SPS-5843-Real-time Weather based Smart Sprinkler System

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1 INTRODUCTION

1.1 Overview

One of the major factors in the design, refurbishment and long-term maintenance of any golf course is the way the greens and fairways are watered. In some golf courses watering systems such as sprinklers or drip water wires are fitted to sprinkle the water automatically and reduce human load. Normally sprinkler systems operate with respect to time, which means if we program it on 9 am it will be on even if rain occurs during that particular time. Since water is a precious resource we need to use it very carefully. The Internet of things will make the system more efficient.

1.2 Purpose

Water scarcity will directly affect nearly 20% of the human population by 2025, UN reports state, and indirectly influence the rest of the planet's inhabitants as well as economies and the whole ecosystems. Smart water systems based on the combination of Internet of Things, big data and AI technologies can help stop these predictions from happening and undo the damage the imprudent usage of water resources has already caused.

1. **Reduce wasting water** used in high volumes in such areas as manufacturing, agriculture, power production. It implies the introduction of high-tech practices like precision farming, smart irrigation and real-time water metering. Learn about our agriculture software development services.
   2. **Improve water quality** and prevent contamination by chemical waste and natural pollution such as acidification. In order to improve and maintain the quality of water, companies use sensor technology for real-time monitoring and control.
   3. **Enhance the efficiency of water systems** such as water collectors, treatment plants, distribution mains and wastewater recycling centers. Using

IoT and data solutions for asset management, companies can keep important measurements such as water pressure, temperature, flow, etc. in sight, practice predictive maintenance and avoid breakage and downtime.
4. **Implement leakage control** by using smart water management devices equipped with leak and moisture sensors. Considering that almost $3 billion are spent on fixing the damage caused by leakage yearly, leakage control is essential to keep water resources and budgets save.
5. **Practice consumption monitoring** to optimize and keep under control the usage of water resources at different levels — in a household, industry, the country or the whole planet.

2. LITERATURE SURVEY

2.1 Existing System

2.1.1 Smart irrigation

One of the leaders among IoT professionals, Bosch provides a sensor-based solution for smart on-demand irrigation. It measures water status in plants to make sure they get just enough water for the best nutritional value and highest yield.
Collected data on the plant's "thirst" is combined with the weather forecast. AI algorithms then calculate the ideal irrigation scheme based on this data and help farmers keep their crops at the ultimate health.

2.1.2 Water system integrity

Adcon is a smart water company that provides a wide range of water management services from leakage detectors to irrigation management and rainwater monitoring. One of the company's solutions is focused on smart water measurement and quality monitoring for different businesses in the supply chain — farmers, meteorologists, utility services, etc. The solution includes sensors, stations, telemetry

units and software which processes generated data and creates insights for the decision-makers.

2.1.3 Smart Water Solution at Digiteum

At Digiteum, we design and develop IoT software and big data applications for sustainable and resilient use of resources. One of the systems we have been working on is a power consumption monitoring system paired with solar that allows households to get full control over their electricity usage and go completely off-grid.

2.2 Proposed Solution

In the proposed solution the soil moisture levels in the golf course should be continuously monitored, updated to IBM IoT platform and store the data in Cloudant DB.by considering the weather forecasting details from the open weather map, the system should control the sprinklers automatically. Develop a mobile App to visualize the soil moisture and weather parameters.

Project Flow:

- Configure and connect the online simulator to publish temperature, humidity and soil moisture values to IBM IoT Platform.
- Create a Node-RED flows to get the data from IBM IoT platform and store it in Cloudant DB.
- Create HTTP API's in Node-RED to send the sensor data to mobile app and also to get the commands from mobile application.
- Create a mobile app to visualize the sensor parameters and also to get the open weather data.
- Configure the mobile app to send commands to IBM IoT Platform to control the sprinklers based on the sensor values and weather details.

3. THEORITICAL ANALYSIS

3.1 Block diagram

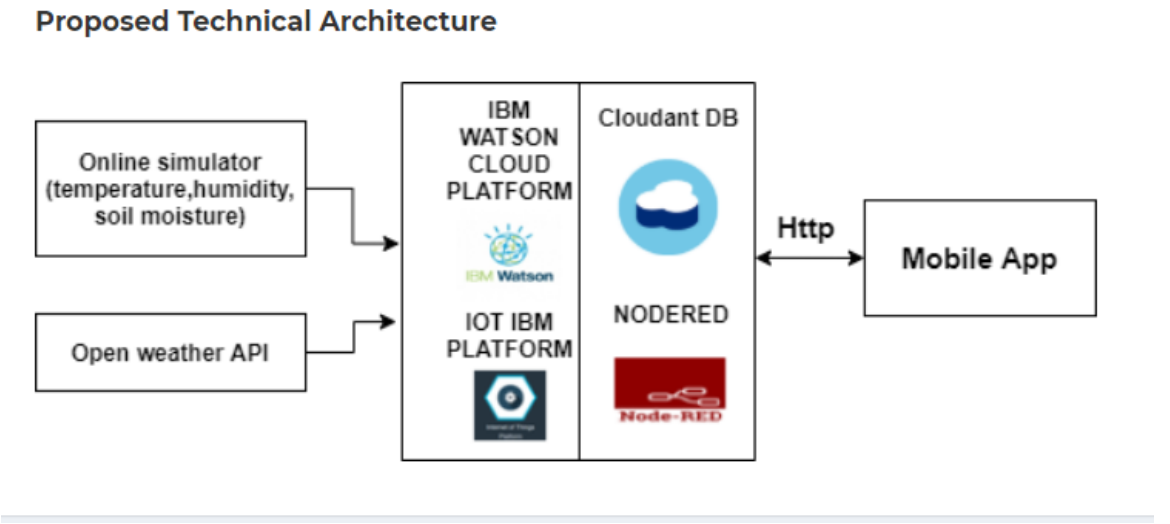


Figure 1:Proposed model diagram

In proposed retrieving data from both real time weather parameters like pressure, Humidity and temperatu values from real-time weather applications as well as sensor values from the golf ground. The weather parame stored in IBM cloudant DB running over IBM WATSON CLOUD PLATFORM. Mobile application is created the client side which has to access the sensor data from IBM cloud. In this proposed model we send the notificati message in email to trigger the user switch on the sprinkler. The sprinkler control command directly send fro mobile application by clicking the button in the mobile application.

3.2 Hardware / Software designing

Hardware:

NODEMCU

SENSORS- Temperature Sensor-LM35

Humidity Sensor- Bosch BME280

Pressure sensor - Bosch BME280

Software:

IBM Watson Cloud platform

Node-Red service

MIT Mobile App Inventor

IOT simulator Sensor

IBM cloudant DB

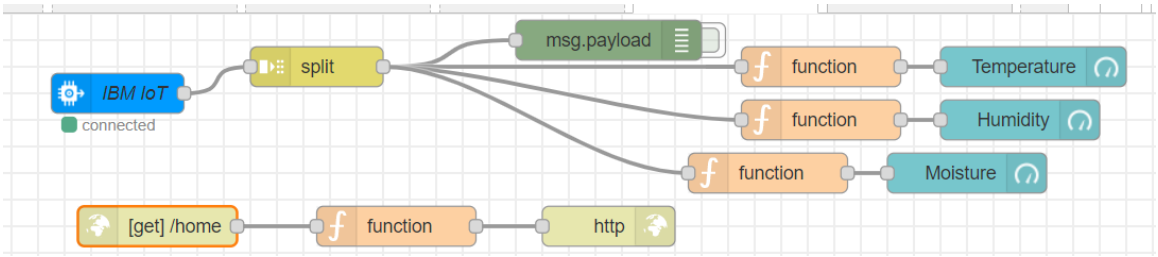
4. EXPERIMENTAL INVESTIGATION

4.1 Create UI to display the soil moisture, temperature Humidity and also weather forecasting data

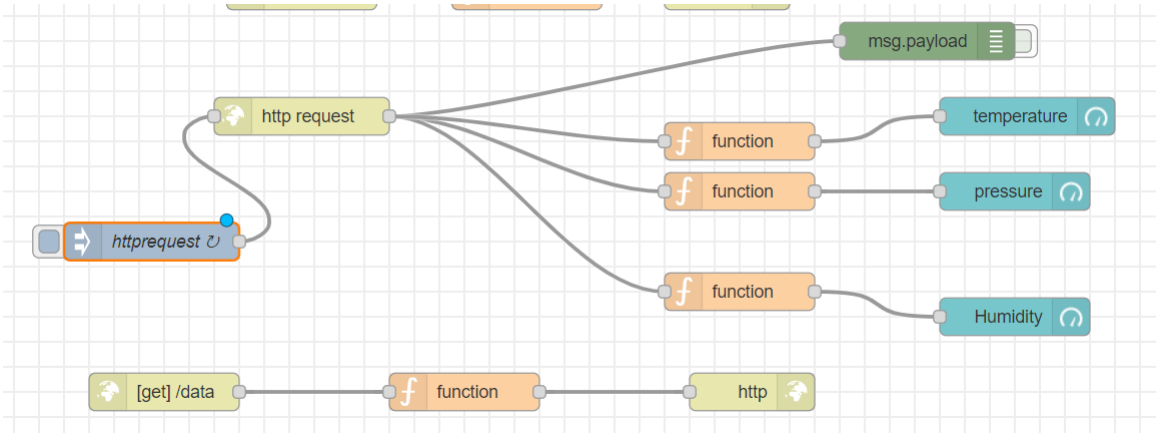
Step1. Start the node-red service in IBM Watson studio platform

Step 2. Pick the corresponding nodes and place them in the workspace.

Step3. Configure HTTP request to receive data from real time weather application.



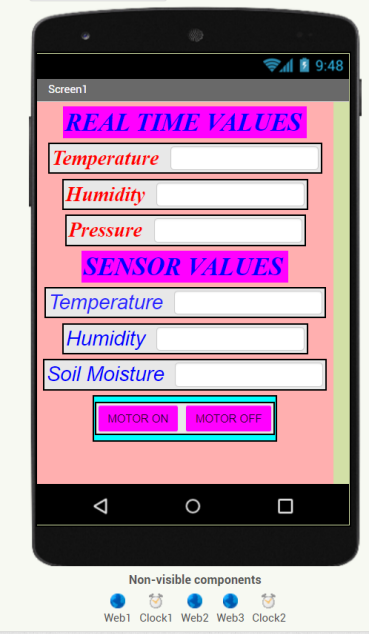
Step4. Configure HTTP request to receive data from IBM IoT platform.



4.2 Configure the mobile app to receive the data from IBM cloud and display it

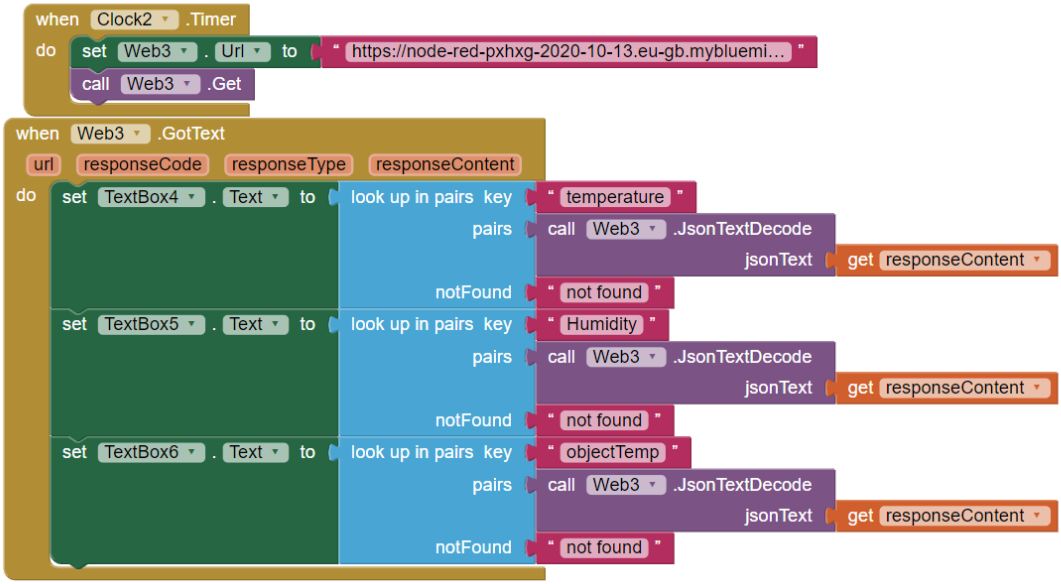
4.2.1 Design the mobile application using MIT APP inventor. Place the corresponding text, labels, buttons and web icon in the mobile screen

4.2.2 Edit and configure screen as shown in figure.

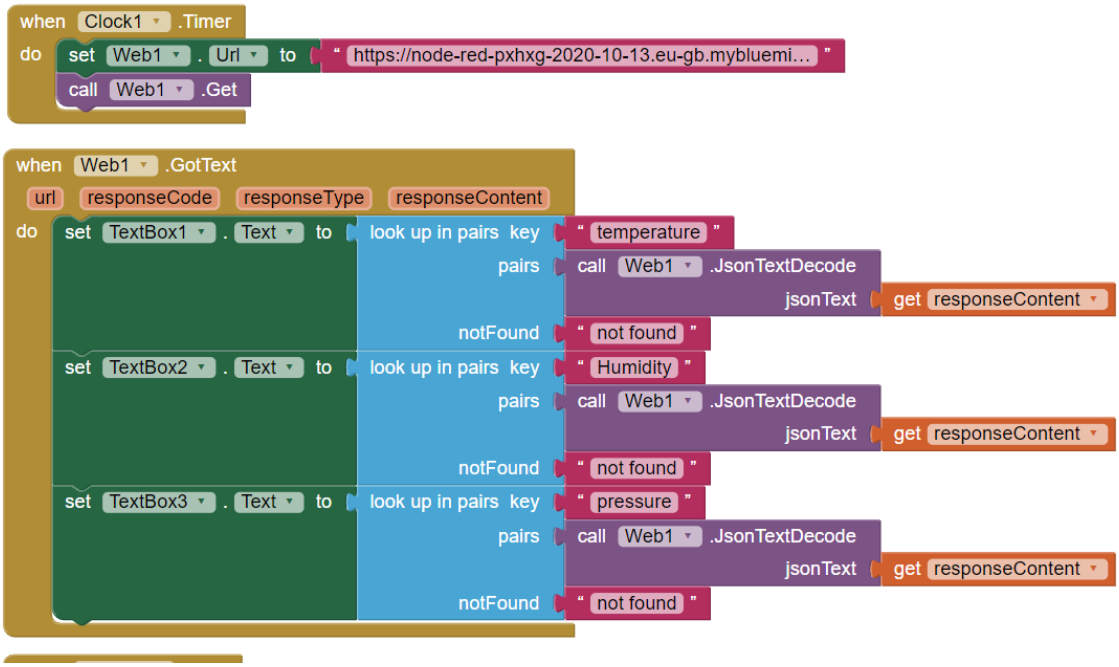


4.2.3 Edit and configure screen as shown in figure.

4.2.4 Configure the blocks to receive the data from real-time weather app

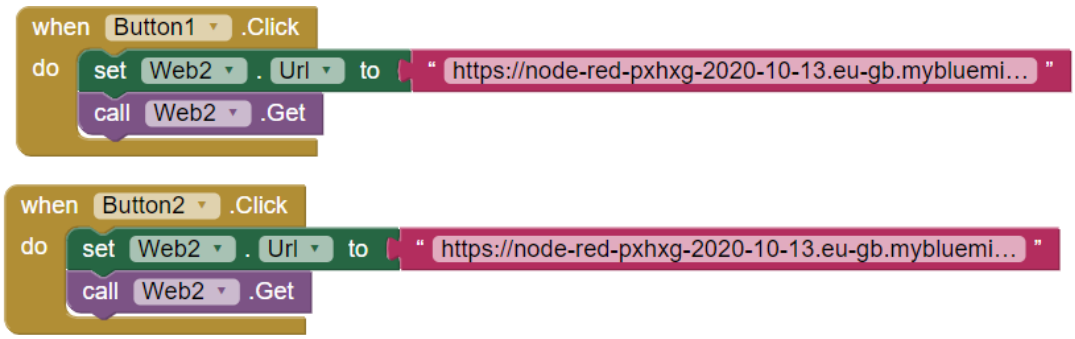


4.2.5 Configure the blocks to receive the sensor data from IBM IoT cloud.



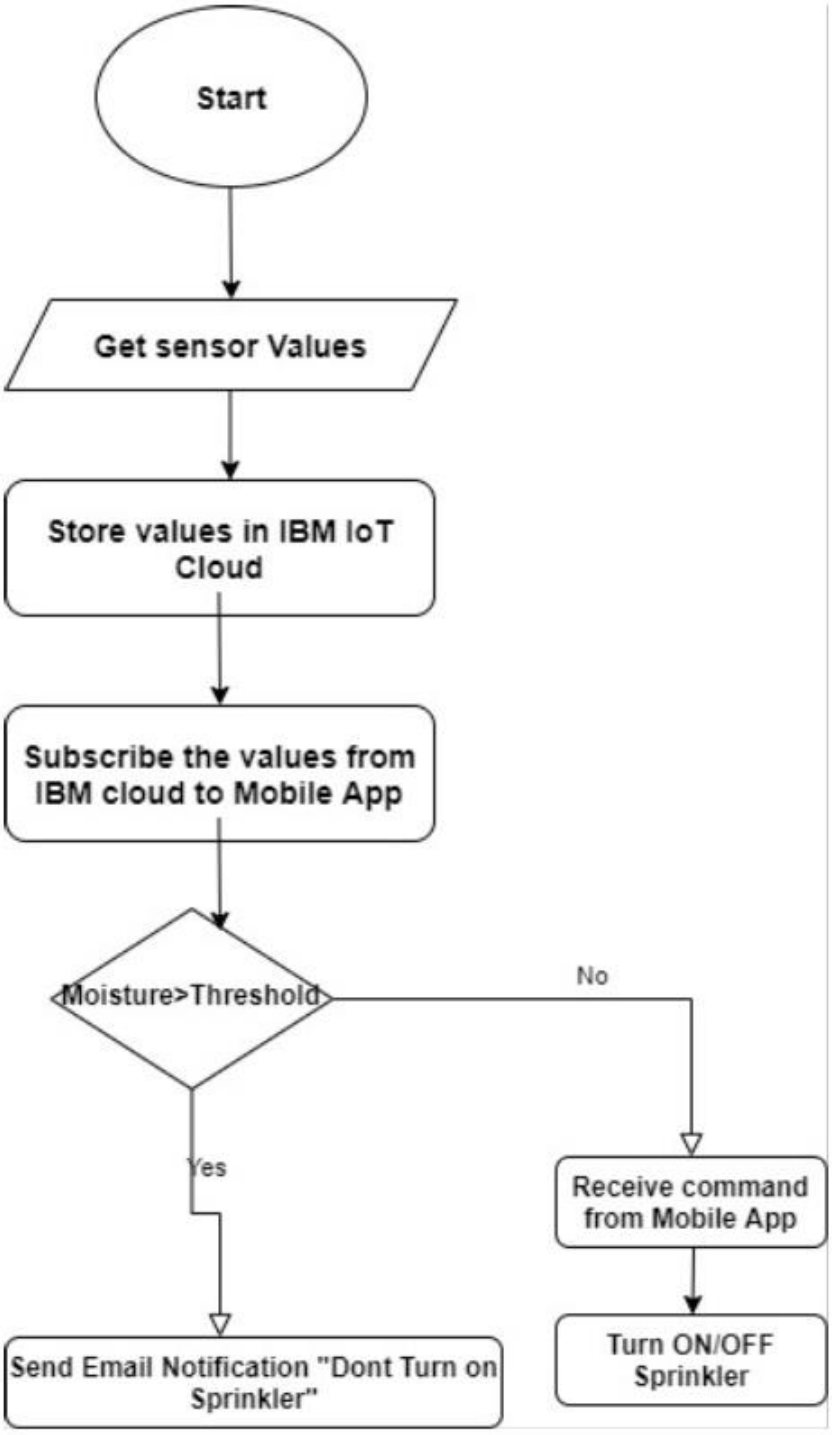
4.3 Create and Button to control the sprinklers

4.4 Configure the buttons to make HTTP request and send data to IBM cloud



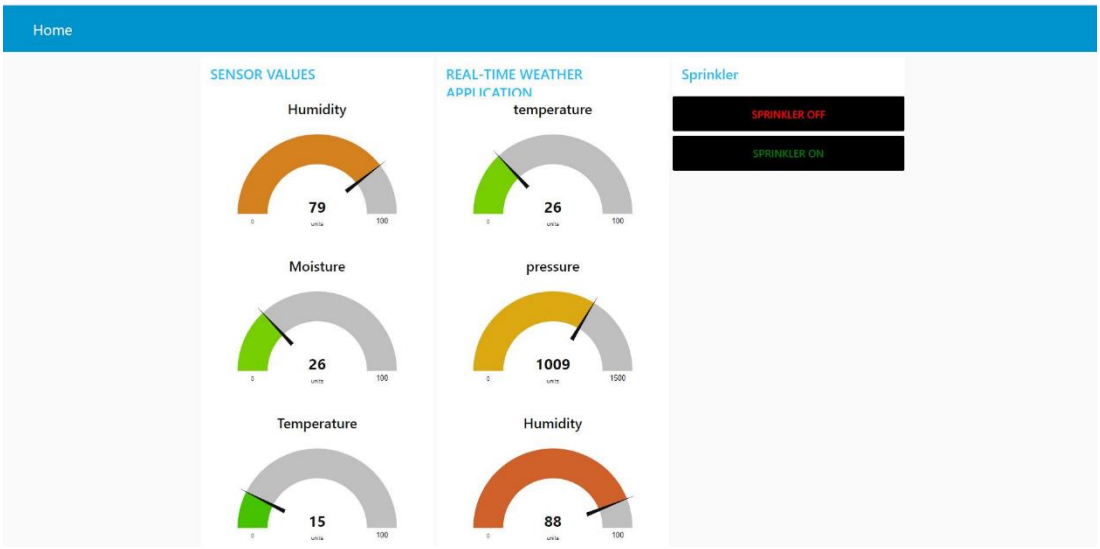
4.5 Check the threshold values and send an alarm notification mail to end user like if enough moisture contents in the ground. Which helps to provide earlier warning as need not to turn on the sprinkler.

5. FLOWCHART



6. RESULT

The detailed results are shown in following screenshots.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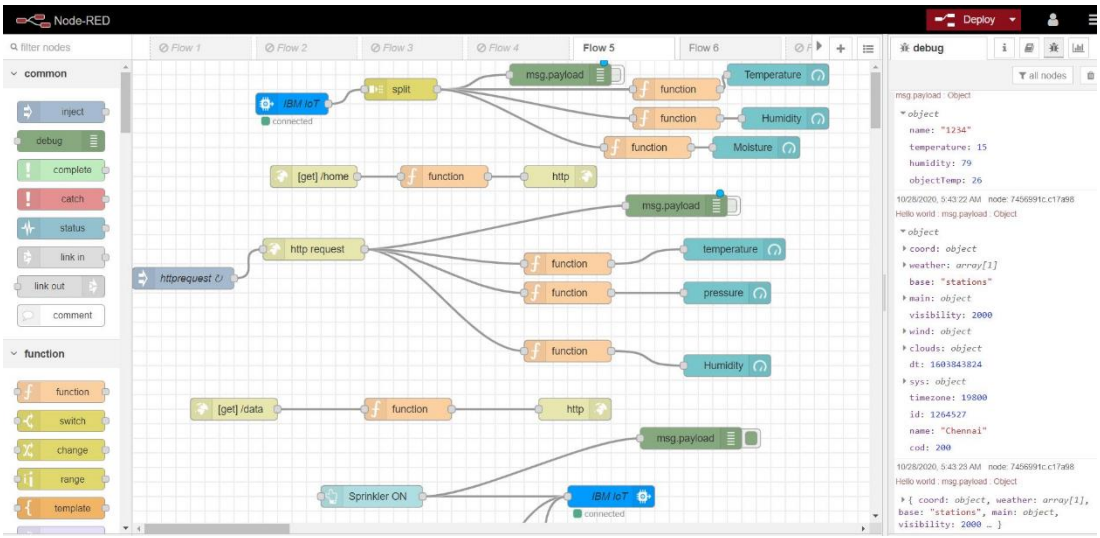
SENSOR VALUES
Humidity
79
Moisture
26
Temperature
15
REAL-TIME WEATHER APPLICATION
temperature
26
pressure
1009
Humidity
88
Sprinkler
SPRINKLER OFF
SPRINKLER ON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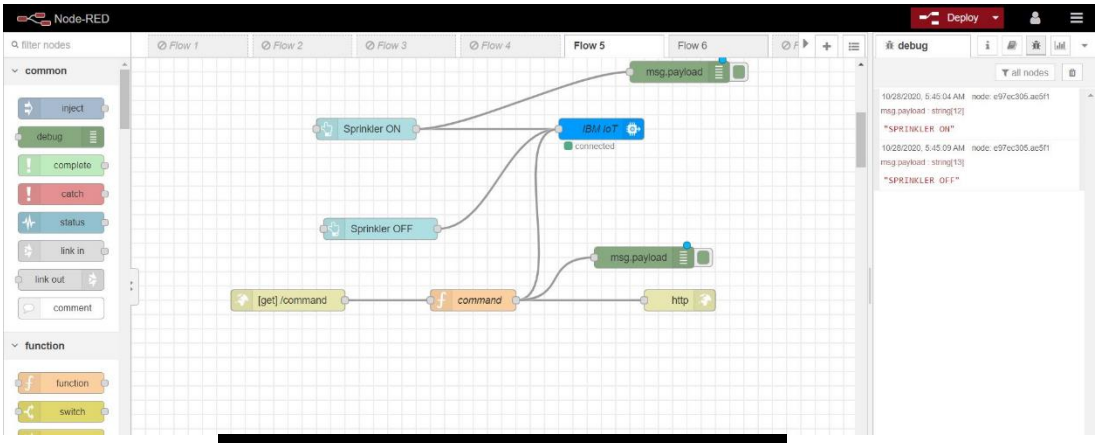
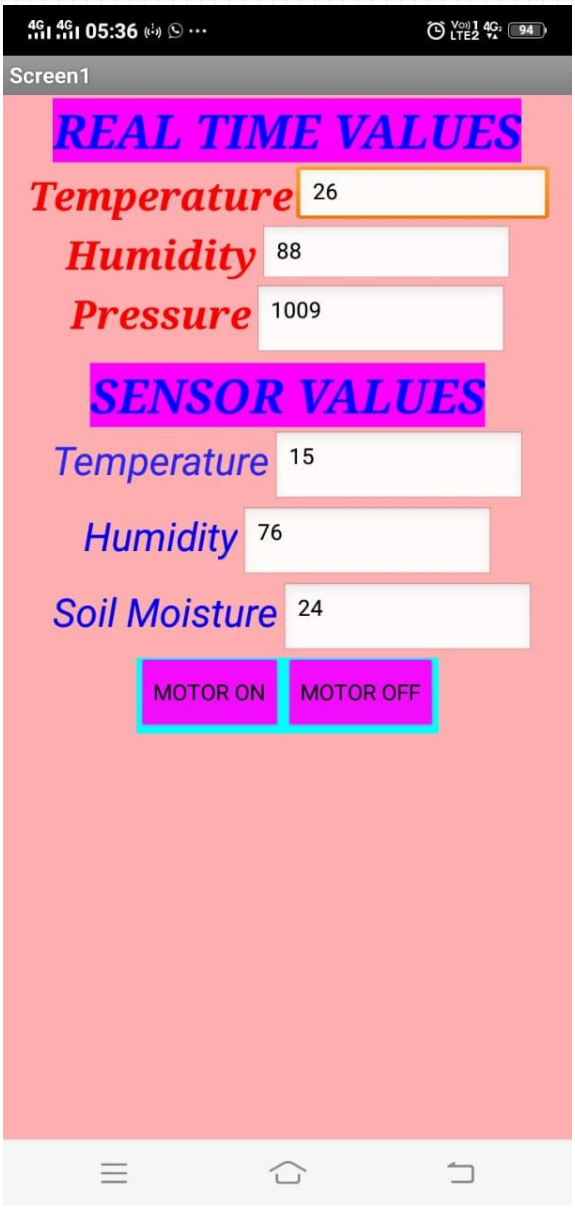
inject
debug
complete
catch
status
link in
link out
comment
function
function
switch
change
range
template
IBM IoT
connected
split
msg.payload
function
Temperature
Humidity
Moisture
[get] /home
http
http request
httprequest
temperature
pressure
[get] /data
Sprinkler ON
debug
all nodes





7. ADVANTAGES AND DIS ADVANTAGES

Advantages

1. Automatically control the sprinkler

2. Reduce the human intervention
3. Save Water during rainy season
4. Data will available in database for future reference

Dis advantages

1. Sensor precision needs to be accurate.
2. Energy consumption will be more for sensors kept in golf ground.

8. APPLICATION

1. We could apply the logic for smart irrigation management
2. Smart water management system
3. Smart agriculture and management system

9. CONCLUSION

In the proposed model, we developed the prototype model for real-time weather based sprinkler system. Based on sensor values, the user can control the sprinkler in remote. The accurate decision could make, since we are receiving values from sensor as well as weather application. We could use this model for smart water and smart irrigation management system.

10. FUTURE SCOPE

We could extend the model with AI which could take decision from real-time as well as historical data samples. Which could takes the predictive measurement and remote accessing effectively.

11. BIBLIOGRAPHY

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APPENDIX


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      ]
    ]
  },
  {
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    "type":"debug",
    "z":"9da29943.afe398",
    "name":"",
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    "tosidebar":true,
    "console":false,
    "tostatus":false,
    "complete":"payload",
    "targetType":"msg",
    "statusVal":"",
    "statusType":"auto",
    "x":590,
    "y":20,
    "wires":[

    ]
  },
  {
    "id":"89ffb58f.a89bc8",
    "type":"ui_gauge",
    "z":"9da29943.afe398",
    "name":"",
    "group":"28936e89.ae2f52",
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    "order":0,
    "width":0,
    "height":0,
    "gtype":"gage",
    "title":"Temperature",
    "label":"units",
    "format":"{{msg.payload.temperature}}",
    "min":0,
    "max":"100",
    "colors":[
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      "#e6e600",
      "#ca3838"
    ],
    "seg1":"",
    "seg2":"",
    "x":910,
    "y":40,
    "wires":[

    ]
  },
  {
    "id":"a36267a0.827c38",
    "type":"ui_gauge",
    "z":"9da29943.afe398",
    "name":"",
    "group":"28936e89.ae2f52",
    "order":1,
    "width":0,
    "height":0,
    "gtype":"gage",
    "title":"Humidity",
    "label":"units",
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```
    "format":"{{msg.payload.humidity}}",
    "min":0,
    "max":"100",
    "colors":[
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      "#e6e600",
      "#ca3838"
    ],
    "seg1":"",
    "seg2":"",
    "x":900,
    "y":80,
    "wires":[

    ]
  },
  {
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    "type":"ui_gauge",
    "z":"9da29943.afe398",
    "name":"",
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    "order":2,
    "width":0,
    "height":0,
    "gtype":"gage",
    "title":"Moisture",
    "label":"units",
    "format":"{{msg.payload.objectTemp}}",
    "min":0,
    "max":"100",
    "colors":[
      "#00b500",
      "#e6e600",
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```
      "#ca3838"
    ],
    "seg1":"",
    "seg2":"",
    "x":860,
    "y":120,
    "wires":[

    ]
  },
  {
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    "type":"split",
    "z":"9da29943.afe398",
    "name":"",
    "splt":"\\n",
    "spltType":"str",
    "arraySplt":1,
    "arraySpltType":"len",
    "stream":false,
    "addname":"payload.d",
    "x":370,
    "y":40,
    "wires":[
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        "4e6fc72d.b72e18",
        "70e19336.b394fc",
        "261a7395.7b176c",
        "b8a35c35.5c7b9"
      ]
    ]
  },
  {
    "id":"f55e8ac5.047d58",
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    "type":"http in",
    "z":"9da29943.afe398",
    "name":"",
    "url":"/home",
    "method":"get",
    "upload":false,
    "swaggerDoc":"",
    "x":250,
    "y":160,
    "wires":[
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        "3d87b0fe.922d8"
      ]
    ]
  },
  {
    "id":"3a97944b.02370c",
    "type":"http response",
    "z":"9da29943.afe398",
    "name":"",
    "statusCode":"",
    "headers":{

    },
    "x":590,
    "y":160,
    "wires":[

    ]
  },
  {
    "id":"3d87b0fe.922d8",
    "type":"function",
    "z":"9da29943.afe398",
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    "name":"",
    "func":"msg.payload = {'temperature': global.get(\"temp\"),'Humidity':global.get('humi'),'objectTemp':global.get('moisture')}\nreturn msg;",
    "outputs":1,
    "noerr":0,
    "initialize":"",
    "finalize":"",
    "x":430,
    "y":160,
    "wires":[
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        "3a97944b.02370c"
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    ]
  },
  {
    "id":"70e19336.b394fc",
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    "z":"9da29943.afe398",
    "name":"",
    "func":"global.set('temp',msg.payload.temperature)\nreturn msg;\n",
    "outputs":1,
    "noerr":0,
    "initialize":"",
    "finalize":"",
    "x":750,
    "y":40,
    "wires":[
      [
        "89ffb58f.a89bc8"
      ]
    ]
  },
```

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{
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  "type":"function",
  "z":"9da29943.afe398",
  "name":"",
  "func":"global.set('humi',msg.payload.humidity)\nreturn msg;\n",
  "outputs":1,
  "noerr":0,
  "initialize":"",
  "finalize":"",
  "x":750,
  "y":80,
  "wires":[
    [
      "a36267a0.827c38"
    ]
  ]
},
{
  "id":"b8a35c35.5c7b9",
  "type":"function",
  "z":"9da29943.afe398",
  "name":"",
  "func":"global.set('moisture',msg.payload.objectTemp)\nreturn msg;\n",
  "outputs":1,
  "noerr":0,
  "initialize":"",
  "finalize":"",
  "x":710,
  "y":120,
  "wires":[
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      "47f66af8.d3e154"
    ]
```

```
  ]
},
{
  "id":"7a1662f7.70589c",
  "type":"ui_group",
  "z":"",
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  "tab":"b41c84d3.632688",
  "order":4,
  "disp":true,
  "width":"6",
  "collapse":false
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{
  "id":"e6bb601e.ea33e",
  "type":"ibmiot",
  "z":"",
  "name":"newapi",
  "keepalive":"60",
  "serverName":"sfier9.messaging.internetofthings.ibmcloud.com",
  "cleansession":true,
  "appId":"",
  "shared":false
},
{
  "id":"25c63f41.edf51",
  "type":"ui_group",
  "z":0,
  "name":"Sprinkler",
  "tab":"b41c84d3.632688",
  "order":7,
  "disp":true,
  "width":"6",
  "collapse":false
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  },
  {
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    "type":"ui_group",
    "z":"",
    "name":"SENSOR VALUES",
    "tab":"b41c84d3.632688",
    "order":1,
    "disp":true,
    "width":"6",
    "collapse":false
  },
  {
    "id":"b41c84d3.632688",
    "type":"ui_tab",
    "z":"",
    "name":"Home",
    "icon":"dashboard",
    "disabled":false,
    "hidden":false
  }
]
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