SMART AGRICULTURE SYSTEM BASED ON IoT

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Index:

1. **INTRODUCTION**: Internet of things plays a crucial role in smart agriculture. Smart farming is an emerging concept, because IoT sensors capable of providing information about their agriculture fields. The project aims making use of evolving technology i.e. IoT and smart agriculture using automation. Monitoring environmental factors is the major factor to improve the yield of the efficient crops.

Fig[1]

1.1 **OVERVIEW**: Smart Agriculture System based on IoT can monitor soil moisture and climatic conditions to grow and yield a good crop. 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 these parameters, farmer can water the crop by controlling the motors using the mobile application. Even if the farmer is not present near the crop, he can water his crop by controlling the motors using the mobile application from anywhere. Here an online simulator is used to measure various parameters such as temperature, humidity, soil moisture values.

1.2 **PURPOSE:** Agriculture plays vital role in the development of agricultural country. In India about 70% of population depends on farming. Issues concerning agriculture have been always hindering the development of the country. The alternative for this is smart agriculture by modernizing the current traditional methods of agriculture[2]. Hence the project aims at making agriculture smart using automation and IoT technologies.

2. **LITERATURE SURVEY**: The researchers have addressed this problem with different dimensions. The table shows reviews of the important contribution or solutions which are proposed.

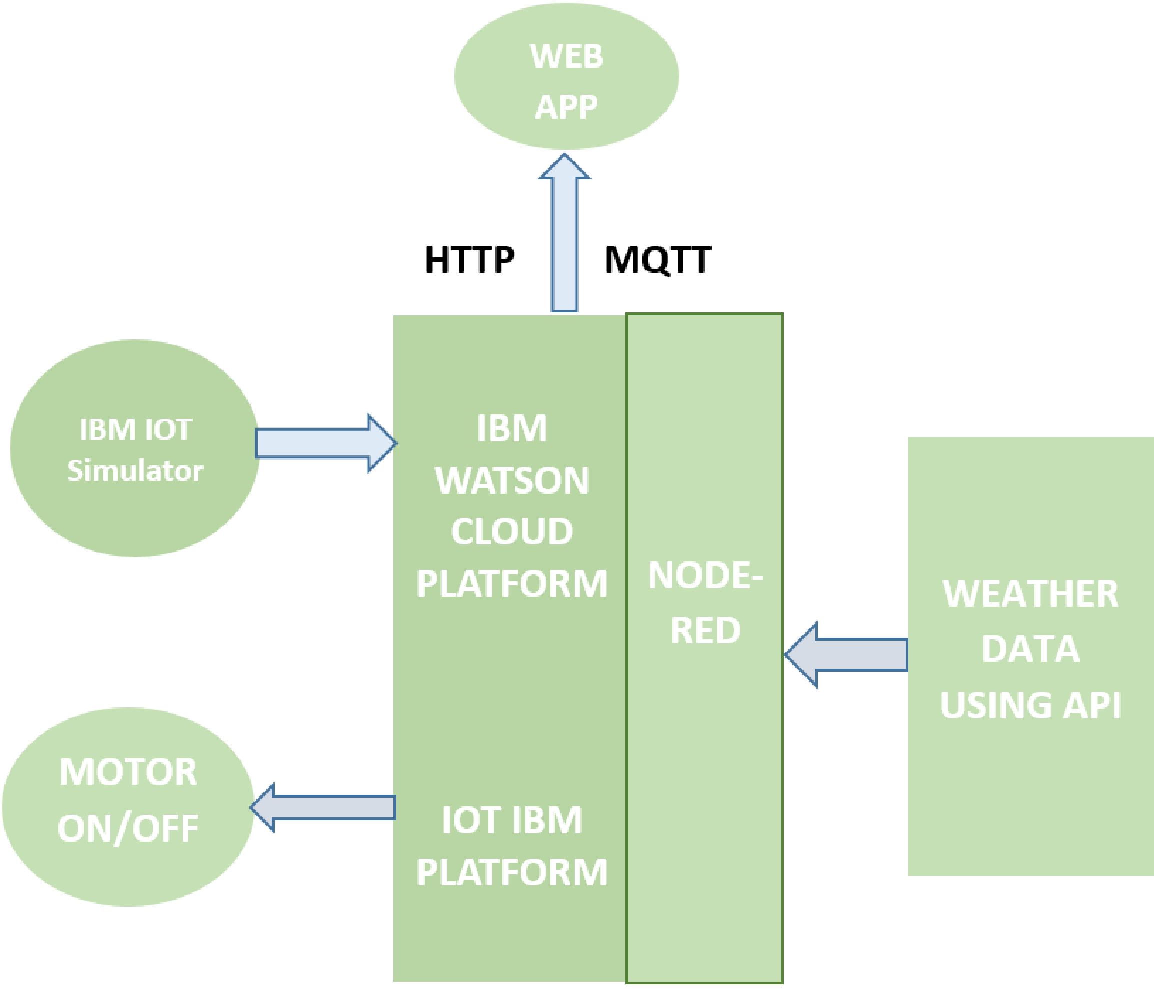
Authors	**Techniques/methodology**	**Contribution**
Alessandro Massaro	ZigBee protocol, GSM / GPRS, DSS algorithm	A cloud to a web platform to monitor and activate electro valves of irrigation network.
Amandeep	ZigBee protocol, Sensor.	Green-energy, Smart technology in agriculture find a better productivity.
Ibrahim khider Eltahir	Sensors	Solar supply, soil humidity analysis is done.

2.1 **EXISTING PROBLEM**: Farmers face new challenges and opportunities every day from feeding an expanding global population while meeting new emission requirements, to producing more food on fewer acres while minimizing their environmental footprint. Issues concerning agriculture have been always hindering the development of the country. The major problems are measuring different parameters to water the crop by controlling the motors. This can be solved by making the agriculture smart by modernizing the traditional methods.

2.2 **PROPOSED SOLUTION:** The solution proposed in this project is making agriculture smart using automation and IoT technologies. Smart Agriculture System based on IoT can monitor soil moisture and climatic conditions to grow and yield a good crop. 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 these parameters, farmer can water the crop by controlling the motors using the mobile application. Even if the farmer is not present near the crop, he can water his crop by controlling the motors using the mobile application from anywhere. Here an online simulator is used to measure various parameters such as temperature, humidity, soil moisture values.

3. **THEORITICAL ANALYSIS**:

3.1 **BLOCK DIAGRAM**: The following block diagram explains the functions of each block and the overall approach to the project.



Block diagram

3.2 **HARDWARE and SOFTWARE DESIGNING**: In this project, software components are used. A simulator called IOT simulator is connected to the Watson IoT platform. A programming tool called NODE-RED is used for wiring together API's and online services. An Open Weather API is also used in this project.

4. **EXPERIMENTAL INVESTIGATIONS**: Firstly, an IBM cloud account is created. A programming tool called NODE-RED is installed for wiring API and online simulators. A device is created in IBM Watson IOT platform. API key has also been added. For further investigations, IOT simulator is connected to Watson IOT platform.

In node-red, required nodes are installed and a flow is created. Now the IBM IoT device is connected to get the simulator data.

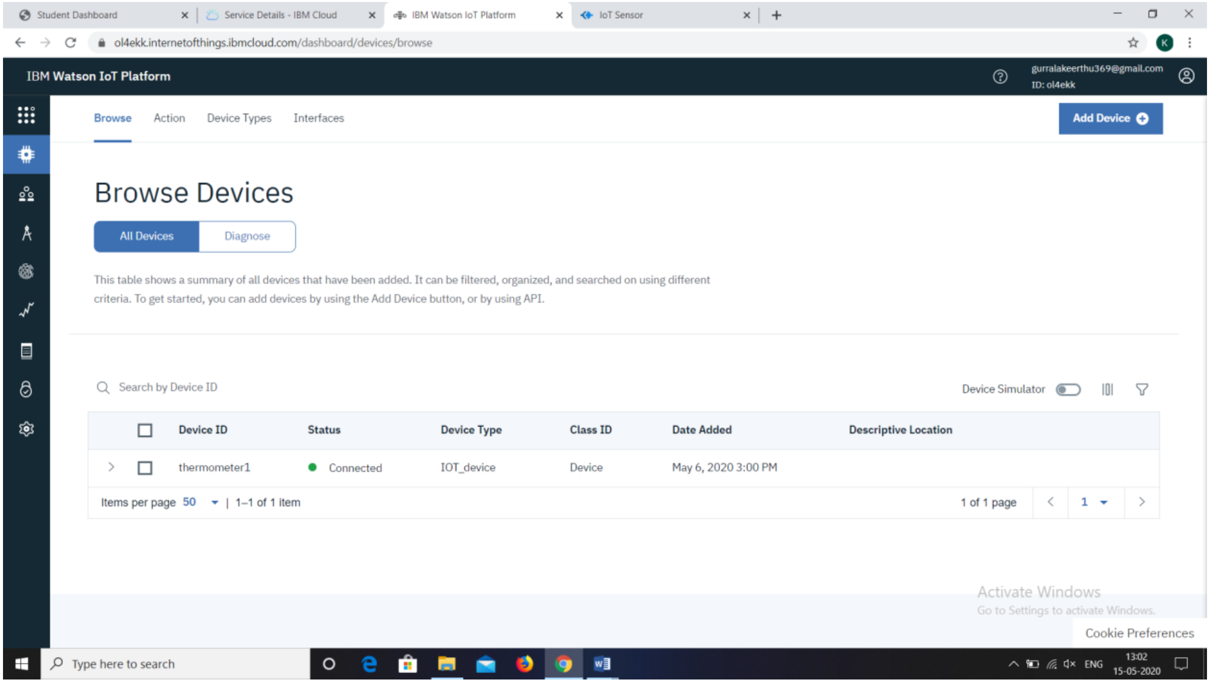


Fig.1-creation of an Iot device.

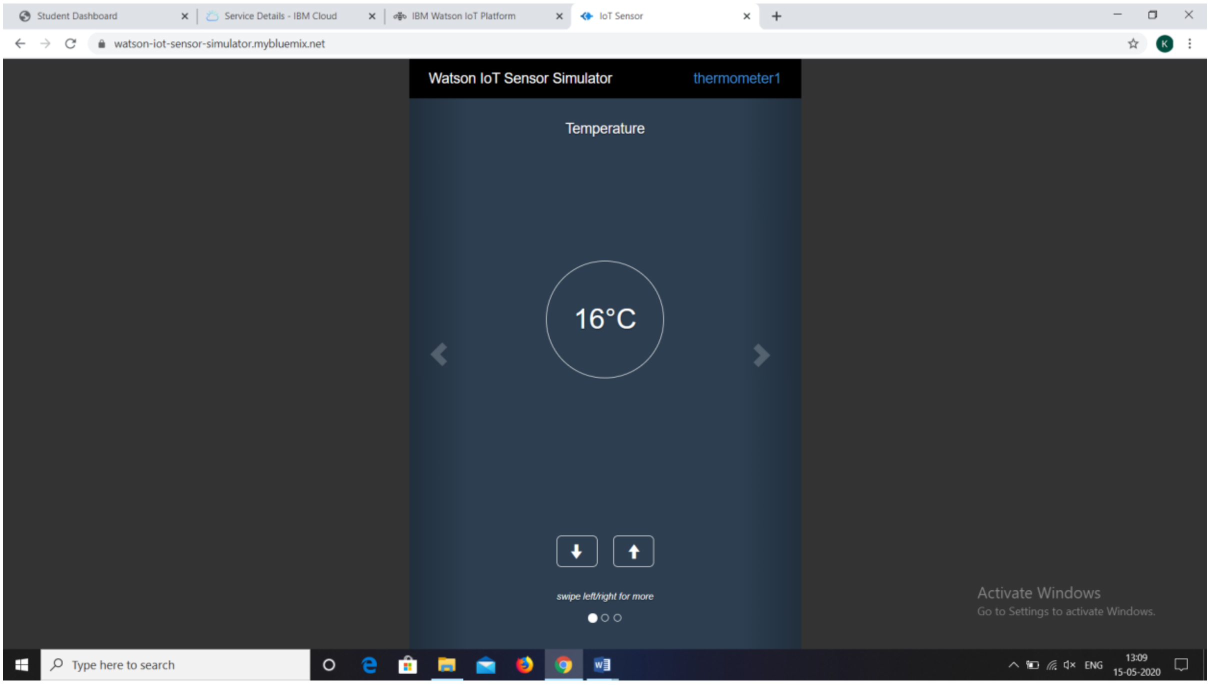


Fig.2 -Watson IoT Sensor Simulator is connected to the IBM IoT device.

Cards have been created in the board to depict the graphs of temperature and humidity as shown below.

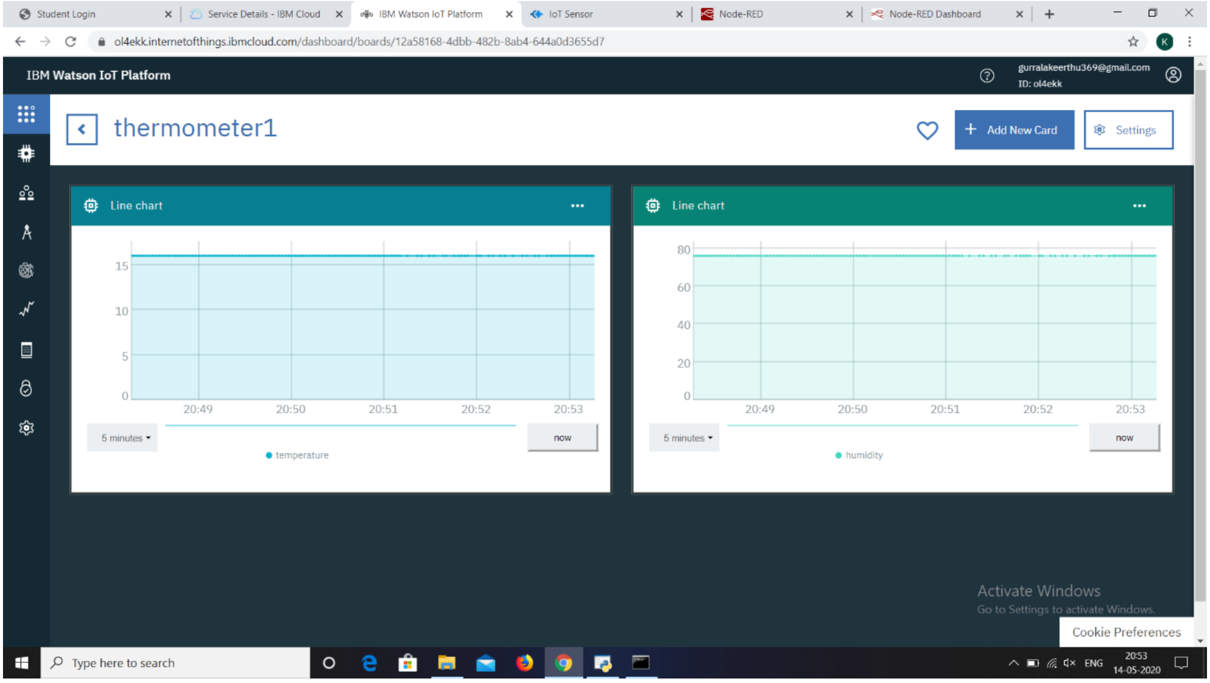


Fig.3-graphs of temperature and humidity.

An Open Weather API account is created. The readings of current location is as shown below.

Fig.4

The node-red is configured to get the weather forecasting data using http requests. The nodes are configured to display the weather parameters which are from IoT simulator and Open Weather API. The nodes are configured to create buttons so that commands are sent to IoT platform.

A python code is subscribed to IBM IoT to retrieve commands so that the device is configured to receive the data from Web Application to control the motors.

PYTHON CODE:

```
import time
import sys
import ibmiotf.application
import ibmiotf.device


#Provide your IBM Watson Device Credentials
organization = "ol4ekk" #replace the ORG ID
deviceType = "IOT_device"#replace the Device type wi
deviceId = "thermometer1"#replace Device ID
authMethod = "token"
authToken = "fVoGSCG5ZzqO!IMMhO" #Replace the authtoken


def myCommandCallback(cmd): # function for Callback
	print("Command received: %s" % cmd.data)
	if cmd.data['command']=='MOTOR_ON':
		print("MOTOR ON IS RECEIVED")

	elif cmd.data['command']=='MOTOR_OFF':
		print("MOTOR OFF IS RECEIVED")

	if cmd.command == "setInterval":

		if 'interval' not in cmd.data:
			print("Error - command is missing required information: 
'interval'")
		else:
			interval = cmd.data['interval']
	elif cmd.command == "print":
		if 'message' not in cmd.data:
			print("Error - command is missing required information: 
'message'")
		else:
```

```
                output=cmd.data['message']
                print(output)

try:
        deviceOptions = {"org": organization, "type": deviceType, "id": deviceId, "auth-method": authMethod, "auth-token": authToken}
        deviceCli = ibmiotf.device.Client(deviceOptions)
        #..............................................

except Exception as e:
        print("Caught exception connecting device: %s" % str(e))
        sys.exit()


# Connect and send a datapoint "hello" with value "world" into the cloud as an event of type "greeting" 10 times
deviceCli.connect()



while True:

      deviceCli.commandCallback = myCommandCallback

# Disconnect the device and application from the cloud
deviceCli.disconnect()
```

5. **FLOW CHART**: The following are the flows in the Node-Red.

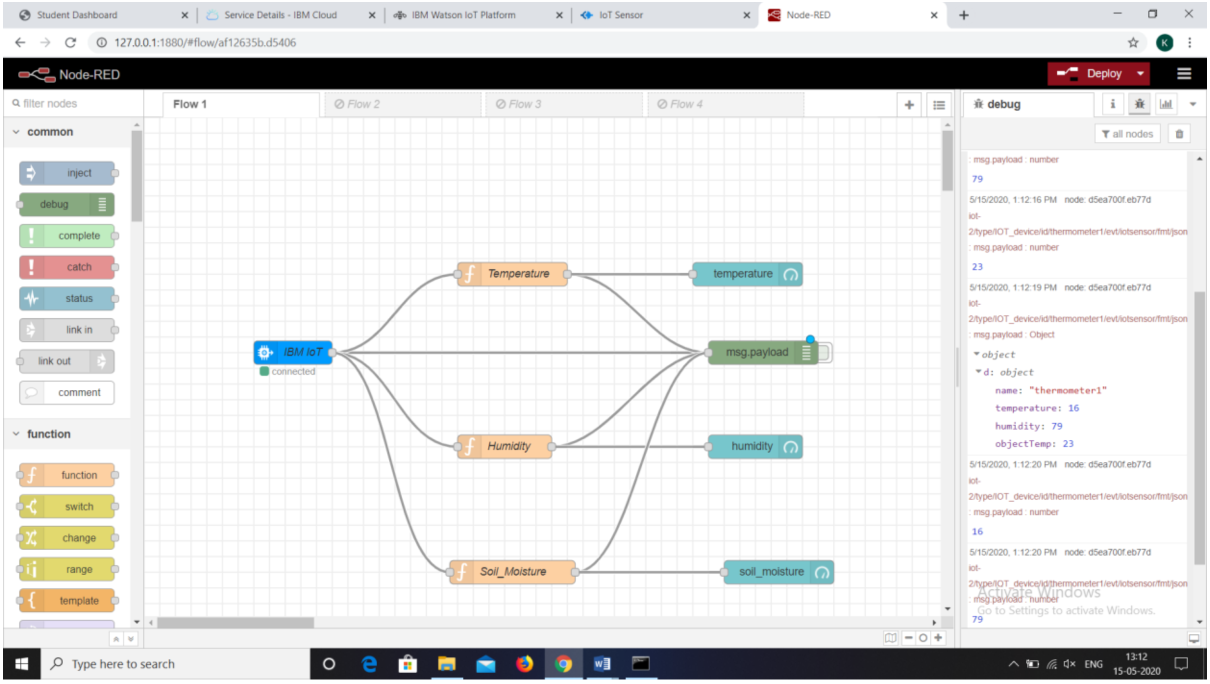


Fig.5- node flow of three parameter values-temperature, humidity, soil moisture in the debug port.

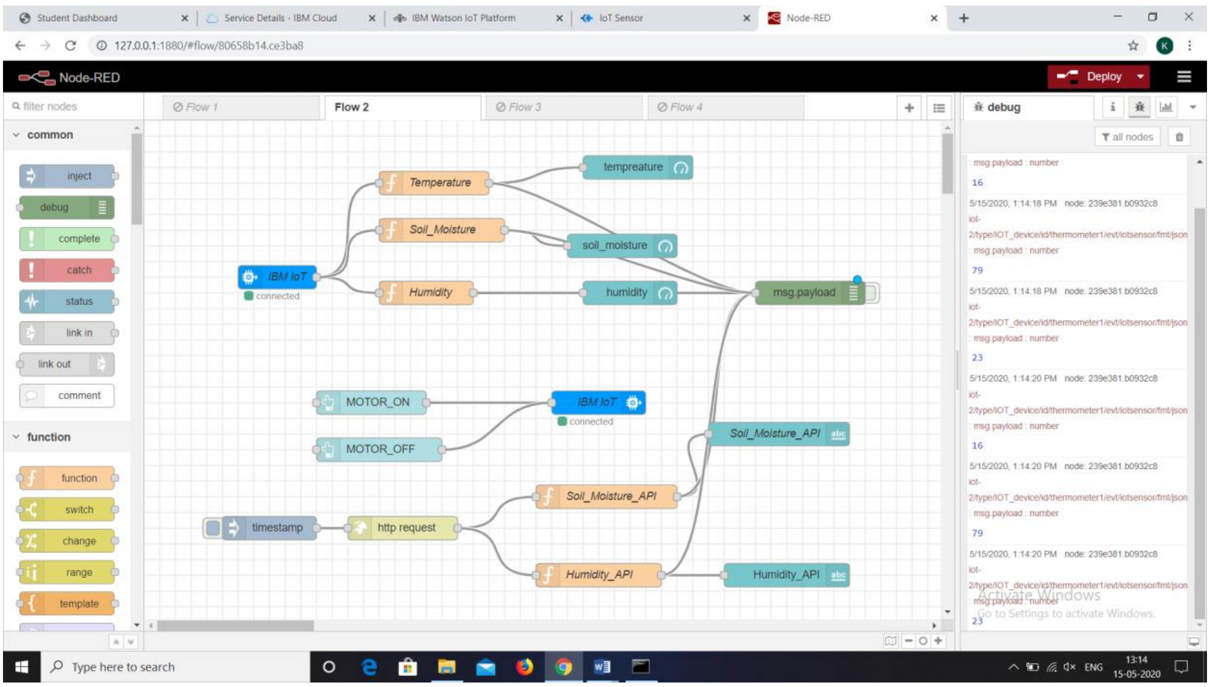


Fig.6-node flow of three parameter values along with the soil moisture API, humidity API and the buttons motor on, motor off.

6. **RESULT**: The results of the above node flows are shown below.

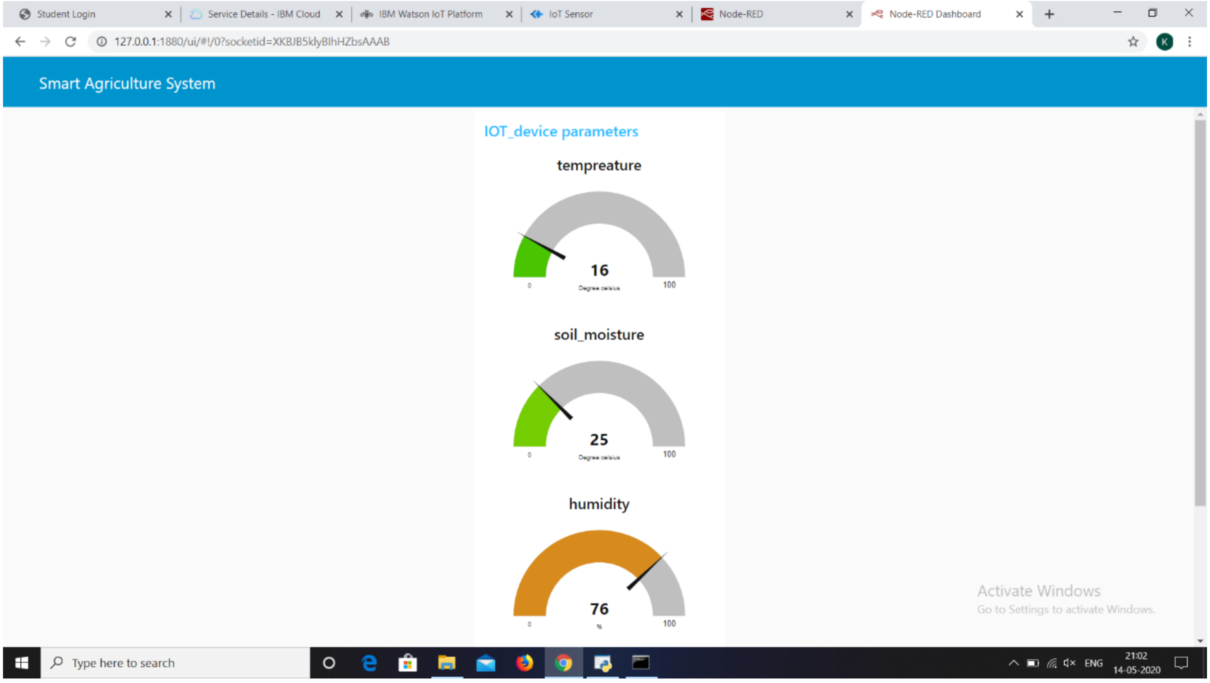


Fig.7-values of temperature, humidity and soil moisture

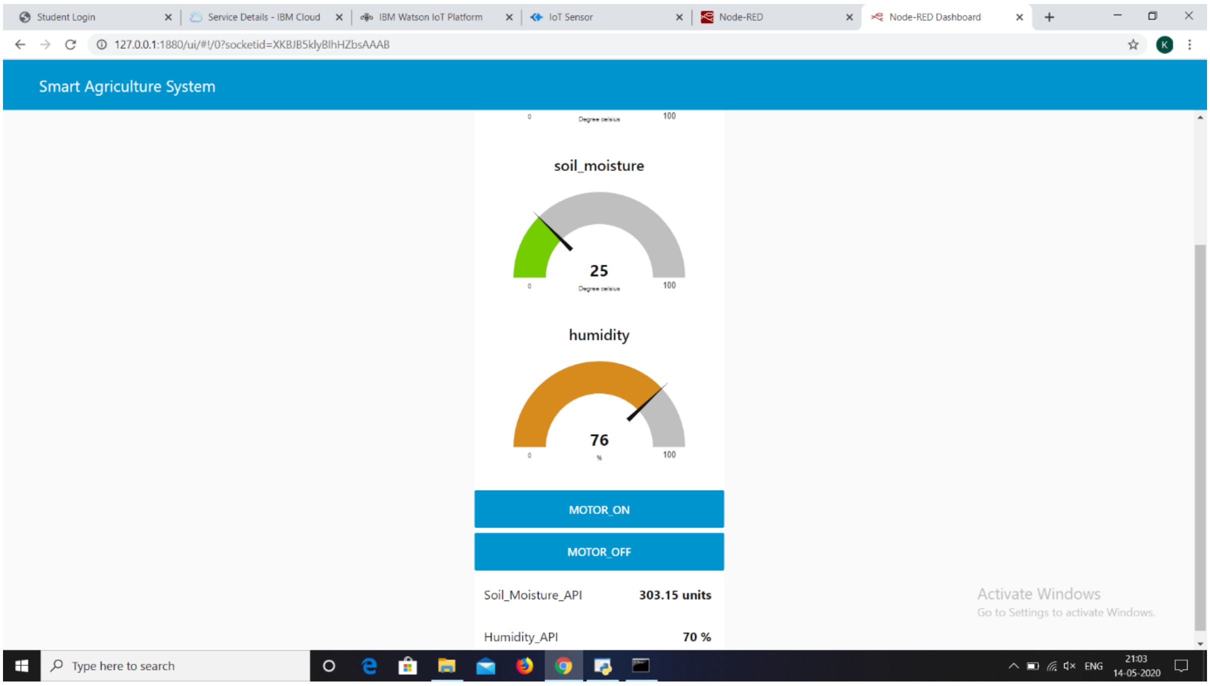


Fig.8-values of temperature, humidity and soil moisture whereas the second result shows the same along with commands motor on, motor off and the API values of soil moisture, humidity.

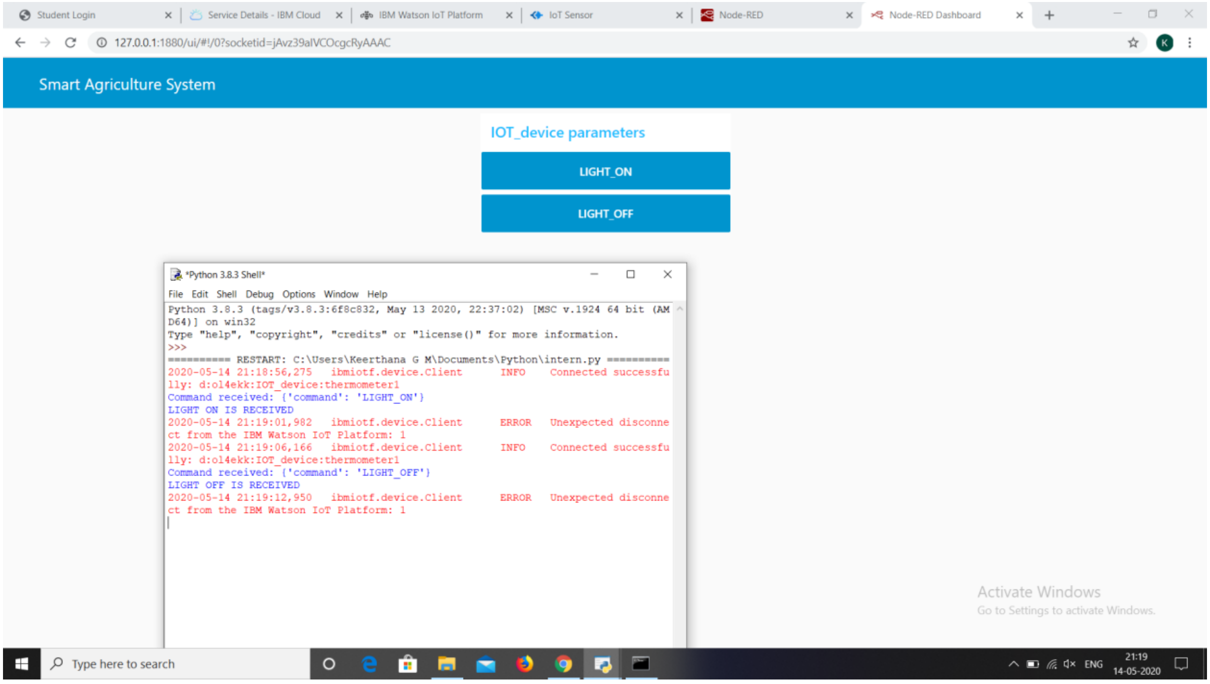


Figure-9-result of running the python code for the commands light on and light off.

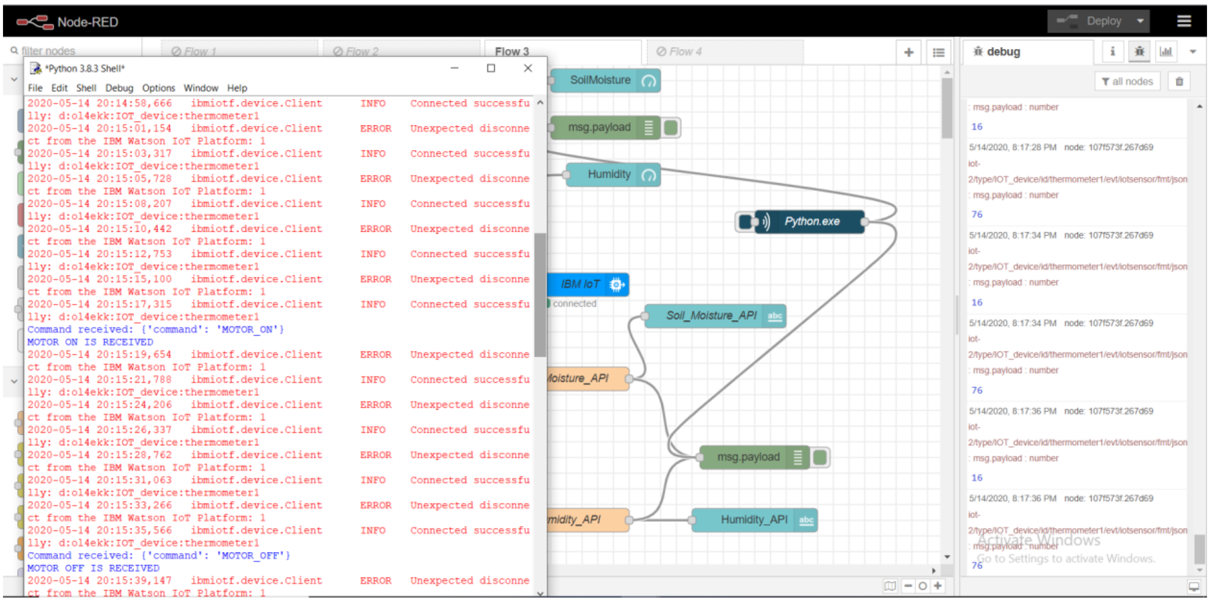


Fig.10-result of running the python code for the commands motor on and motor off.

7. ADVANTAGES:

There are many reasons to implement a smart agriculture solution into commercial and local farming. Monitoring, collecting data for soil moisture, air temperature, air humidity and sunlight intensity across multiple fields will improve efficiency of water usage and crop yield of large and local farms. As the world population increases, farming and food production will have to increase with it. Low cost sensors, data insights and IoT platforms will enable this increase in efficiency and production.

DISADVANTAGES:

Challenges in Using Smart Technologies in Farming: Smart farming will require certain skill sets in particular in order to understand and operate the equipment. In the case of equipment like robots and computer-based intelligence for running the devices, it is highly unlikely that a normal farmer will be able to possess this knowledge or even develop them. Farmers are not used to these high-end technologies. They do not understand computer language or the artificial intelligence.

The other disadvantage is the **cost** involved in smart agriculture is high. Farmers cannot afford those high prices.

8. APPLICATIONS:

Smart agriculture system based on IoT has lot many applications. It can measure various parameters such as humidity, temperature, soil moisture along with weather forecasting details. On monitoring these parameters helps in improving efficiency of water usage and crop yield of farms. Using web application, the motors can be made on and off on basing these parameters. These are the applications of smart agriculture system based on IoT.

9. CONCLUSION:

In review, this project provides way for finding and measuring various parameters which includes temperature, humidity, soil moisture along with weather forecasting details using IoT simulator and IBM Watson IoT platform. Node-Red, tool for wiring online simulators and API is used to predict those values. Using a mobile application, the farmer can water his crop by controlling the motors on basing these parameters by retrieving commands from IBM IoT.

10. FUTURE SCOPE:

Agriculture plays vital role in the development of agricultural country. In India about 70% of population depends on farming. Issues concerning agriculture have been always hindering the development of the country. The alternative for this is smart agriculture by modernizing the current traditional methods of agriculture. Hence the project aims at making agriculture smart using automation and IoT technologies.
Smart Agriculture System based on IoT can monitor soil moisture and climatic conditions to grow and yield a good crop. 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 these parameters, farmer can water the crop by controlling the motors using the mobile application.

11. BIBLIOGRAPHY:

APPENDIX (SOURCE CODE):

[1]
https://www.engineering.com/DesignerEdge/DesignerEdgeArticles/ArticleID/16653/Smart-FarmingAutomated-and-Connected-Agriculture.aspx

[2]
https://www.semanticscholar.org/paper/IoT-based-Smart-Agriculture-Gondchawar-Kawitkar/c77d1965f44f2aa55eef4220251841e9551ed1b2