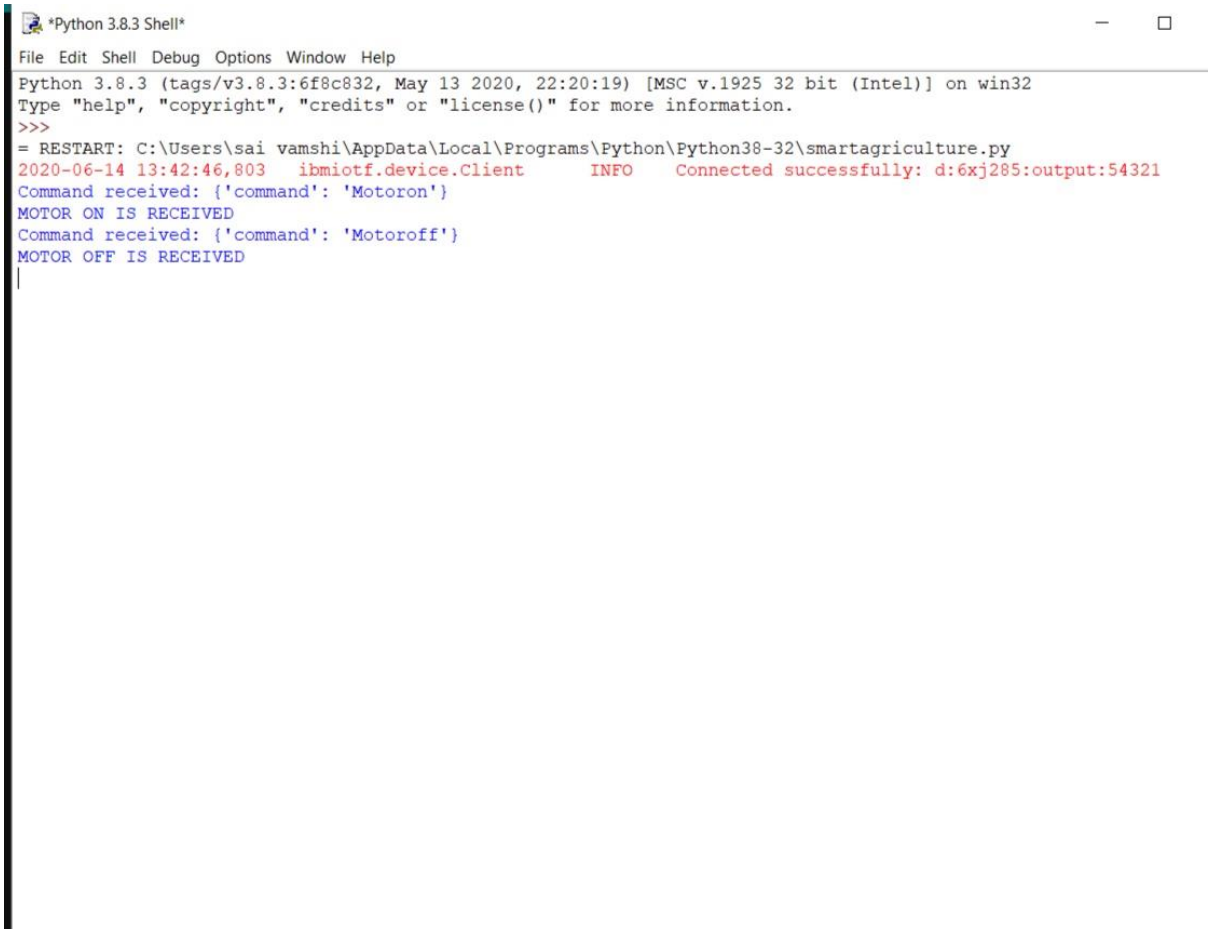
2. It displays the motor button and its status



3. The below figure shows the parameters obtained from OpenWeatherMap



4. Below shows the commands recived when we run the python code



5. CONCLUSION

IoT based SMART FARMING SYSTEM for Live Monitoring of Temperature and Humidity has been proposed using Cloud Computing . The System has high efficiency and accuracy in fetching the live data of temperature and soil moisture. The IoT based smart farming System being proposed via this report will assist farmers in increasing the agriculture yield and take efficient care of food production as the System will always provide helping hand to farmers for getting accurate live feed of environmental temperature and soil moisture with more than 99% accurate results.

6. FUTURESCOPE

Future work would be focused more on increasing other features on this system to fetch more data especially with regard to Pest Control and by also integrating GPS module in this system to enhance this Agriculture IoT Technology to full-fledged Agriculture Precision ready product. we can also add some external features like we can find the soil nutrients contents and help the farm to yield a better crop.