Project background

The world population is increasing rapidly .Providing The basic need has become a challenge.The basic requirment for any person is healthy food. But due to the increasing population, the old farming methods are providing insufficient for providing food in large scale .However ,by making use of the latest technalogies we can increase efficiency and productivity. For the purpose of increasing the efficiency and productivity of agriculture crops, an IOT based smart Agriculture monitoring project is proposed.

Project Scope:

The purpose and scope of project is developing Smart Agriculture System based on IoT can monitor soil moisture and climatic condition to grow and yield a good crops .Farmer is provided a mobile app using which he can monitor the temperature ,humidity and soil moisture parameter along with weather forecsting 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 by controilling the motors using the mobile application from anywhere.

Project schedule:

To complete thid project we are given approximately four weeks of time .
My aim is to complete the task in :

- Project planning and Kick off : Explore the IBM cloud platform : connect the IOT simulator to watson IOT platform in 1 week.
- Configure the nodered to get the data from IBM IOT platform and open weather API in 2 week.
- Building a web app in 3 week.
- Configure your device to receive the data from Web application and control your motors and also complete final reports in 4 week

Agriculture IOT

Project Name

Smart Agriculture System based on IoT

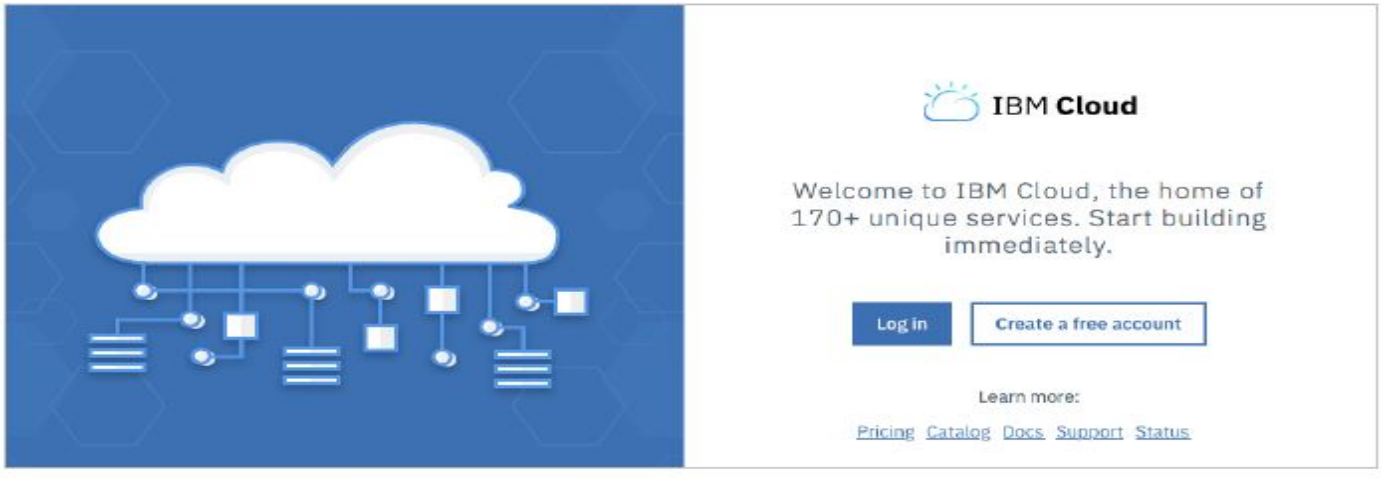
Project Manager

Durga prasad

Before Starting

This hands on required to have an IBM Cloud account.If you do't you can create one here: *https//cloud.ibm.com*

- Open a browser and access to IBM Cloud *https://www.ibm.com/cloud/get-started.*
- If you have an IBM cloud account ,click Log in, and enter your IBM ID credentials. If you don't have an IBM cloud account ,click Create a free account. Enter your email address, and additional information required .You will receive an email with activation link. Once activated, you could use your new free IBM cloud account: log in.



- If needed ,free resources (GB #services) in your IBM Cloud Organization & Spaces to run the lab exercises.
- If you encounter a resource contention (error message saying you are out of resources), clean up your spaces by deleting existing Apps or Services.

1. INTRODUCTION

Agriculture is the main backbone of Indian Economical growth.The most important barrier is that arise in tradition farming is climate change.The number of effect of climate change include heavy rainfall most intense storm and heat ,less rainfall etc, due to these productivity decreases to major extent. Climate change also raise the environmental consequence such as seasonal change in the life cycle of the plant.To boost the productivity and minimize the barrier in agricultural field there is need to use innovative technology and technique called Internet of things .The technological advances in their areas gather increasing monentum and this means that maintaining as the overview. The most important things of smat farming are environmental measurment and water managment.The reason is that the environmental measurment and water management .The reason is that the environmental and water management affect plant growth[6].

1.1. Overview

In this hands-on session ,you will create a Node-Red application in IBM Cloud to collect ,store and display virtual sensor data.

Node-Red is a flow - based programming tool, originally developed by the IBM Emerging Technology Services team (in early 2013) and now a part of JS Foundation . Traditional development can be very technical ,but Node-Red enables us to concentrate on the logic of your workflow and allows fast prototyping .

Node-Red consists of a Node.js-based runtime with a flow editor accessed through a web browser. Within the browser ,you create your application by dragging node from a customizable palatte into a workspace and start to wire them together . With a single click, the application is deployed back to its runtime.

Session Objectives are:

- Create IBM account.
- Discover Watson sevices.
- Discover Watson Iot Platform
- Create & modify an application using Node-Red in IBM Cloud.
- Discover new services & Node-Red to consume or create sevices(iot).
- Build an app to receive all details.

1.2. Purpose

The paper aims at making agriculture smart using automation and IOT technologies. The highlighing features of this paper include smart irrigation with smart control base on real time fired data. Secondly temperature maintenance ,humidity maintenance and other environmental parameters. And finally the recomondation of farmer for smart agriculture.

2. LITERATURE SURVEY (problem / solution)

The scenario of decreasing water tables, drying up of rivers and tanks unpredictable environment present an urgent need of proper utilization of water .

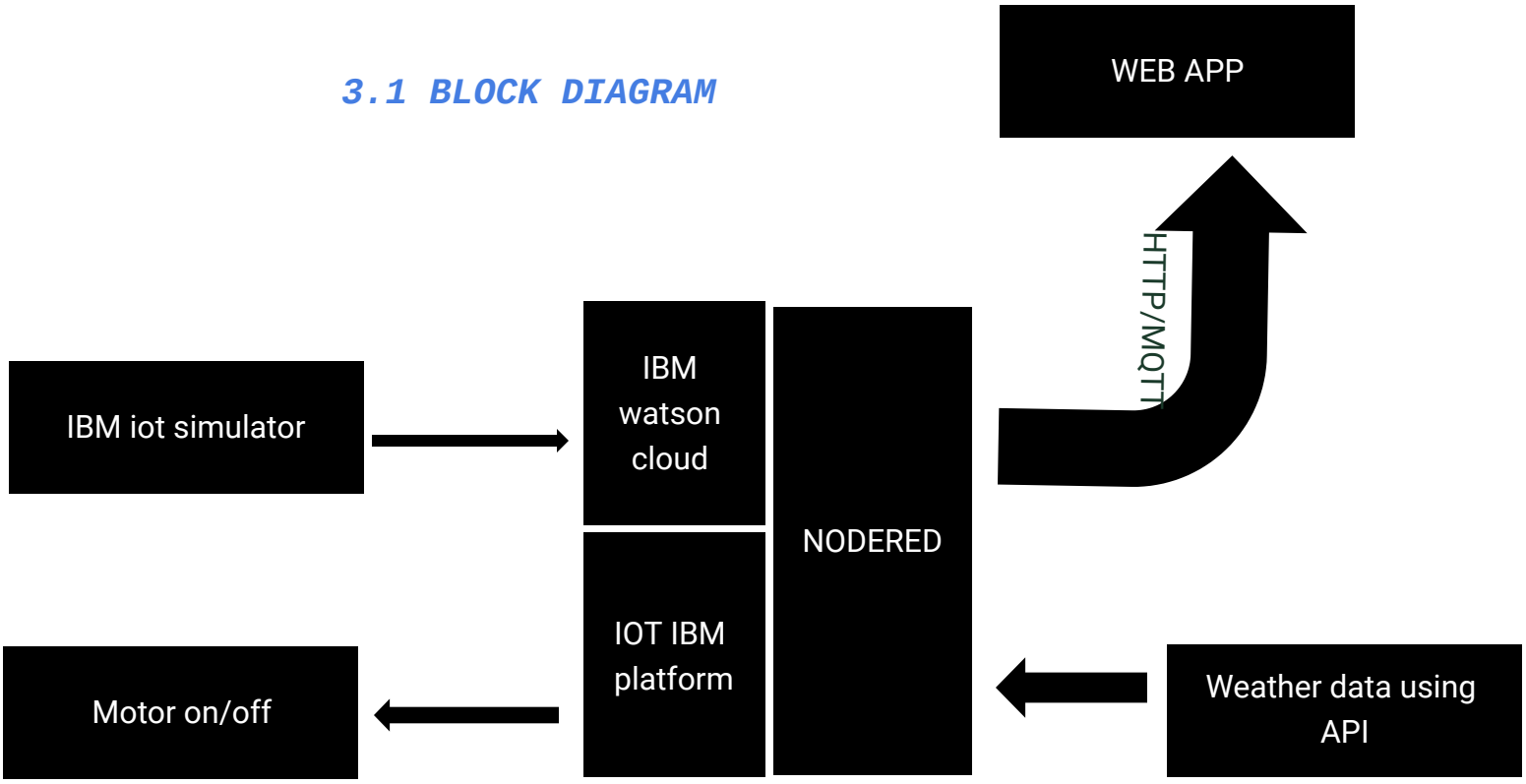
To cope up with this use of temperature and moisture sensore at suitable locations for monitoring of crops is implemented in [8].

An algorithm developed with thresold values of temperature and soil moisture can be programmed into micro controller based gateway to control water quantity .The system can be powered by Photo voltaic panels and can have duplex communication link based on cellular - Internet interface thar allow data inspection and irrigation scheduling to be programmed through web page.[9].

The technological development in open source software and hardware make it easy to develop the device which can make better monitoring and wireless sensor network made it possible to use in monitoring and control of green house parameter in precision agriculture.[7].

3.THEORITICAL ANALYSIS

3.1 BLOCK DIAGRAM



3.2 Hardware /Software

To make the system one micro-controller which will process the data coming from the sensor? Off-Course sensors are the heart of the system and in this system use LM35 temperature sensor because this sensor gives the output in degree Celsius and also easy to interface.

A. Temperature

Figure.1 Temperature sensor LM35

The change of soil moisture keep and sport .[5] The soil temperature plays a certain role on many of the physical processes of soil.

B. Humidity Sensor

Figure 4.Humidity Sensor

Humidity sensors senses ,measure the relative humidity in the air, it therefore measure moisture .

C. Pressure Sensor

Figure 3. Barometric Pressure Sensor

It is known that heavy shower can be expected when the atmospheric pressure is high .Rainfall is inversely proportional to atmospheric pressure .The pressure sensors connected to the micro controller also regulate the water flow by stopping the supply when the pressure is lower than a threshold value.The plant are watered using sprinklers or small nozzels.To avoid errors in pressure values due to external factors like animal or flapping of wing of birds,etc, the pressure value is determined by an avg. of pressure values taken from a number of sensors installed at different points in the field.

Software Requirement:

1). Node Red: Node-red is a instrument for Iot apps, that is easily used, fundamentally and open source. This visual programming tools is very helpful , which helps Iot developers incorporate APIs ,hardware and on-line Services in a very creative way. The Node-Red library consists of thousands of flows and nodes to allow the user to connect all types of devices and services.Here this flow run of IBM watson cloud since node-red runtime includes node.js . Node-Red provides a platform where single click mechanism is used for light weight runtime environment to deploy the Iot developer's flows.

2). IBM watson IoT platform: It is cloud based service for IoT devices for IBM watson IoT platform. Sensor information can be stored and analyzed , in order to gain valuabale information.

3). Python IDLE : Python is an interpreted, high-level, general-purpose programming language. ... It supports multiple programming paradigms, including structured (particularly, procedural), object-oriented, and functional programming. Python is often described as a "batteries included" language due to its comprehensive standard library [8]https://smartinternz.com/Student/workspace/1442.

3. EXPERIMENT OBSERVATION

Explore IBM !

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 centers 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 multicloud 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.

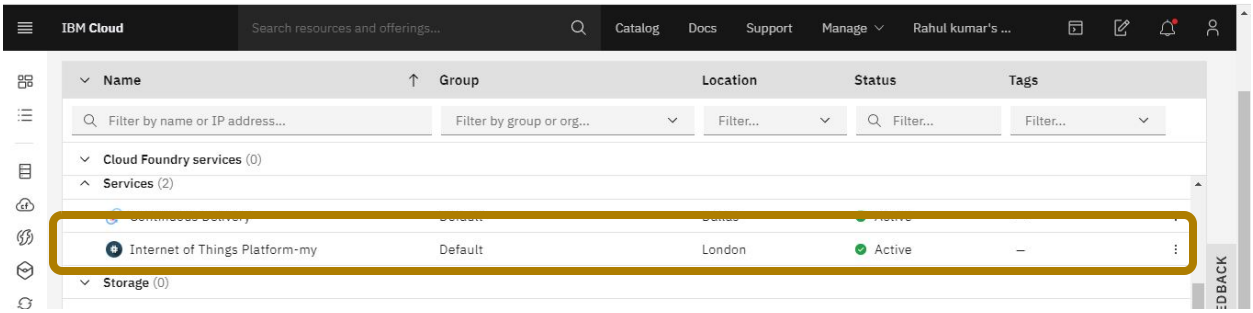
Whether you need to migrate apps to the cloud, modernize your existing apps by using cloud services, ensure data resiliency against regional failure, or leverage new paradigms and deployment topologies to innovate and build your cloud-native apps, the platform's open architecture is built to accommodate your use case.

https://cloud.ibm.com/docs/overview?topic=overview-whatis-platform

Section 1. Create new device in Watson IoT Platform

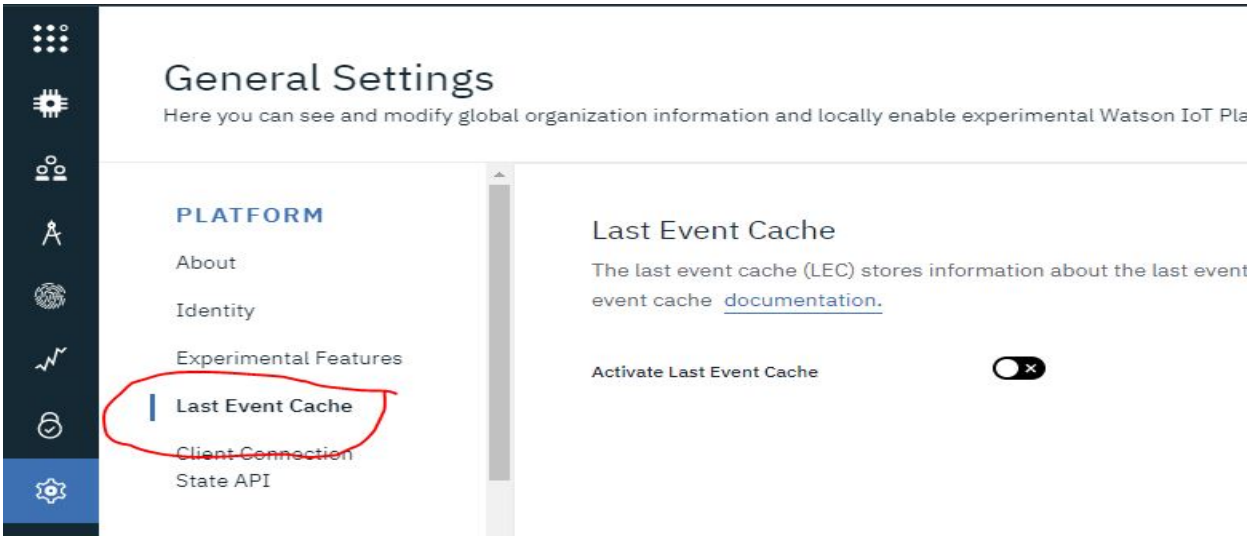
1. Switch back to your browser window open on IBM Cloud environment.
2. Create a free IoT service on IBM cloud, >click on Catalog and Search for Internet of things.{note: during creating must choose **London** as region}

3. If you already create this IoT Service then it's time to launch it by clicking on this service.

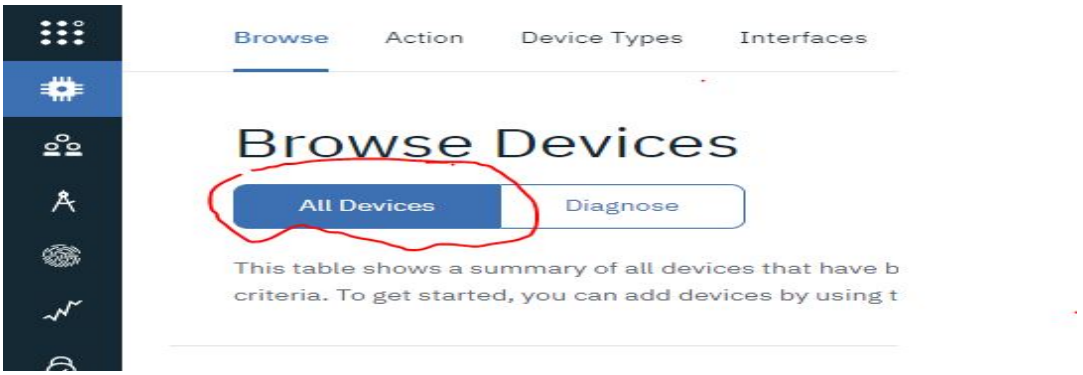


4. Click **Launch** button to open your Watson IoT organization dasboard in a new browser tab. You are now connected to the IBM Watson IoT Platform dashboard.With the platform You can manage your devices, store and access your data.

5. From left panel **Setting** menu, activate the **last Event** Cache feature: By using the Watson IoT platform Last Event Cache API ,you can retrieve the last which allows you to retrieve device status regardless of the device's physical location or use status. Last event data of a device can be retrieved for any specific event that occurred up to 7/45 days ago.

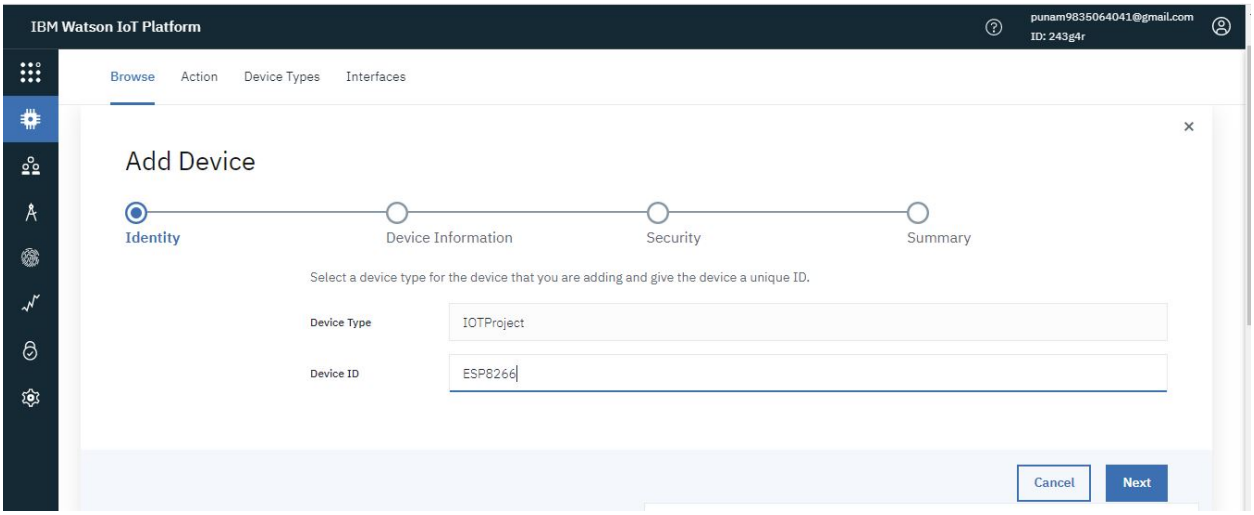


6. You are now going to register a new device in your organization: first adding a device type, then the device.> Click on **Devices** menu from left panel.Click on **Device** Type, then **Add device** Type button.



7. Choose Device and put a name (case sensitive) for your device : ***IOTProject*** click **Next**.
   Their is no need of adding Device information.
   Click **Done**.

9. Select the **Device Type** that we created before.
   Give **ESP8266** as device name (it will be your Device ID) , then click next

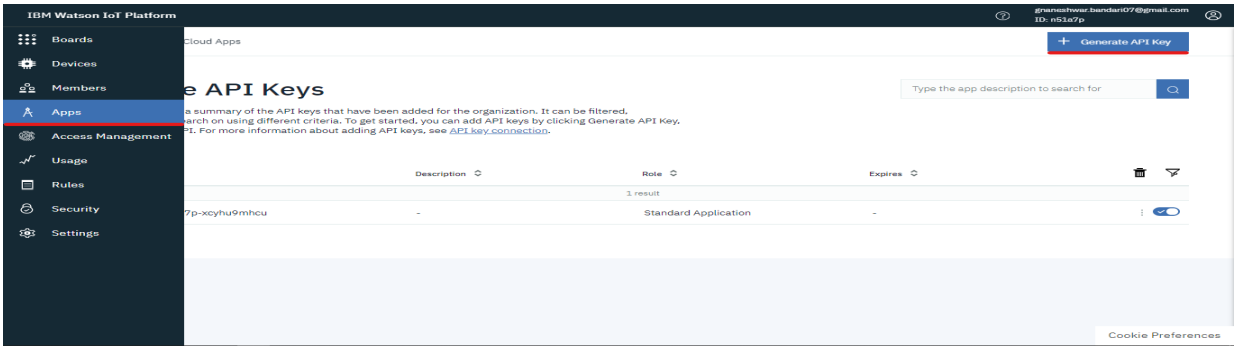


10. Click **Next** again you don't need any **metadata**.

11. In the security part, it is recommended to provide a simple token (I given **123456789** as a password). If you skip this , then a typical token will be automatically generated .Click **Next**.

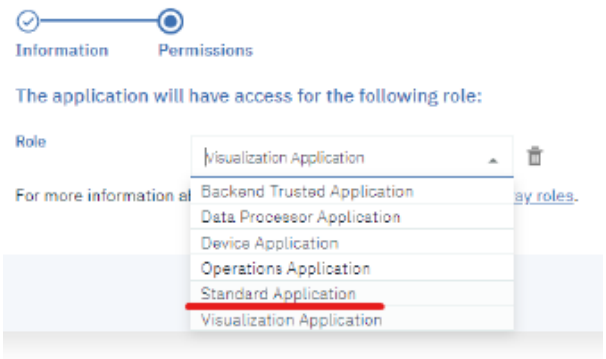
12. A summary of device details appears. Copy all these information in notepad for future purpose, then click **Done**.

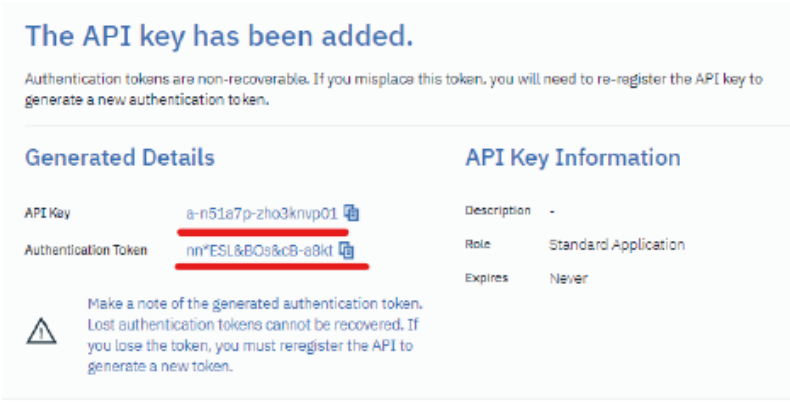
13. In the APPs Section -> Click on Generate API key.



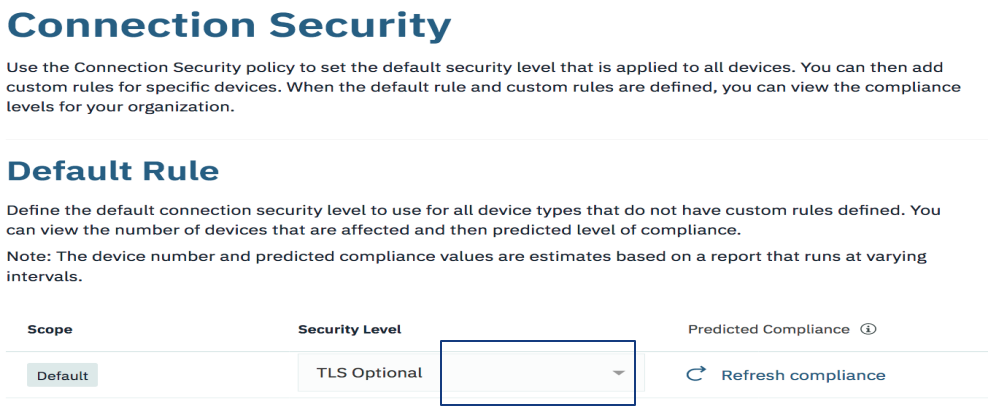
14. Click Next for futher Information. In Permissions select Standard Application as Role and click on Generate API key.
Copy your API Key and Authentication token i.e note down this text editor.

->





13. In the **Security** menu on the left panel ,click on **Connection Secrity** and change security setting to accept non-SSL connection to **TLS Optional**.



14. Now, we Buid our Device.

Section2: IBM Watson IoT Platform : Create Dashboard

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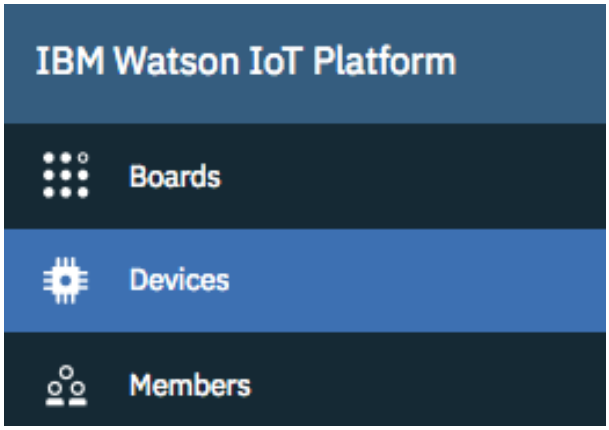
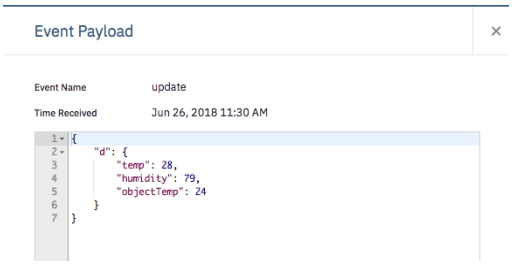
1. Now, move back to watson platform ,in left pannel , click **Device** menu.



2. Click on **IOTProject** , our previously created device. Now set up the simulation process, Click on state to see the **recent event**.



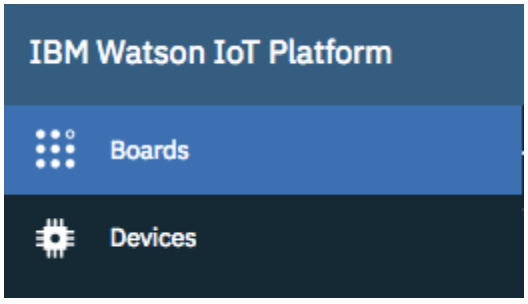
Recent Events

The recent events listed show the live stream of data that is coming and going from this device.

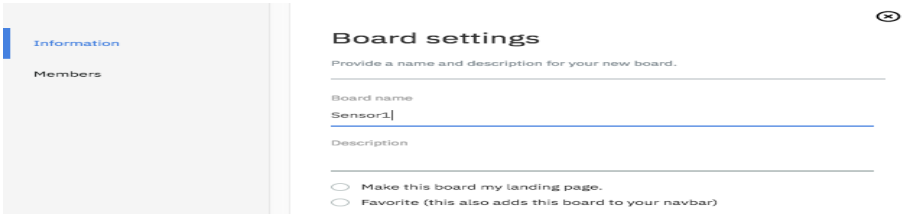
Showing Raw Data | The recent events listed show the live stream of data that is coming and going from this device.

Event	Value	Format	Last Received
update	{"d":{"temp":28,"humidity":79,"objectT...	json	a few seconds ago
update	{"d":{"temp":28,"humidity":79,"objectT...	json	a few seconds ago
update	{"d":{"temp":28,"humidity":79,"objectT...	json	a few seconds ago
update	{"d":{"temp":28,"humidity":79,"objectT...	json	a few seconds ago
update	{"d":{"temp":28,"humidity":79,"objectT...	json	a few seconds ago

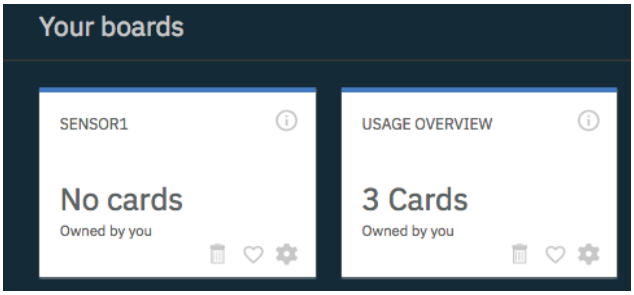
3. Now , we move to create a simple dashboard using IBM Watson IoT platform. From left panel , click on **Board**.



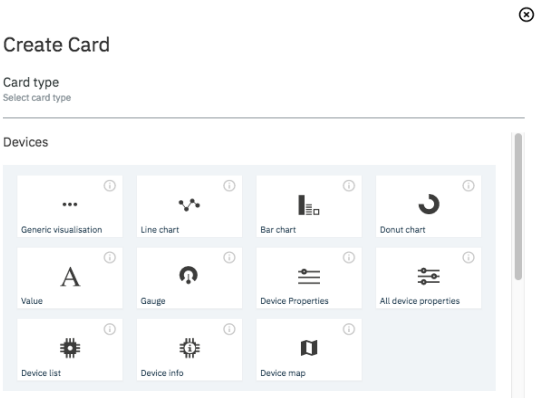
4. Click <(top left corner).
   Click on Create New Board.
   Enter name to your new board as Sensor1



5. Click Next , then **Summit**. After then Click on **New Board**.

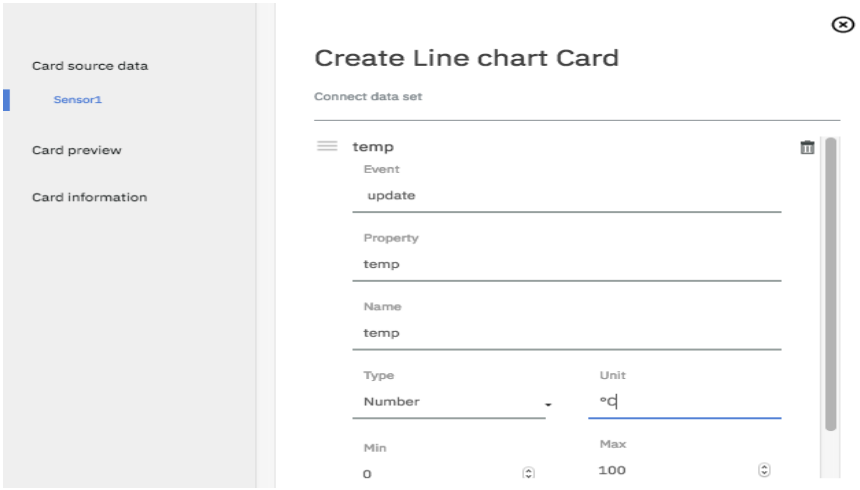


6. Click on Add new card button , Select **Line chart** or whatever you want, then click **Next**.



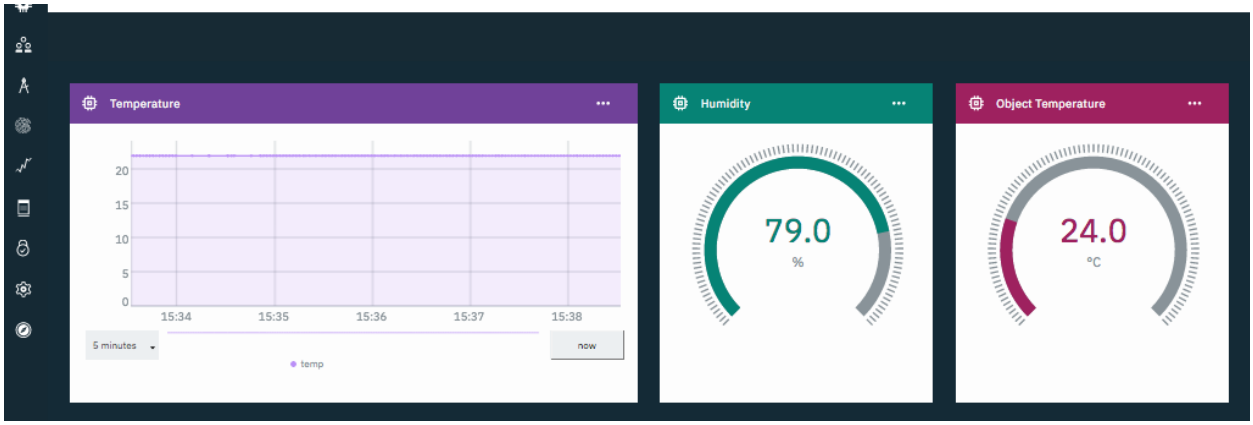
7. To collect data from device, Select IOTProject . Click Next.

8. To select value to display, click on Connect new data set , and fill form as below choose event as event_1.Click Next > Summit.



9. Now new Card is available and displays live temperature values from IOTProject.

10. Following same step , create 2 another cards to display Humidity and Object temperature.



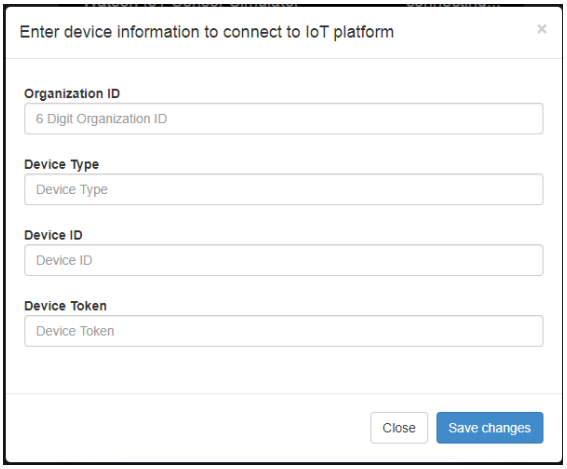
Section3: Connect The IOT Simulator To Watson IOT Platform

The Watson IoT Device Simulator is a solution that that enables customers to create and simulate hundreds of virtual connected devices, without having to configure and manage physical devices, or develop time-consuming scripts

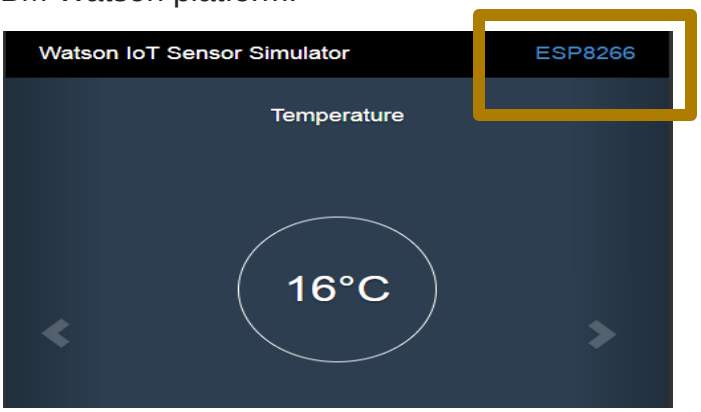
go through this link:

http://watson-iot-sensor-simulator.mybluemix.net/

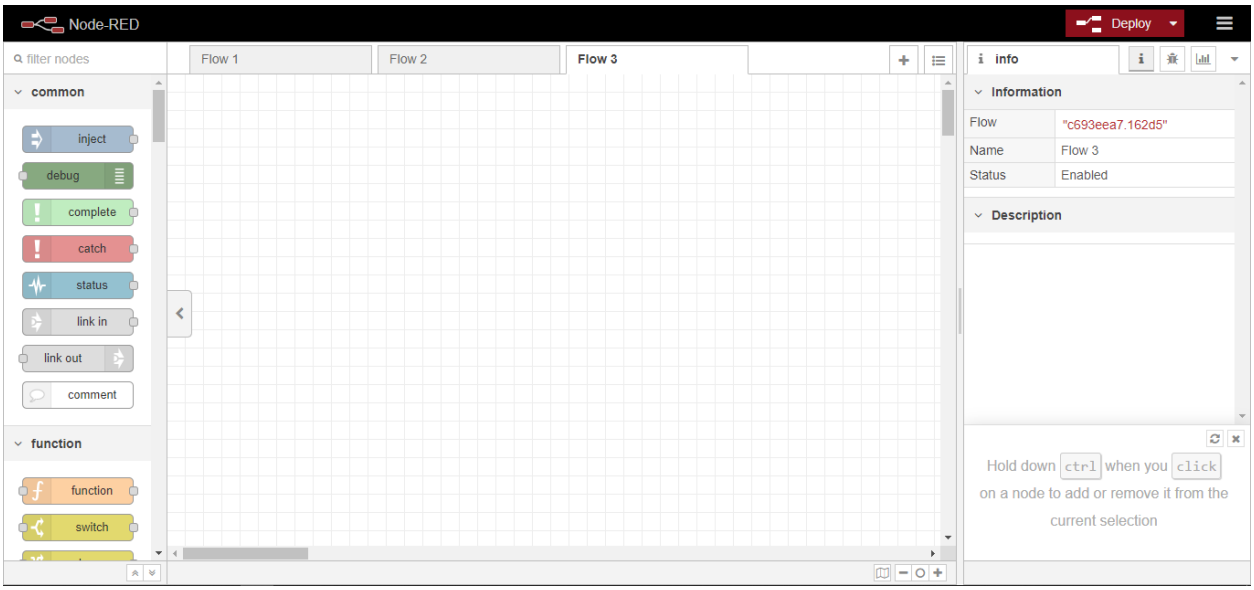
1. Put all the authentication we save till in notepad,that is the data related to Device.



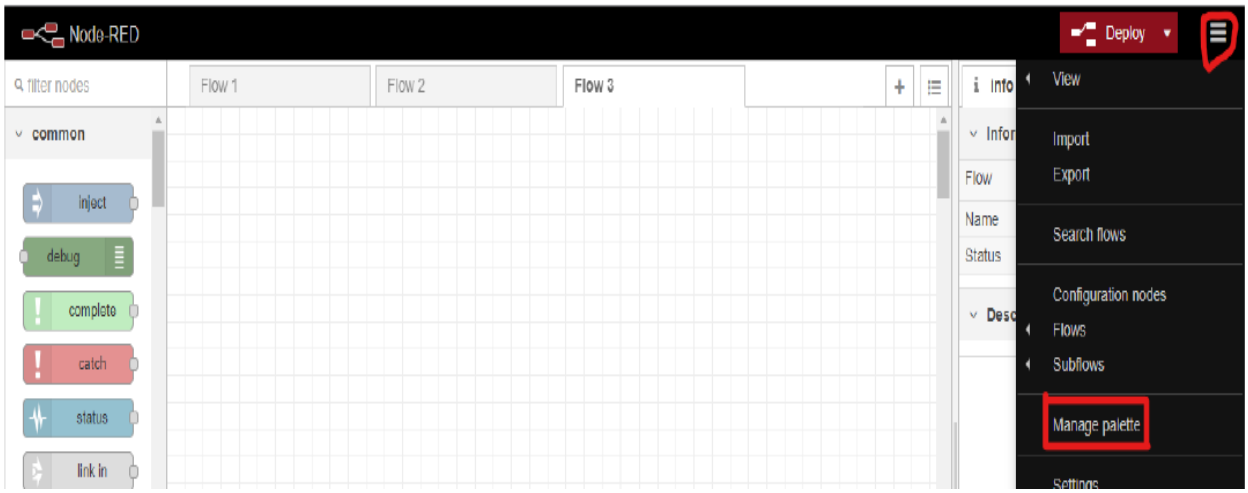
2. After click on save change , if top right show your device name then it is connected to IBM Watson platform.



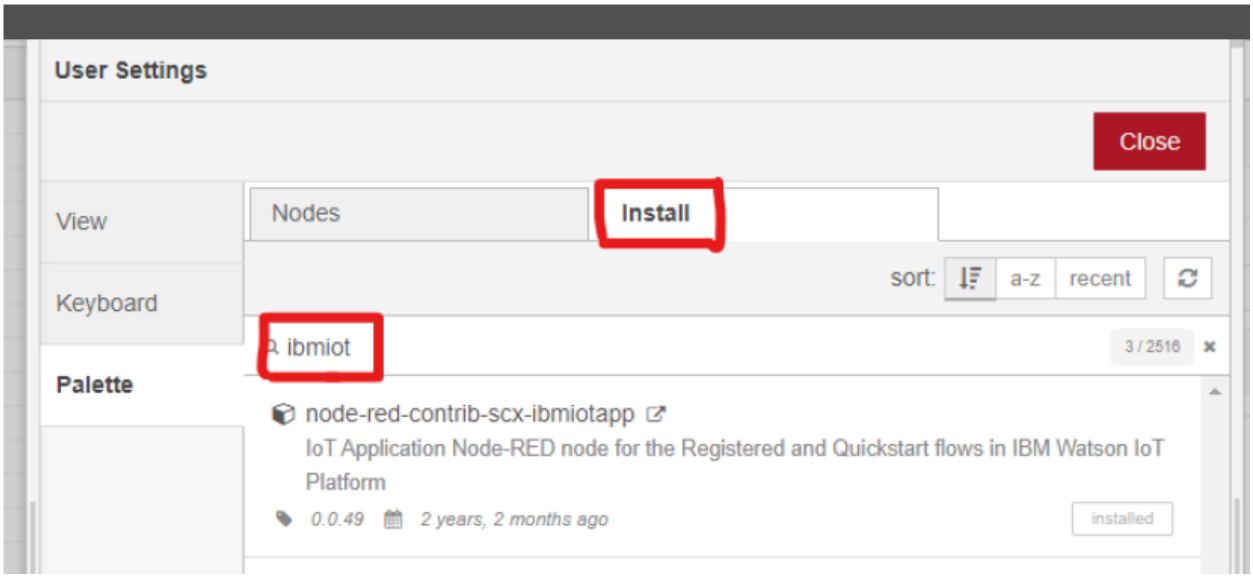
Section4: Creating a Node-Red UI to view data in graphical form



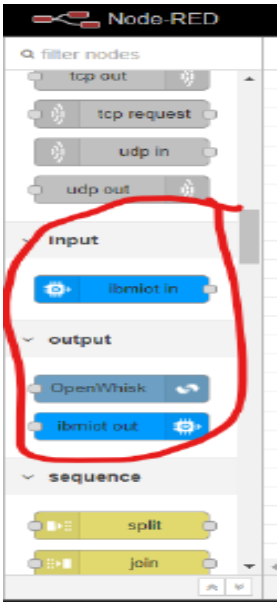
1. Click on manage palatte in the menu option which is on the top-right of the screen , to install IBM nodes in Node-Red flow editor.



2. In install section search for ***ibmiot*** and install the ibm nodes to flow editor.

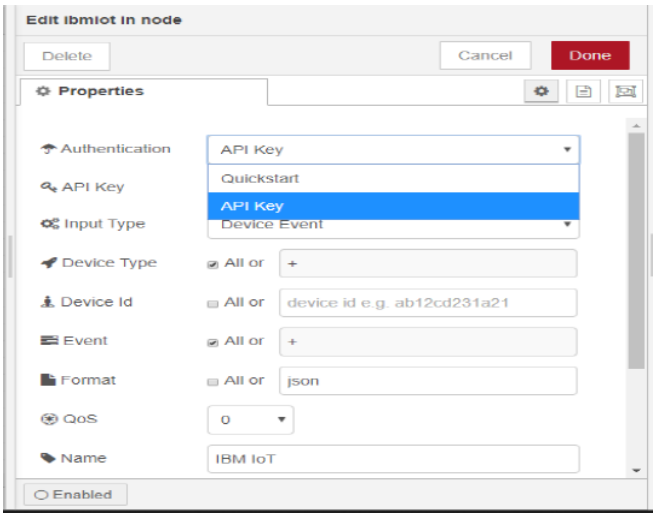


3. Search for IBM nodes in the filter nodes section.



4. To get the data from the IBM IoT platform by using Node-RED IBM IoT Input node and double click on the IBM IoT input node.

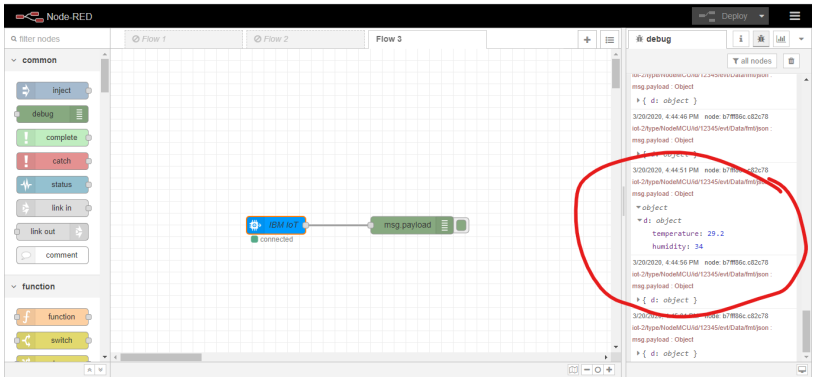
5. Select API for authentication, whatever the data is saved on text editor used here.



6. Also update input type as event , Device type , Device ID , command and format in the properties section and click on **Done.**

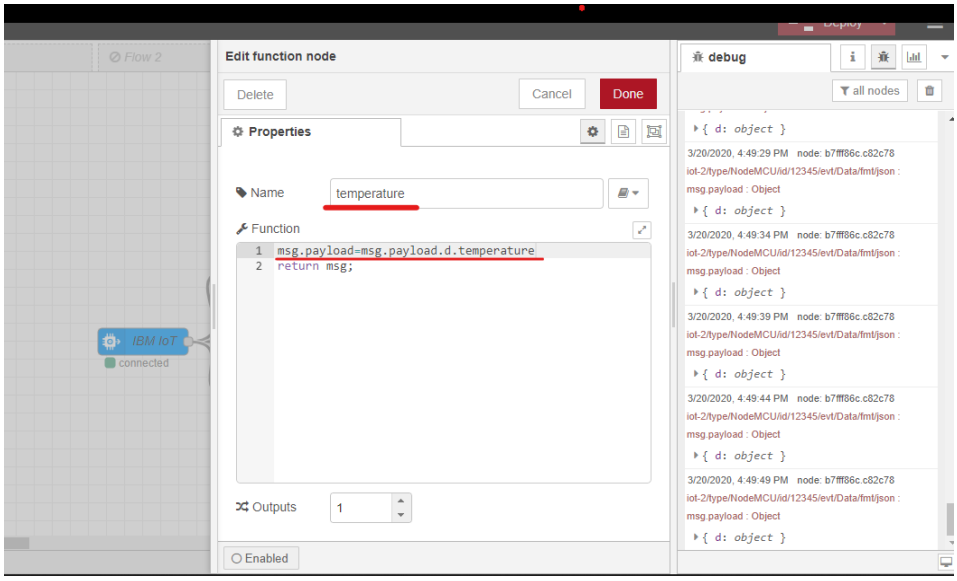
7. Now Click on Deploy option to check whether it is connected or not.If the status is disconnected check for IBM IoT properties and try again.

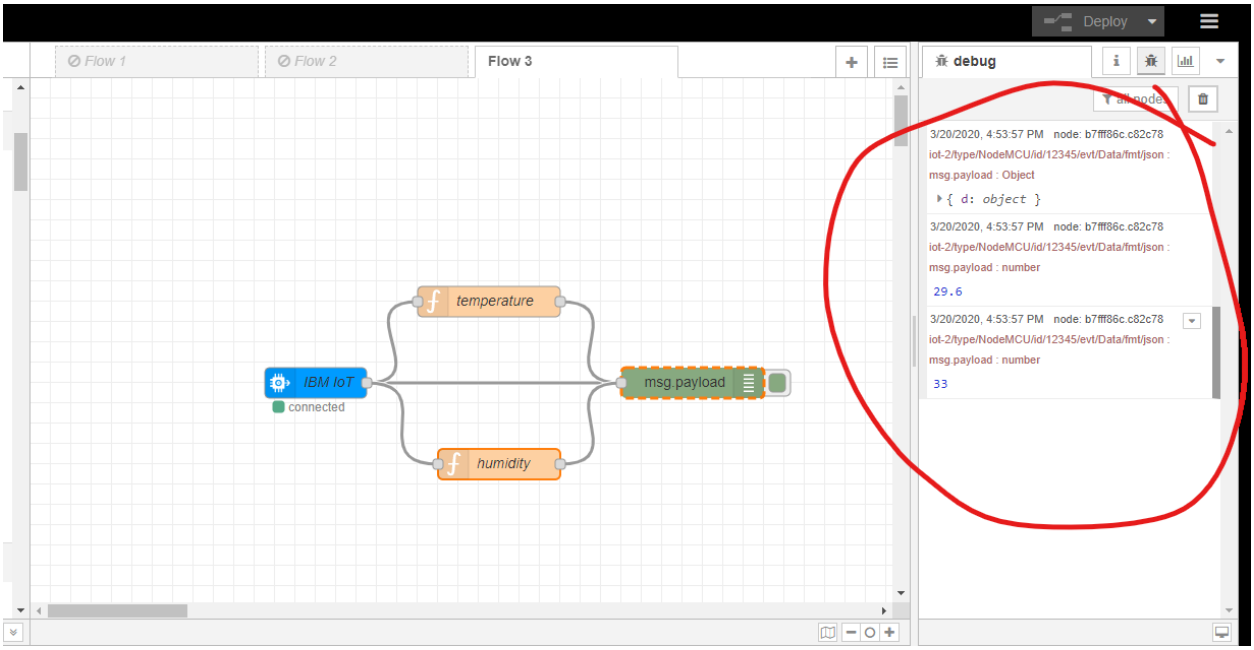
8. Put the debug node in the flow editor and click on deploy to see the temperature and humidity value in the debug tab.



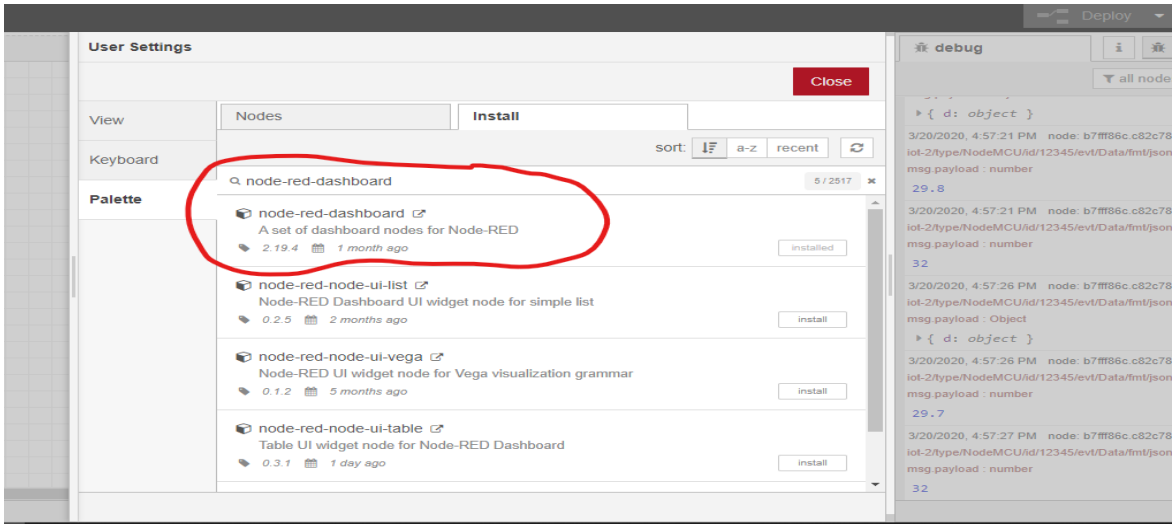
9. Drag the function node in the flow editor to separate the temperature and humidity individual from IBM watson cloud.

10. Type :-> ***msg.payload=msg.payload.d.temperature*** in one function and Type:-> ***msg.payload=msg.payload.d.humidity*** in another function to separate the humidity and temperature values from payload and click **deploy.**

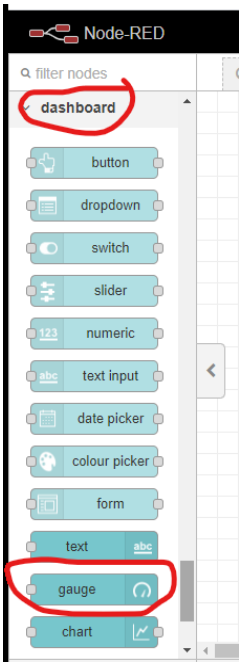




11. Temperature and Humidity values appear separately.
Install the dashboard nodes from the manage palatte to create a UI to display temperature and humidity values in the Dashboard.

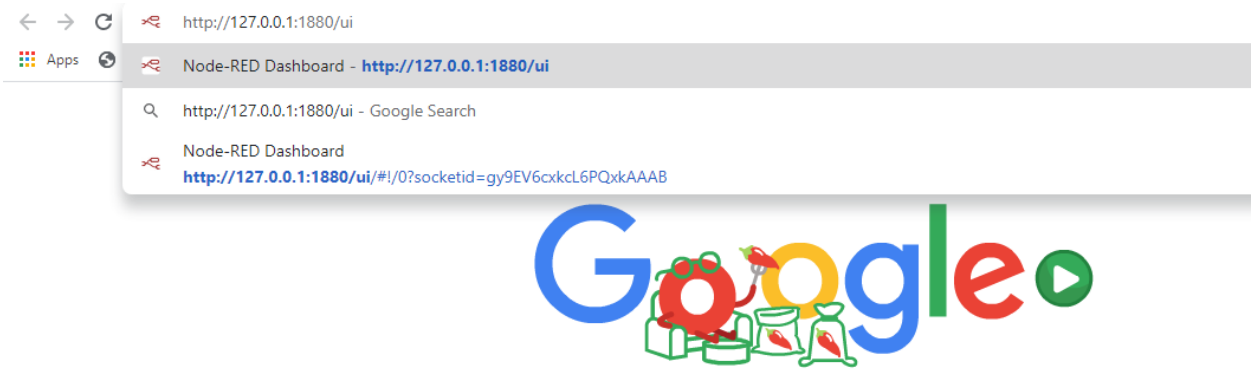


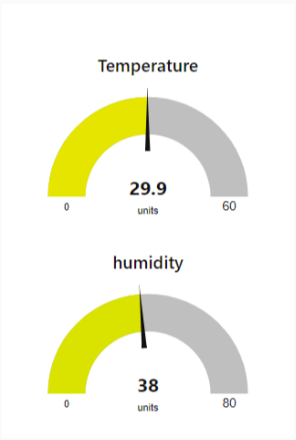
12. Select the Gauge function node and chart node and many more it depend upon creativity , how much attractive we build out UI .



13. Edit bote humidity and temperature node and then Deploy it.

Display the humidity and temperature value in the Dashboard by copying and pasting the URL of the Nodered in the new tab and add ***/ui***





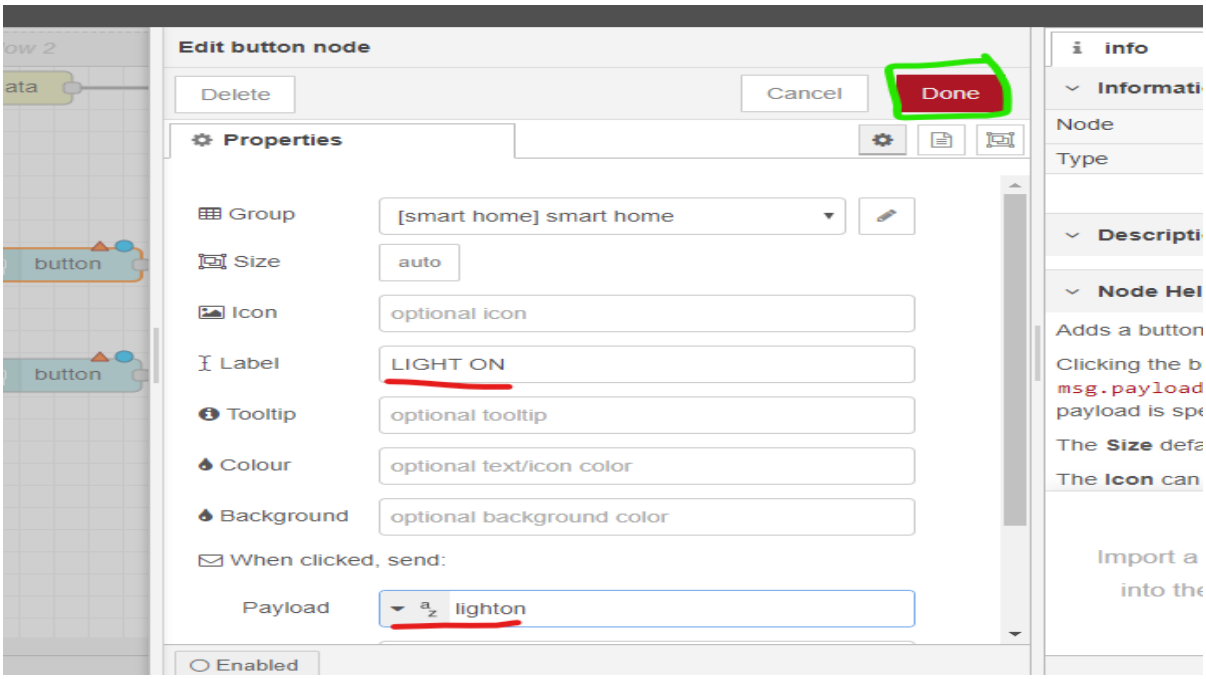
Section5: CONTROLLING THE LIGHT APPLIANCES ON/OFF BY GIVING COMMAND TO THE DEVICE

1. Drag and drop the IBM IoT output node in the flow editor.

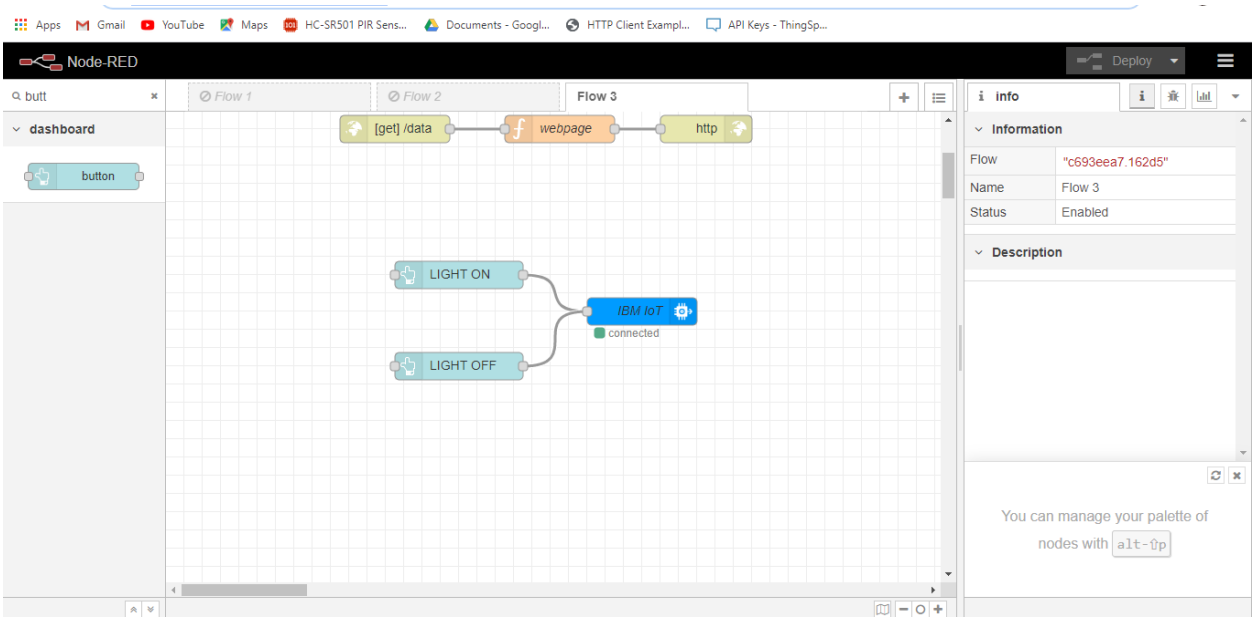
2. Write all the device crdentials and Api key in the IBM IOT output node and deploy it so that the status of the ibm IoT output node will be in conneted status.

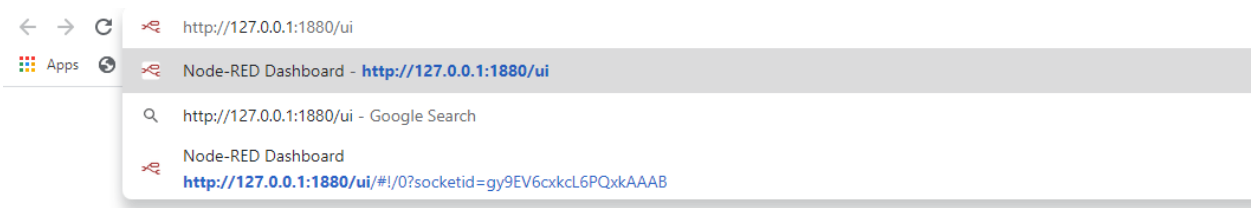
3. Drag and drop two button nodes from the Dashboard node.

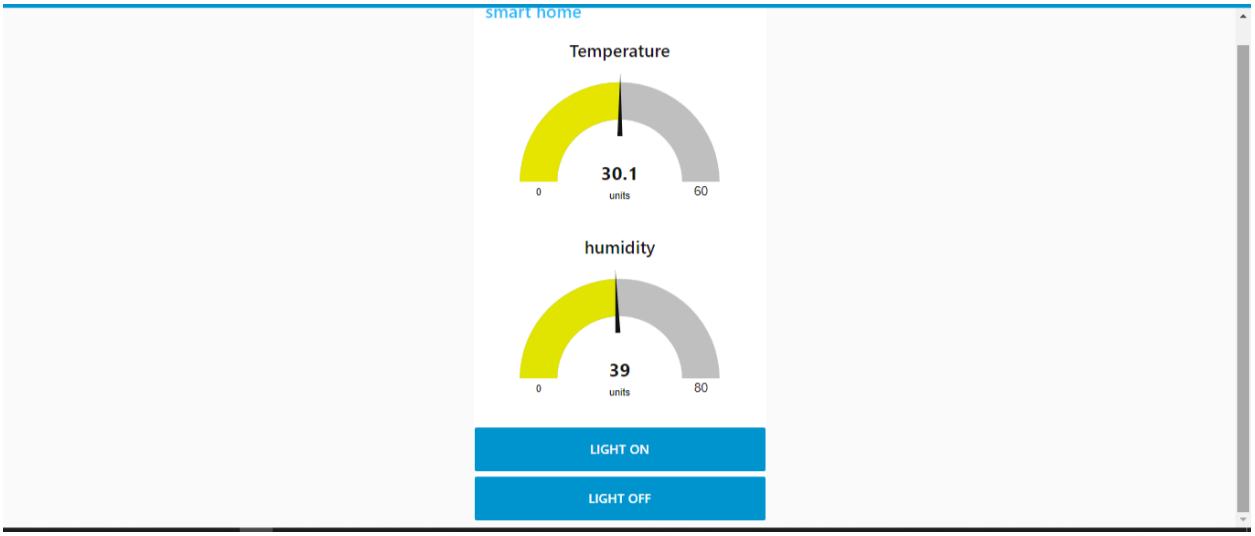
4. Configure the button node for light on and light off.



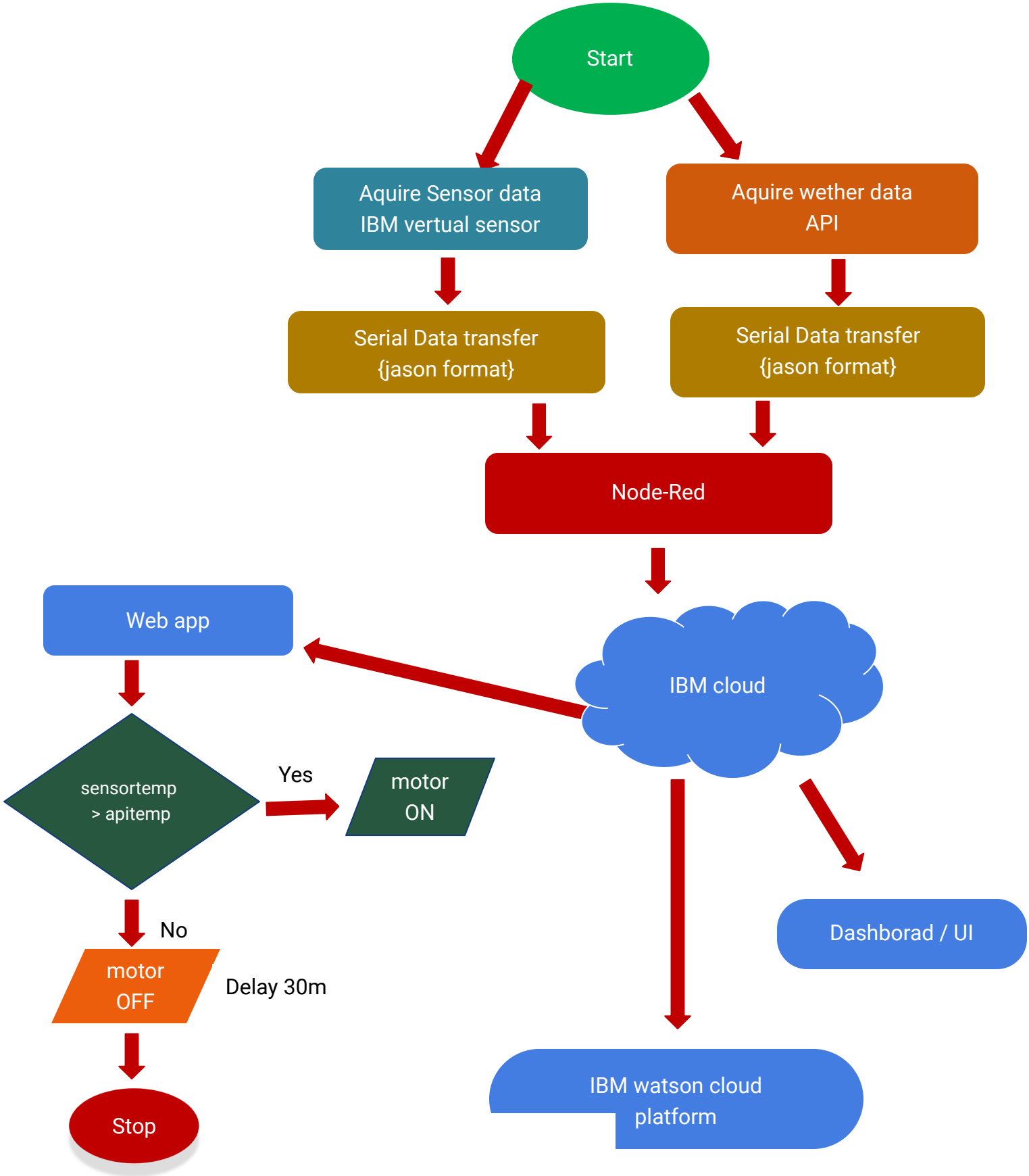
5. After ***Deploy***, copy the nodered url till ***https://localhost/1880/ui*** along with ***/ui*** and press **enter** which will display the UI for controlling the light on /off.

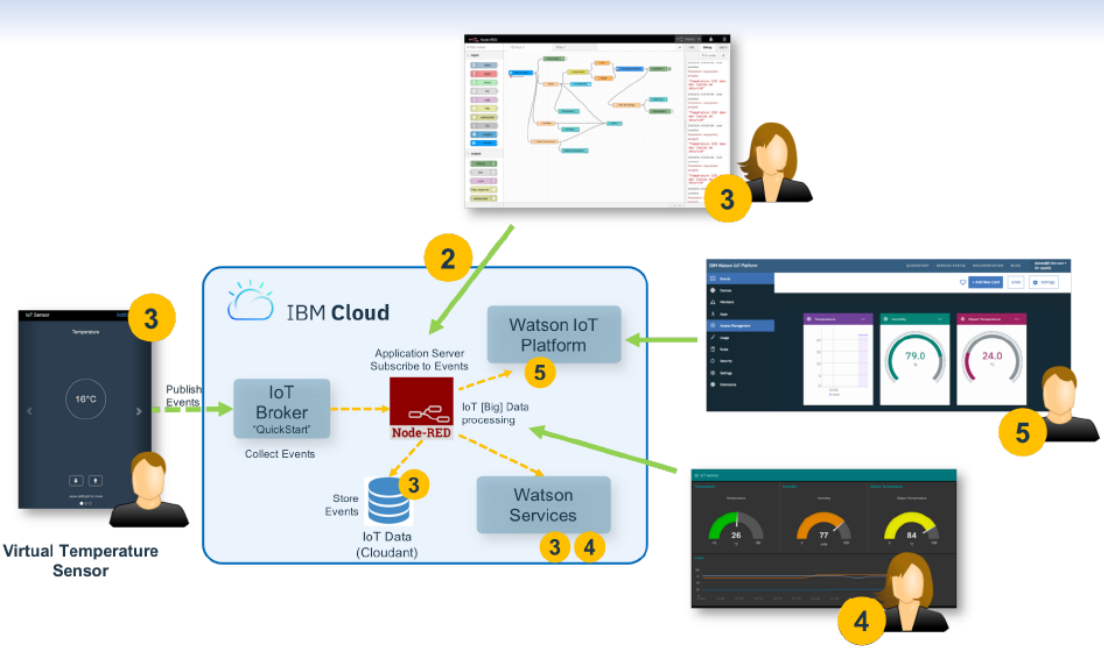






5: Flowchart

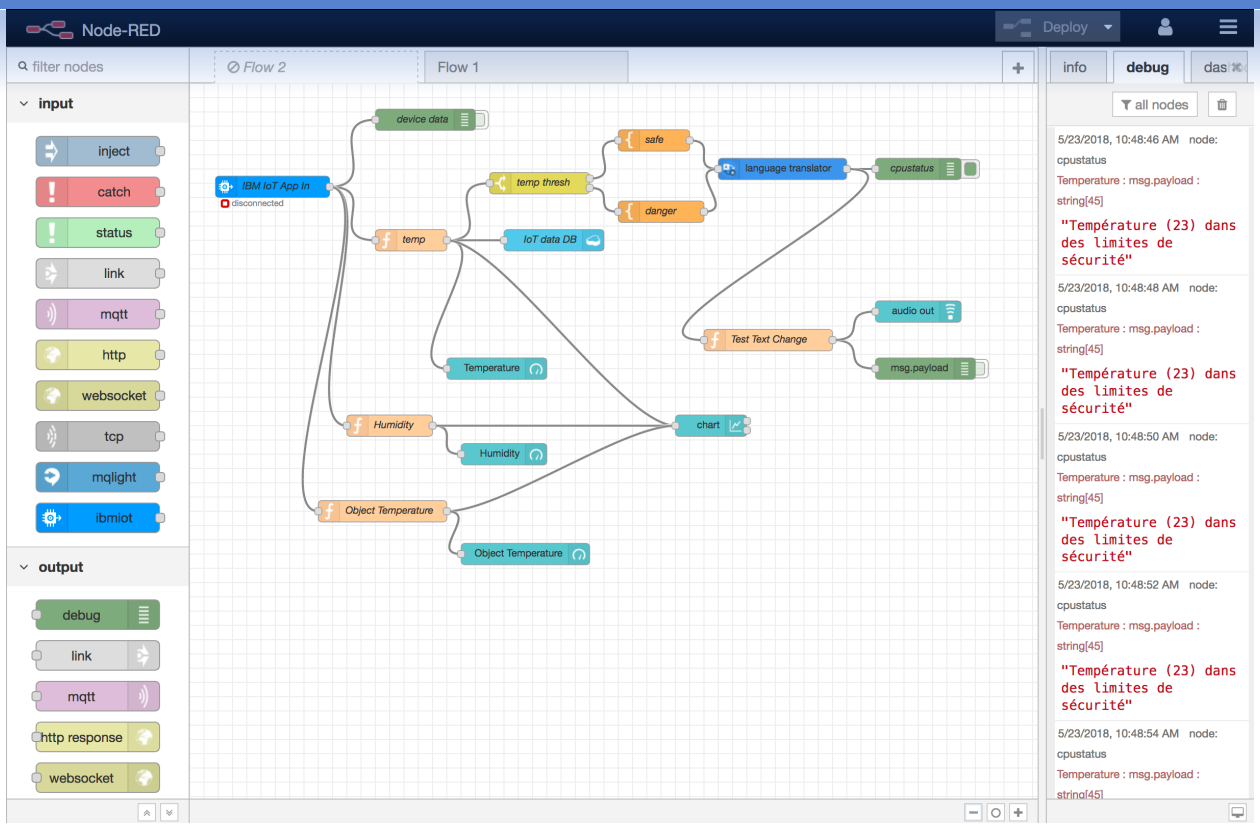

Start
Aquire Sensor data
IBM vertual sensor
Aquire wether data
API
Serial Data transfer
{jason format}
Serial Data transfer
{jason format}
Node-Red
Web app
IBM cloud
sensortemp
> apitemp
Yes
motor
ON
No
motor
OFF
Delay 30m
Stop
Dashborad / UI
IBM watson cloud
platform



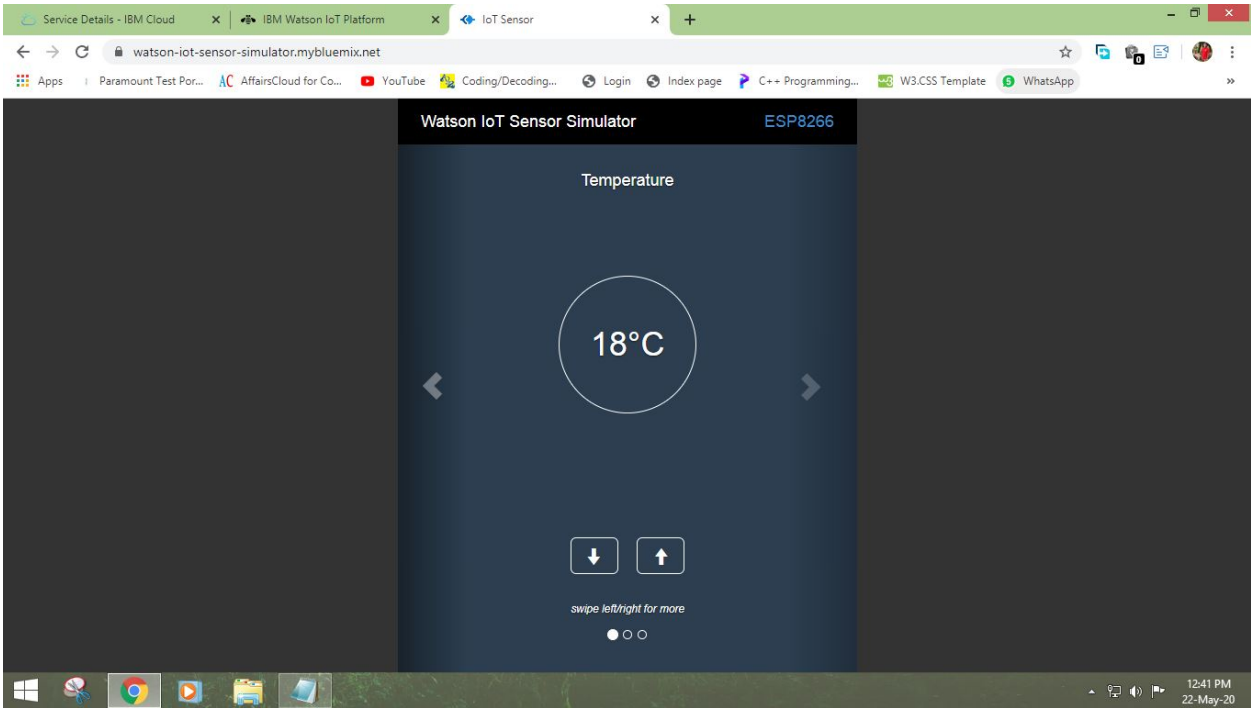
6. Expected Result

The Sensor data and Zonal weather api data is clearly visible in the Dasboard . The weather temperature , Humdity and wind speed and many more are displayed in both dial and trend format. Node-red dashboard can have varied feature to visualize the data in different form . The user can remotely and localy analize or visualize this dashboard . Otherwise through the dedicated web app that is connelted to IBM watson IoT platform , the authorities can have acess to the sensor reading and can see real - time humidity and object temperature parameters that are stored in cloud service. Authorities can decide to solve this problem constructively in order to safe the agricultural system.

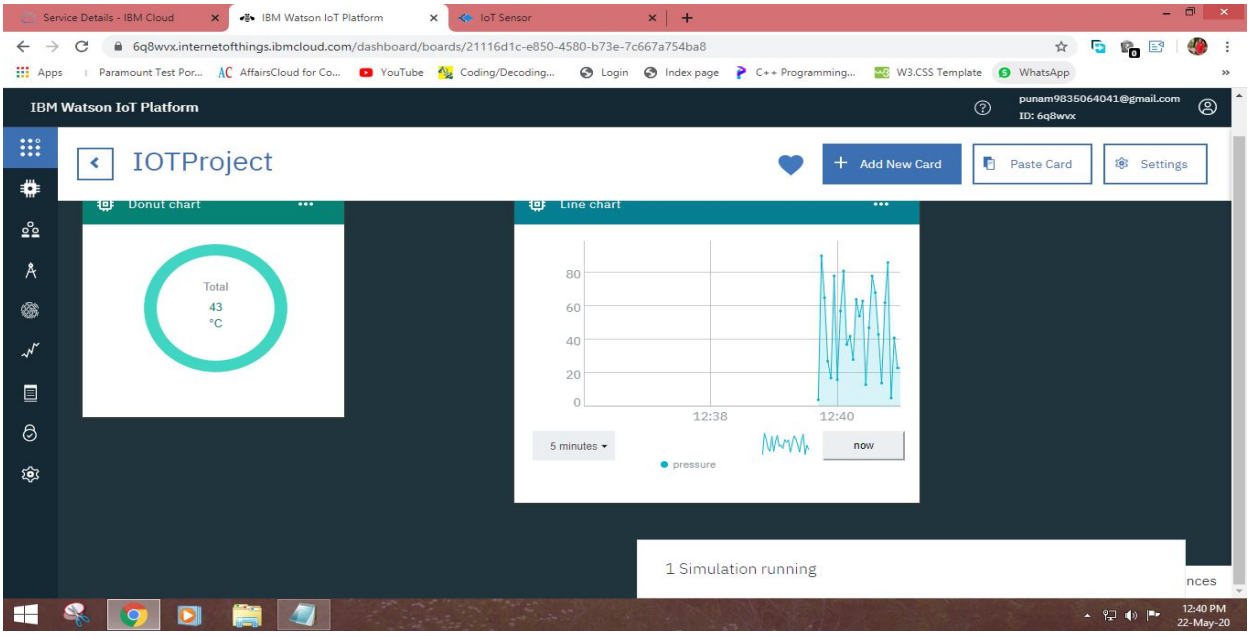
1. Node-red application is operational (using Node.js runtime), accessing cloudant & IoT platform (quikstart).



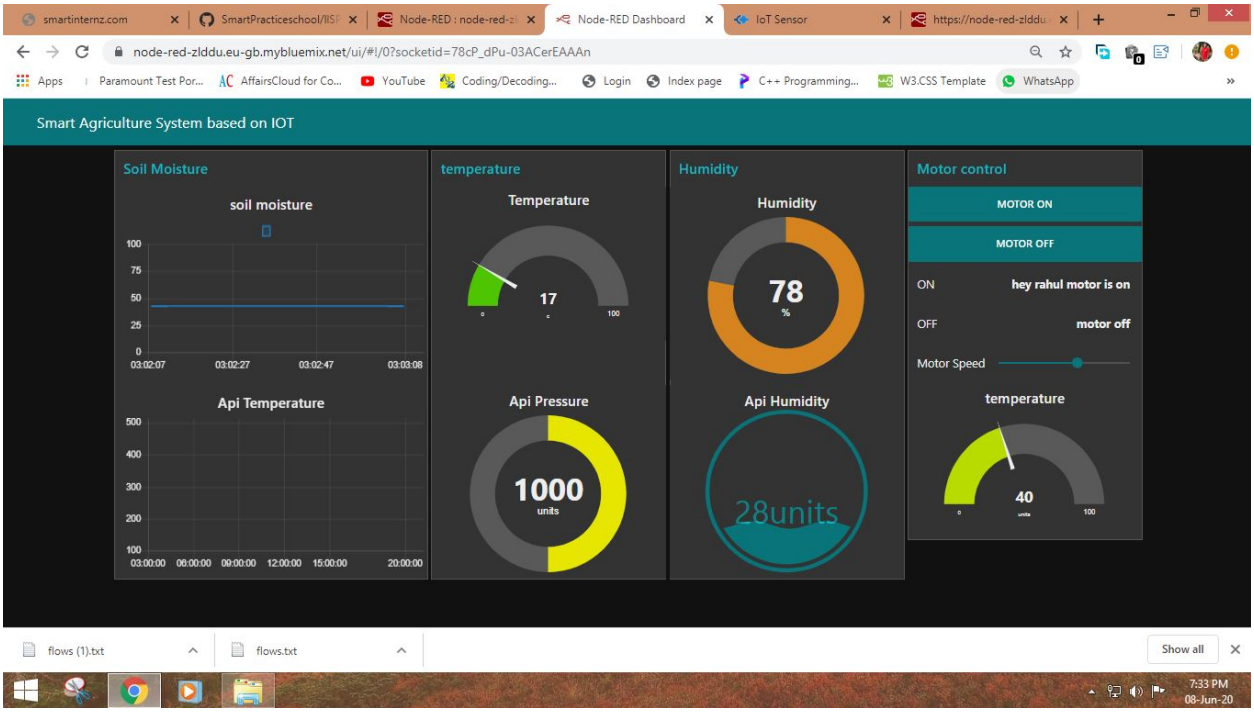
2. Connect IoT simulator to IoT watson platform.



3. All the data of Iot Simulator sensor and open weather api data is visible in IBM ui.



4. Attractive UI is created where we can observe all data either of sensor and api weather directly.



7. Advantage and Disadvantages

Advantages:

With the help of Sensor and automation technology , Smart agriculture benifits the society in the following ways.

- Optimization of energy resources.
- Conservation of water
- Better crop Yield
- Pollution prevention
- Eliminate human errors
- Time efficiency , accurate diagnosis of nutrient deficiency
- Automation with low power consumption components

On the whole smart farming refers to data gathering , data processing , analyzing and automatic control system .

Disadvantage

- implementation is Expensive
- Farmers are not able to implement this SetUp on their own due lack of knowledge.
- Sensor or other hardware get damaged due to environmental condition.

8.Conclusion

This paper present smart agriculture system which is capable to send and receive the data from the sensor and also get the updated and precious data from the cloud. The cloud is connected to web app and node red UI where we get update of every seconds data. This data is further analyze for best selection criteria depends on the review given by the farmers and engineers , then cloud will update the same data to the web app and control the Motor as per requirement to improve crop productivity and soil fertility.

9. Future Scope

Smart farming is a concept quickly catching on in the agricultural business. Offering high-precision crop control, useful data collection, and automated farming techniques, there are clearly many advantages a networked farm has to offer.

A recent Beecham's report entitled *Towards Smart Farming: Agriculture Embracing the IoT Vision* predicts that food production must increase by 70 percent in the year 2050 in order to meet our estimated world population of 9.6 billion people. It also describes growing concerns about farming in the future: climate change, limited arable land, and costs/availability of fossil fuels. So, what's the solution? Smart farming.

Of the many advantages IoT brings to the table, its ability to innovate th

e landscape of current farming methods is absolutely groundbreaking. IoT sensors capable of providing farmers with information about crop yields, rainfall, pest infestation, and soil nutrition are invaluable to production and offer precise data which can be used to improve farming techniques over time. New hardware, like the corn-tending Rowbot, is making strides by pairing data-collecting software with robotics to fertilize the corn, apply seed cover-crops, and collect information in order to both maximize yields and minimize waste.

Another direction in which smart farming is headed involves intensively controlled indoor growing methods. The OpenAG Initiative at MIT Media Lab uses "personal food computers" (small indoor farming environments that monitor/administrate specific growing environments) and an open source platform to collect and share data. The collected data is termed a "climate recipe" which can be downloaded to other personal food computers and used to reproduce climate variables such as carbon dioxide, air temperature, humidity, dissolved oxygen, potential hydrogen, electrical conductivity, and root-zone temperature. This allows users very precise control to document, share, or recreate a specific environment for growing and removes the element of poor weather conditions and human error. It could also potentially allow farmers to induce drought or other abnormal conditions producing desirable traits in specific crops that wouldn't typically occur in nature.

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