Name of the project:SMART AGRICULTURE SYSTEM
Client:Smartinternz
Manager:Anjali Kalwar
Date: 21 /05/20

PROJECT REPORT ON-
SMART AGRICULTURE SYSTEM USING IOT

INTERNSHIP UNDER -
SMARTINTERNZ

MADE BY-
ANJALI KALWAR

PROJECT REPORT INCLUDES-

- Introduction
- Literature survey-

1. Existing problems
2. Proposed solution

- Theoretical Analysis

1. block digram

- Software Designing

1. IOT platform
2. Node-RED
3. Python code

- Flowchart
- Results
- Hardware components
- Advantages
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SMART AGRICULTURE SYSTEM BASED ON IoT

INTRODUCTION:

- Smart Agriculture System is for the farmers that work in feilds. It will be an IOT based system which will be a solution to many problems that farmers face.
- The farmers will be able to get all the information like soil moisture, weather forcasting , etc on their phones and they will also be able to do their activities from anywhere .
- The main purpose is to save water and increase productivity of crops by not only decreasing the labour work but also bringing modernization into agiculture by giving some basic information and handling the agriculture systemon finger tips.

LITERATURE SURVEY-

EXISTING PROBLEMS-

1. The farmers working in the farms go through many problems.
2. They have to walk long distances in sun to 'on' and 'off' the water pump for irrigation.
3. These impacts the health of farmer and increases the rate of labour work done by farmers.
4. Sometimes there can be problems like over flooding of water .
5. This can degrade the quality of soil.
6. Farmers also face problems related to water management

PROPOSED SOLUTION-

1. Smart Agriculture System will decrease the labour work done by the farmers and can help them to do agriculture in large farms.
2. For the best quality and quantity of crops, the farmers should have a complete knowledge about the soil moisture, temperature , weather condition ,etc and should also be able to fix some problems like dry soil by not actually doing a lot of labour work.
3. This project will help the farmers to actually maintain favaourable conditions for crops to grow healthy and easily.

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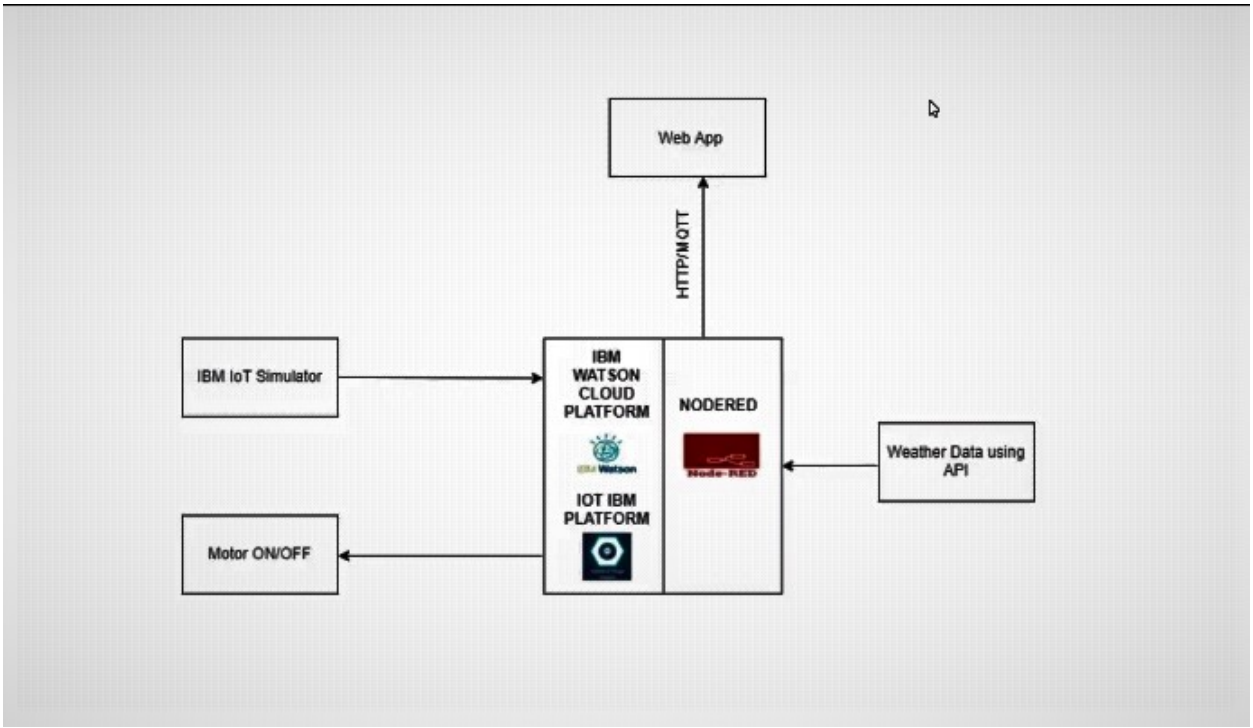
THEORITICAL ANALYSIS-

BLOCK DIAGRAM-



SOFTWARE
web app (using nodred ,IBM IoT simulator, IBM cloud platform)

DESIGNING-

Software designing:

1. Sign-in to your IBM cloud account from the link https://cloud.ibm.com/login. Then , go to Catalog and search for IoT in the search bar. Then select Internet of Things platform and subscribe for the desired plan and click create. Now, in the menu, go to Resource List - - Services - - Internet of Things Platform and then click Launch, as shown below:

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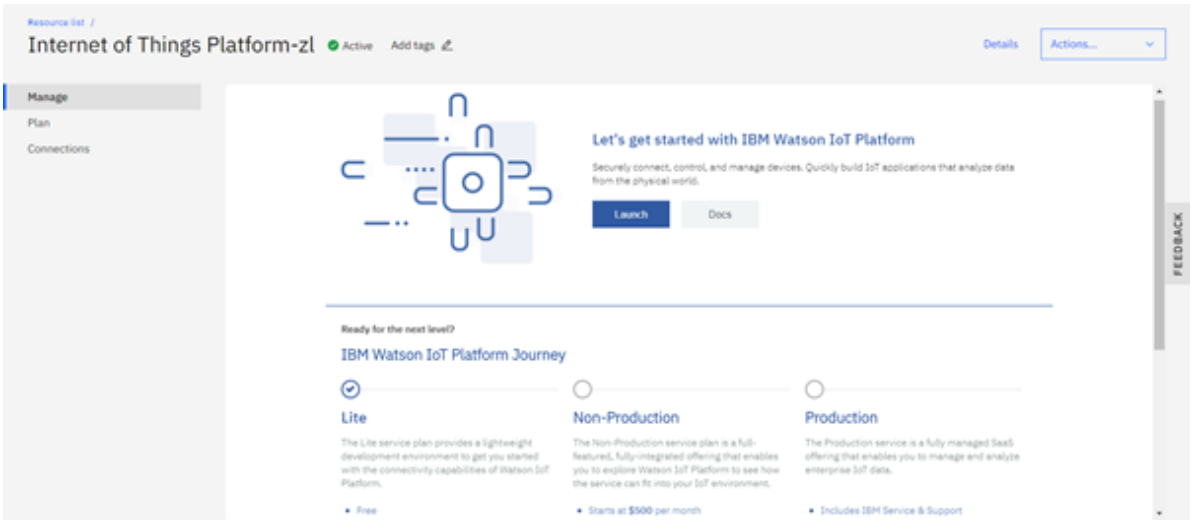
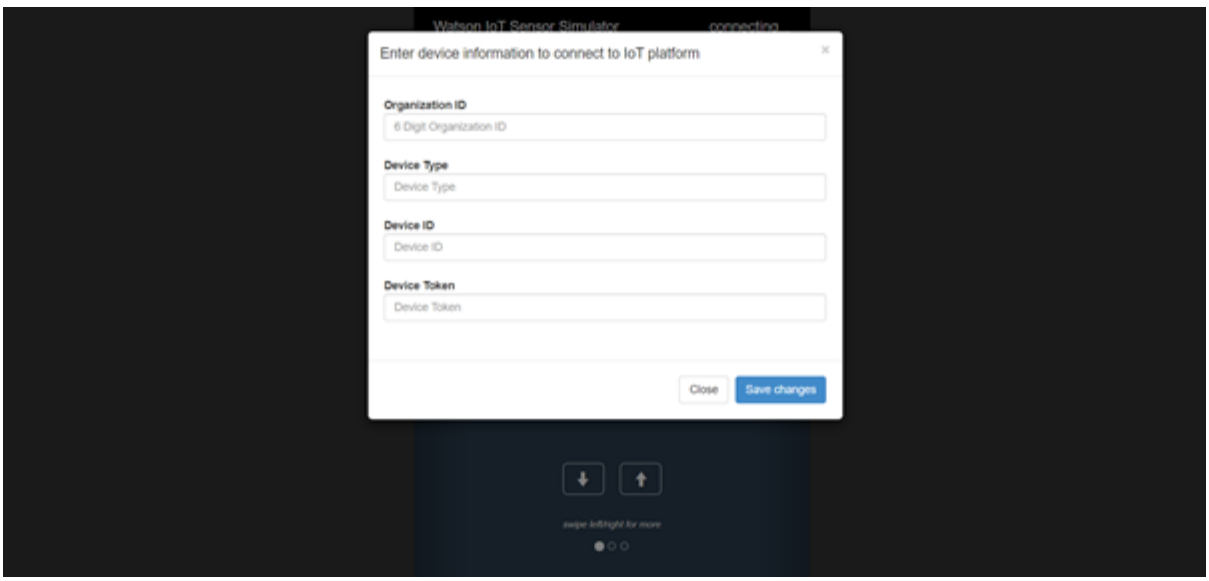


Now in the Watson IoT platform, click on the Add Device button at the top right corner, as shown below, to create a device to get the soil conditions from the sensor (simulator).

Make a note of the device credentials given during the device creation for further uses.

Now go to http://watson-iot-sensor-simulator.mybluemix.net/ to use the IoT sensor Simulator to generate sensor data to be uploaded to the cloud. It redirects to the screen similar to the following image. Here, give the device credentials that are saved earlier while creating the device.



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Now, we can view the simulator data in the Watson Iot Platform by creating cards in the Boards section at the left. Now, once the sensor data is received by the cloud, we use a special tool called Node-Red, a low-code programming tool for event-driven applications, to build a Web-App.

ABOUT NODE-RED

Node-RED is a programming tool for wiring together hardware devices, APIs and online services in new and interesting ways.It provides a browser-based editor that makes it easy to wire together flows using wide range of nodes in the pallete that can be deployed to its runtime in a single click.

The platform of Node-RED is Node.js and is written in JavaScript.

HOW TO INSTALL NODE-RED?

1. Install Node.js

Download the latest 10.x LTS version of Node.js from the official Node.js home page. It will offer you the best version for your system.

Once installed, open a command prompt and run the following command to ensure Node.js and npm are installed correctly.

Using Powershell: `node --version; npm --version`

Using cmd: `node --version && npm --version`

2. Install Node-RED

Installing Node-RED as a global module adds the command `node-red` to your system path. Execute the following at the command prompt:

```
npm install -g --unsafe-perm node-red
```

3. Run Node-RED

Once installed, you are ready to run Node-RED.

Now, to build the web app for the Smart Agriculture System using Node-Red, a minimum of three flows would be required:

Flow-1: To take the weather forecast data from Open Weather API.
Flow-2: To take the sensor data from the IBM cloud.
Flow-3: To control the motor by passing commands to the cloud.

WORKING ON NODE-RED-

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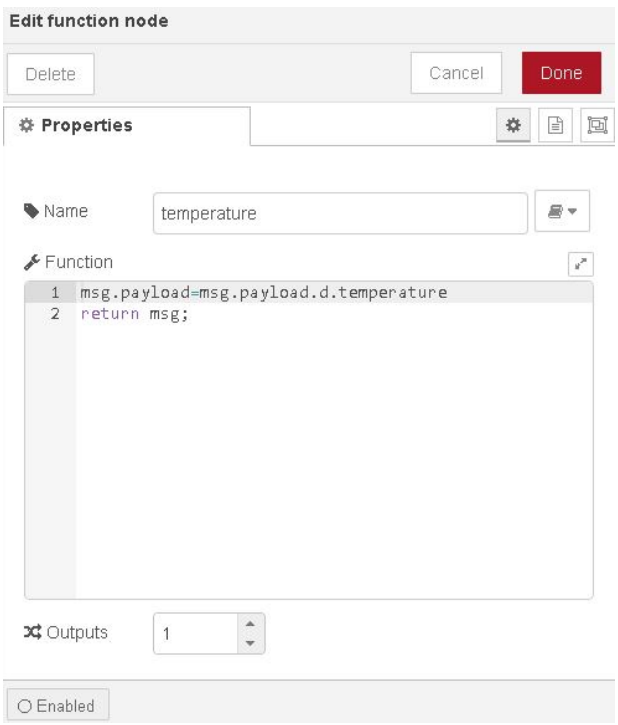
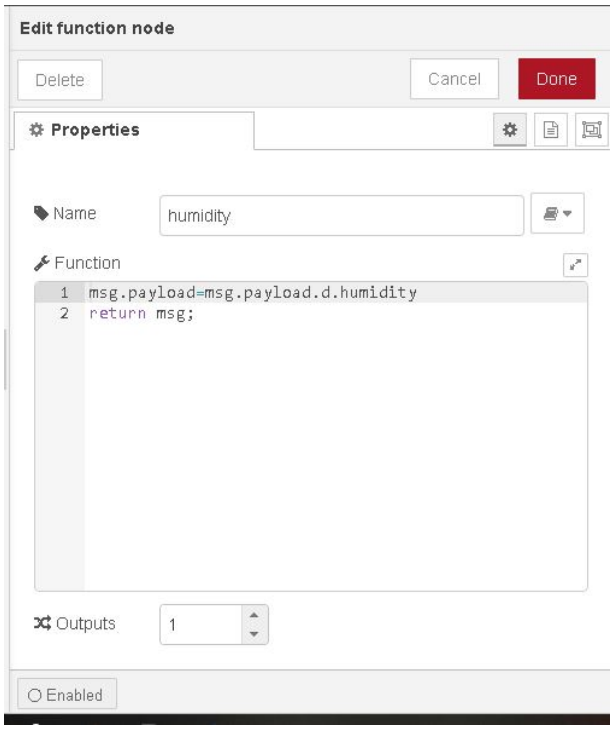
FOR TAKING INPUTS FROM SENSORS ABOUT SOIL-
Use the IBM IoT input node- Use the IBM IoT node and edit its properties to get connected to the device created in IoT platform using the API key generated.
Use the function node- use the function node and edit its properties and write the code below

for temperatue labelled node-
msg.payload=msg.payload.d.temperature
return msg;

for humidity labelled node-
msg.payload=msg.payload.d.humidity
return msg;

for soilmoisture labelled node-
msg.payload=msg.payload.d.objectTemp
return msg;





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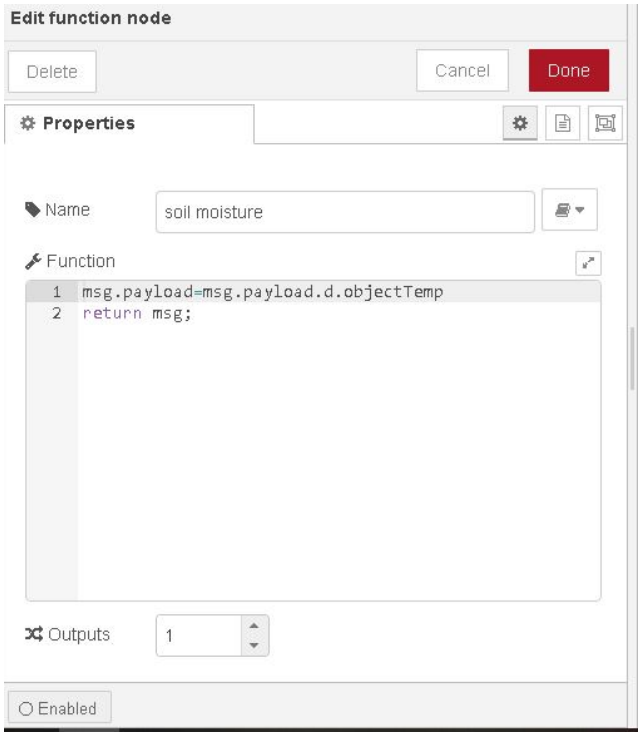

Use the debug node - msg.payload is the default name labelled. This nodes debugs the flow and gives the output.
Use the gauge node- These are attached to the function nodes and are visible in UI .

FOR SENDING COMMANDS AND CONTROLLING MOTORS-
Use IBM IoT output node- Edit its properties to control the another device (control the motors).
Use the button nodes- Edit its properties to make the UI user friendly.

FOR TAKING WEATHER READINGS-
Use the input node- Edit its properties to time stamp .
Use http request node- Edit its properties to get weather condition information from https://openweathermap.org/ (make an account and put your location)
Use function nodes- use the function node and edit its properties and write the code below

for humidity-
msg.payload=msg.payload.main.humidity
return msg;

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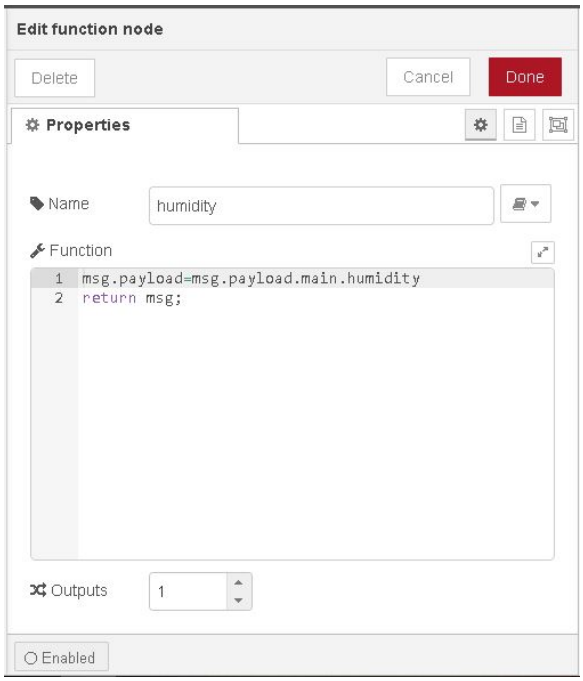
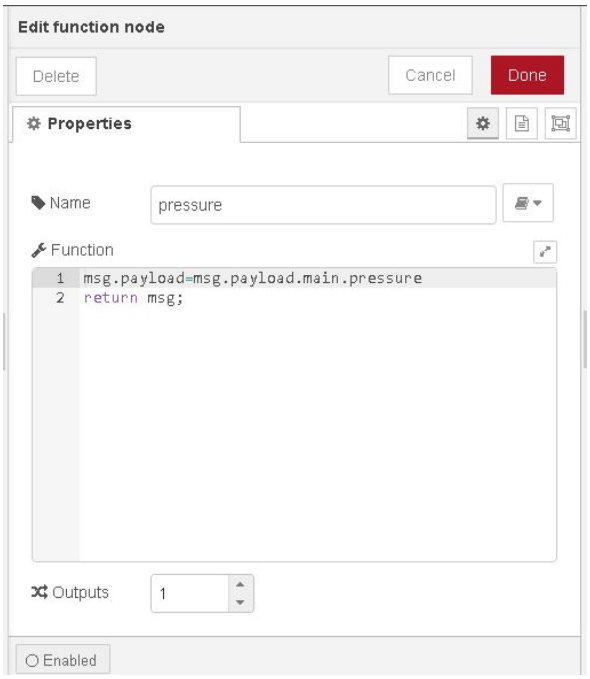
for pressure-
msg.payload=msg.payload.main.pressure
return msg;

for temperature
msg.payload=msg.payload.main.temp
return msg;
for temperature and also converting it to degree celcius
msg.payload=Math.round(msg.payload.main.temp-273.15)
return msg;





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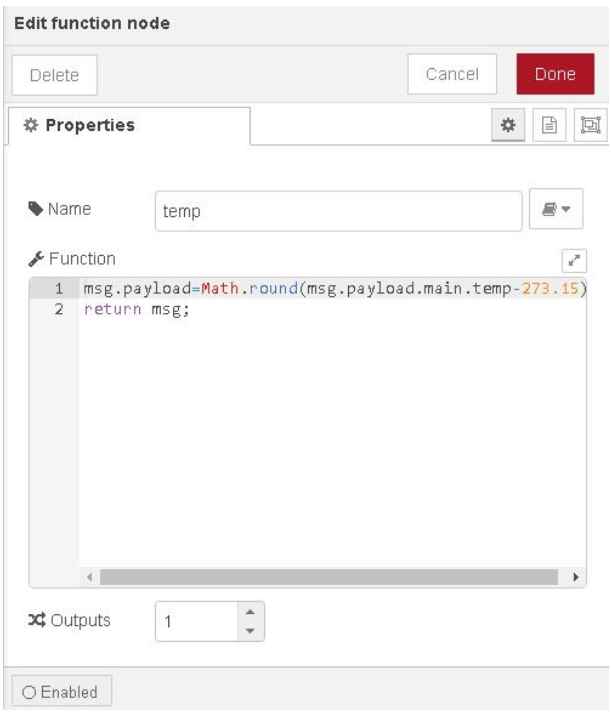

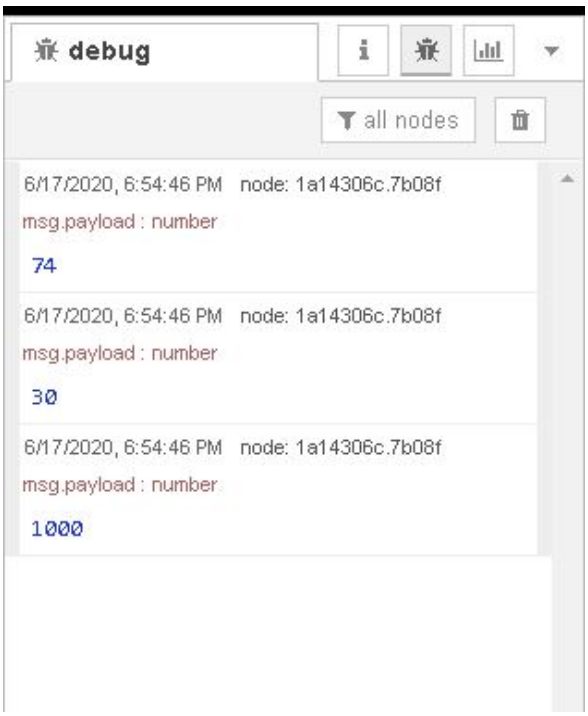

Use debug node-msg.payload is the default name labelled. This nodes debugs the flow and gives the output.
Use gauge nodes- These are attached to the function nodes and are visible in UI .

Connect the flows as shown in diagram .
Install the required nodes from mange pallete option.

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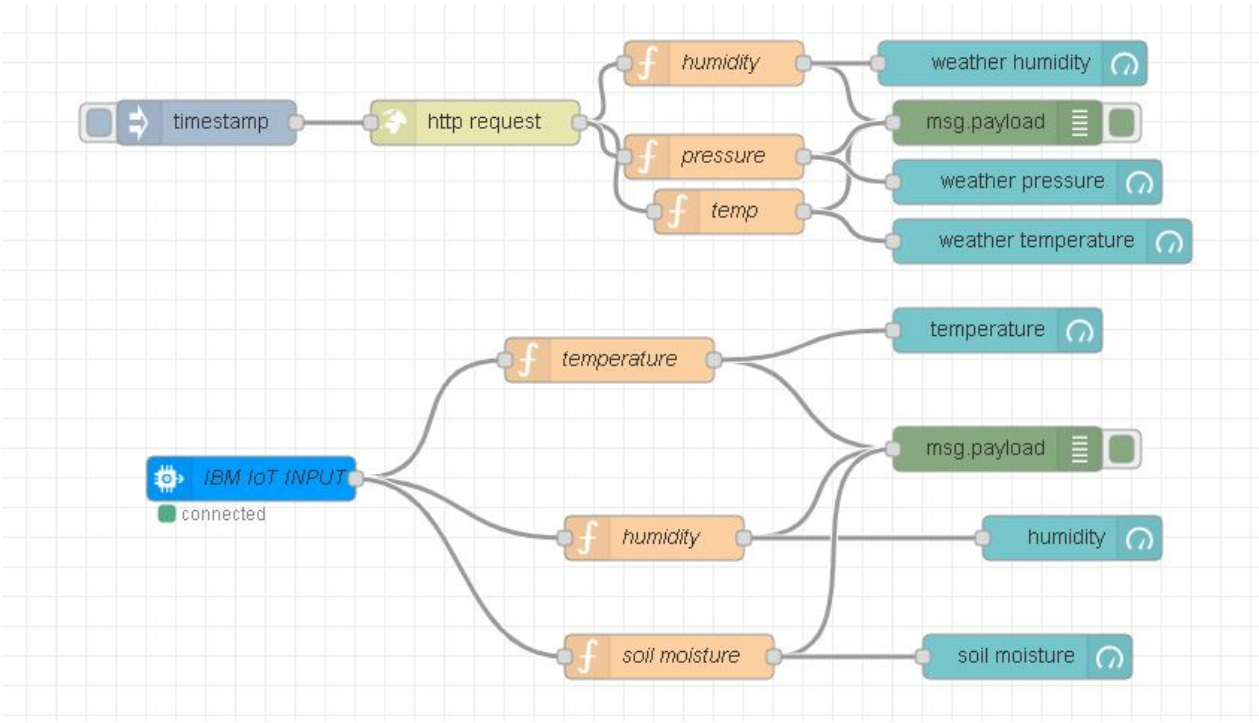

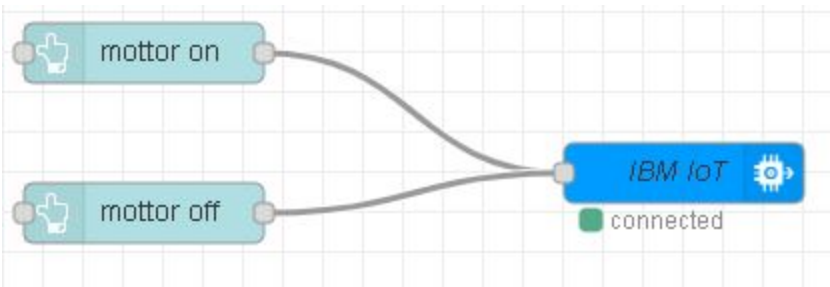

PYTHON CODE for controlling the second device that controls motor

```
import time
import sys
import ibmiotf.application # to install pip install ibmiotf
import ibmiotf.device
```

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```
#Provide your IBM Watson Device Credentials
organization = "7Sbcix" #replace the ORG ID
deviceType = "motor"#replace the Device type wi
deviceId = "12345789"#replace Device ID
authMethod = "token"
authToken = "1234567VV89" #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()
```

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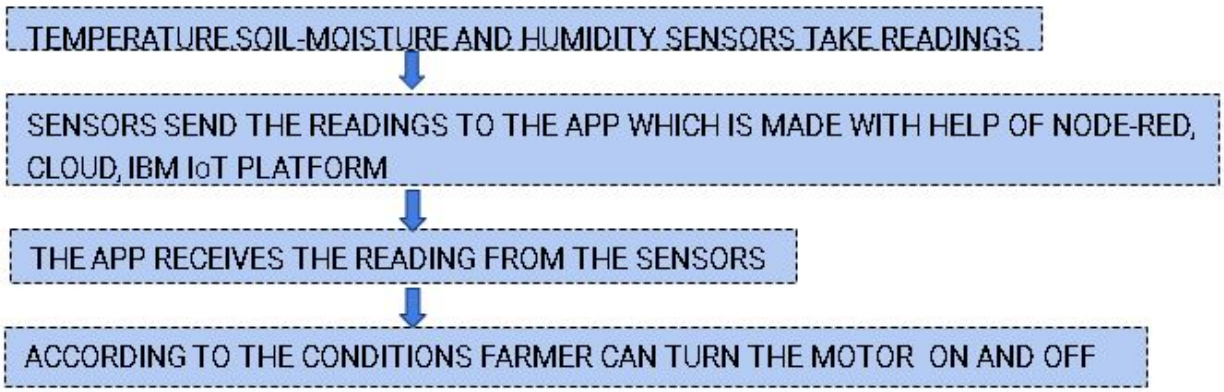
```
# Connect and send a datapoint "hello" with value "world" into the cloud as an event of type "greeting" 10 times
deviceCli.connect()

while True:

    deviceCli.commandCallback = myCommandCallback

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

FLOWCHART-



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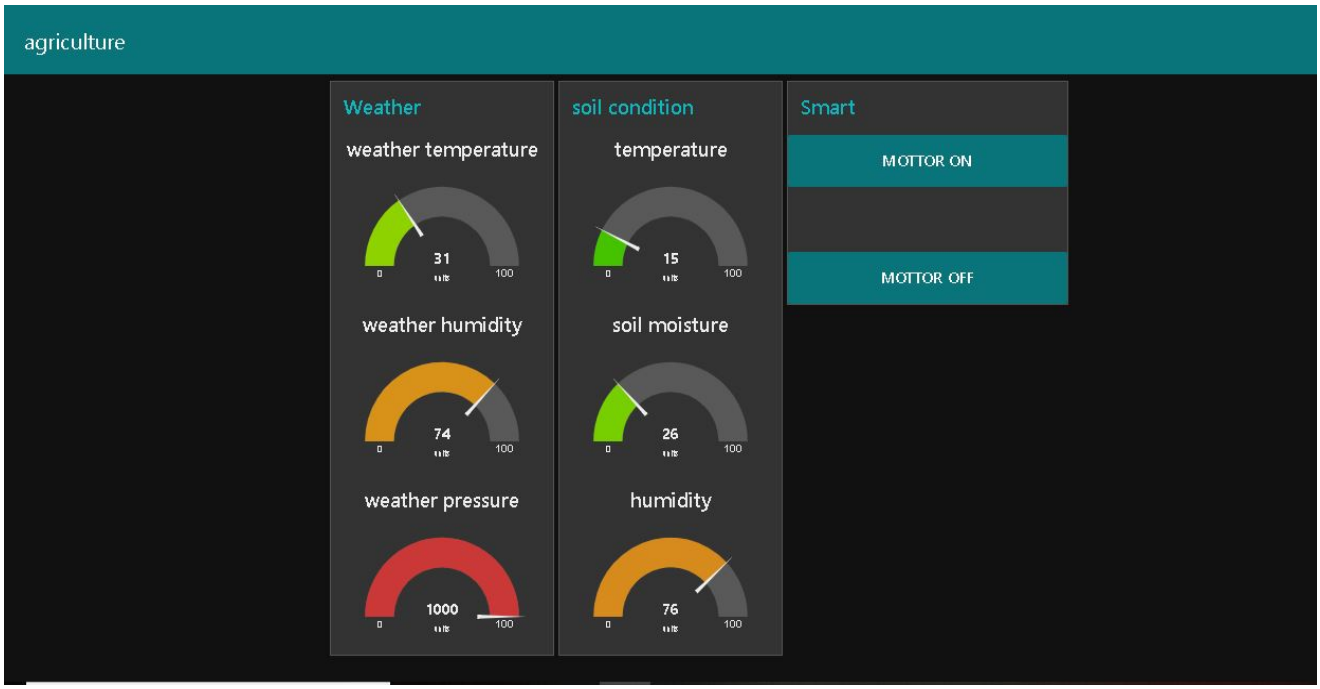
RESULTS-

Farmer will be 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.
This reduces the labour work and give better crops.
Adopting such systems can allow us to do multi-tasking



When the farmer presses the "motor on" or " motor off" button -
The output of python code-

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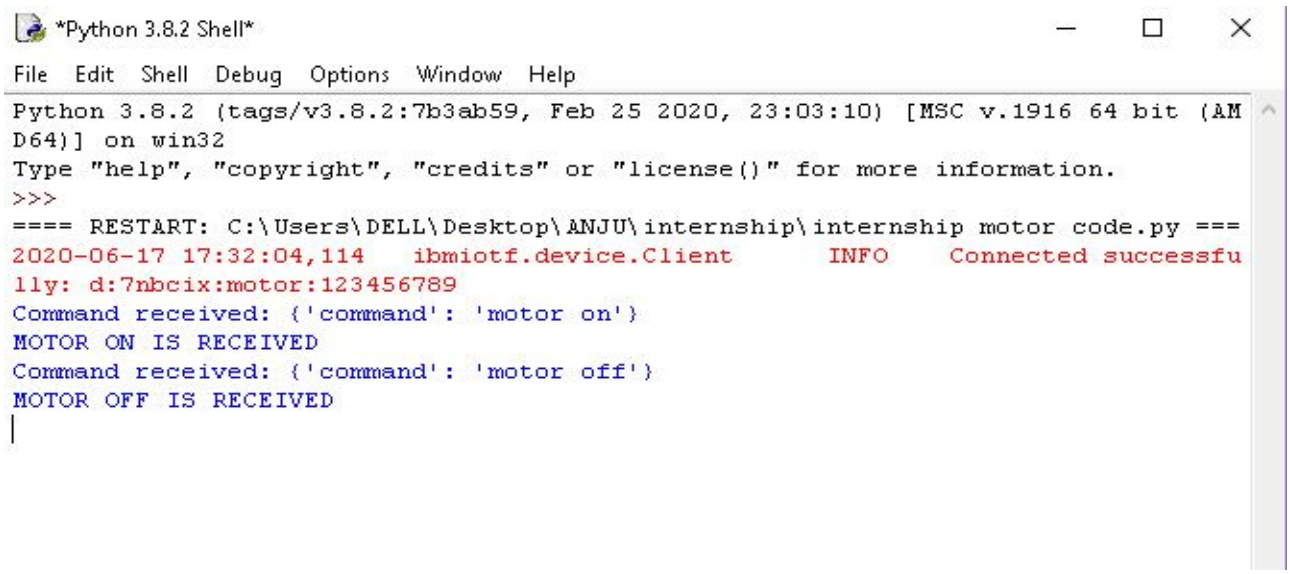
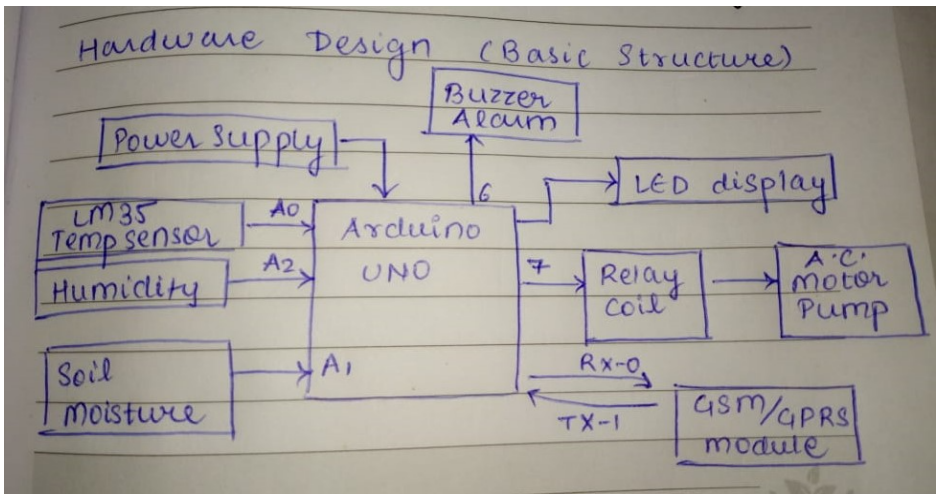


Hardware diagram

HARDWARE COMPONENTS

Arduino UNO, soil moisture sensor , temperature sensor(lm35),humidity sensor, object temperature sensor, LED display, GSM/GPRS module, relay coil, power supply.



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Working of hardware components-

1. The soil moisture sensor, humidity sensor and the temperature sensor senses and sends the readings to led display through arduino .
2. It takes 3 readings and gives the accurate reading which is further sent to GSM/GPRS module .
3. This GSM/GPRS module forwards the information to the app installed in phone .
4. Through this the farmers get the information about their farms and can further control the motors on their finger tips.

ABOUT SENSORS-

SOIL MOISTURE SENSOR-

- The sensor blade is constructed of multilayer fiber glass stick
- There is no electrical contact with the soil
- It uses capacitance to ensure dielectric permittivity of surrounding medium
- In soil, the dielectric permittivity is a function of water content
- A sensor creates a voltage proportional to the dielectric permittivity and therefore the water content of soil.
- We will use volumetric soil moisture sensor as it check the amount of water in soil . Three types in this category are TDR, TDT and FDR.
- Tensiometric is another type but it checks the capacity of soil to absorb water.

TEMPERATURE SENSOR-

- In temperature sensor LM35 output voltage is directly proportional to degree celcius.
- It can check temperature between range -55 degree celcius to 150 degree celcius LM35C has range between -40 to 110 degree celcius (-10 degree celcius improved accuracy)
- Sensitivity is 10mV/degree celcius.
- Output is in centigrade (does not require any external calibration circuitry).

HUMIDITY SENSOR-

- Humidity sensor is a device that detects and measures water vapor.
- A humidity sensor or hygrometer senses, measures and reports both moisture and air temperature.
- The ratio of moisture in the air to the highest amount of moisture of a particular air temperature is called relative humidity.

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GSM/GPRS module-

- GSM -Global System for Mobile communication.
- It is a chip / circuit that establishes communication between a mobile device or computing machine and a GSM/GPRS system.
- GSM is available as SIM900/SIM900A/SIM900D.
- SIM900 supports all four frequency brands that is 850, 900, 1800, 1900 Mhz.
- Input power depends on manufacture.
- It may need 15V/1A DC or 12V/1A DC.
- Sometimes only 5V is needed and hence it can be directly connected to Arduino.

ADVANTAGES-

- Better management-

According to the soil and weather condition, the farmer can control the motors.Hence not much water will be wasted unnecessarily .Since not muchwater is wasted by giving to the soil , the soil quality does not deteriorate. This leads in improvement of water management .

- Improves productivity-

Sometimes crops are damaged due to overflooding of water. Hence this app will take care that the soil gets the exact amount of water required to give the best production of crops.

- Weather and soil conditions available in hands within no time-
- Constantly monitoring land-
- Motor controls are handy-
- Labour work reduced-

DISADVANTAGES-

- Smart phone is a must requirement
- Compatibility of devices
- Availability of internet
- Chances of failure of sensors after a span of time
- Cost-expensive

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APPPLICATIONS-

Smart Agriculture system can be used in farms for better productivity and for solving issues of water management and also taking care of the hard-working farmers by reducing the rate of labour work in their daily lives .

CONCLUSION-

This IoT application in farming can be a great step towards a better management system and a productive farm. Only wih controls on finger tips, a frmer can operate things on farm from far away which reduces his labour. Although, this system can be expensive at starting stages but after mass production this system can be a thing of great advantage for everyone.

FUTURE SCOPE-

Iot when worked on low power consumptions and low power communications, it will be beneficial for farmers. Low cost is the key factor for Iot . When worked on its specifications, better results are expected. Sensors that can add to the fertility of the soil by calculating the amount of essential components like salt, ph, potassium, etc . can support our economy by bringing a drastic increase in production of crops . Sensors can also let us know about the actual amount of fertilizers and insceticides needed by the crops. This will bring modernization in agriculture .

BIBILOGRAPHY-

Articles on this topic-
https://ieeexplore.ieee.org/abstract/document/8355152
https://ieeexplore.ieee.org/abstract/document/7857638

To get more detailed information about node-red installation click on the link below-
https://nodered.org/docs/getting-started/windows#1-install-nodejs

cloud account link-

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https://cloud.ibm.com/login