Real-Time Weather Based Smart Sprinkler System

Submitted by
Lakshmy S

1. INTRODUCTION

1.1 Overview

Water is a very precious resource and water shortage is becoming one of the biggest problems in the world. The unplanned use of water results in reduced the ground water level and the lack of rains and scarcity of land water also results in decrement in volume of water on earth.

There are many instances where water is being wasted, such as watering the lawn or garden using automated sprinkler systems. The automated sprinklers are usually designed on timers and gets switched on during a predetermined time. This will cause wastage of water since it does not check the soil moisture and it be switched on even if it is raining.

For effective and optimum utilization of fresh water in irrigation, it becomes essential to develop the smart systems based on dynamic prediction of soil moisture pattern of the field and precipitation information of upcoming days.

1.2 Purpose

The purpose of the project is to develop a smart sprinkler system, which continuously monitors the data from sensors deployed at the field along with the weather forecast. This will reduce the wastage of water since the sprinklers will be not be turned on if it is raining.

2. LITERATURE SURVEY

2.1 Existing problem

The earlier technologies are designed to water the plants at a particular time. The sprinklers will be switched on at the specified time even when if it is raining during that time. The next generation sprinkler systems used moisture sensors, which will measure the moisture content in the water. When soil moisture level is low, the sprinklers gets automatically turned on. This method also did not consider the local weather pattern.

2.2 Proposed solution

The project aims to develop a smart sprinkler system, which continuously monitors the data from soil moisture sensor, temperature and humidity sensor, updates the IBM IoT platform and stores the data in Cloudant DB. By monitoring the weather forecasting details from the open weather map, the system should control the sprinklers. A mobile App is designed to visualize the data from soil moisture sensor, temperature sensor, humidity sensor and the local weather parameters. The mobile app can also be used to control the sprinklers.

3. THEORITICAL ANALYSIS

3.1 Block diagram

The block diagram of the proposed sprinkler system is shown in Figure 3.1. The temperature and humidity values are measured using the DHT11 sensor and soil moisture is measured using the soil moisture sensor. These values are compared with the current weather parameters obtained from the Open weather map portal. The data from sensors as well as the open weather map are uploaded to IBM cloud data base Cloudant DB. A mobile app is used to visualize the data and to control the sprinkler system.

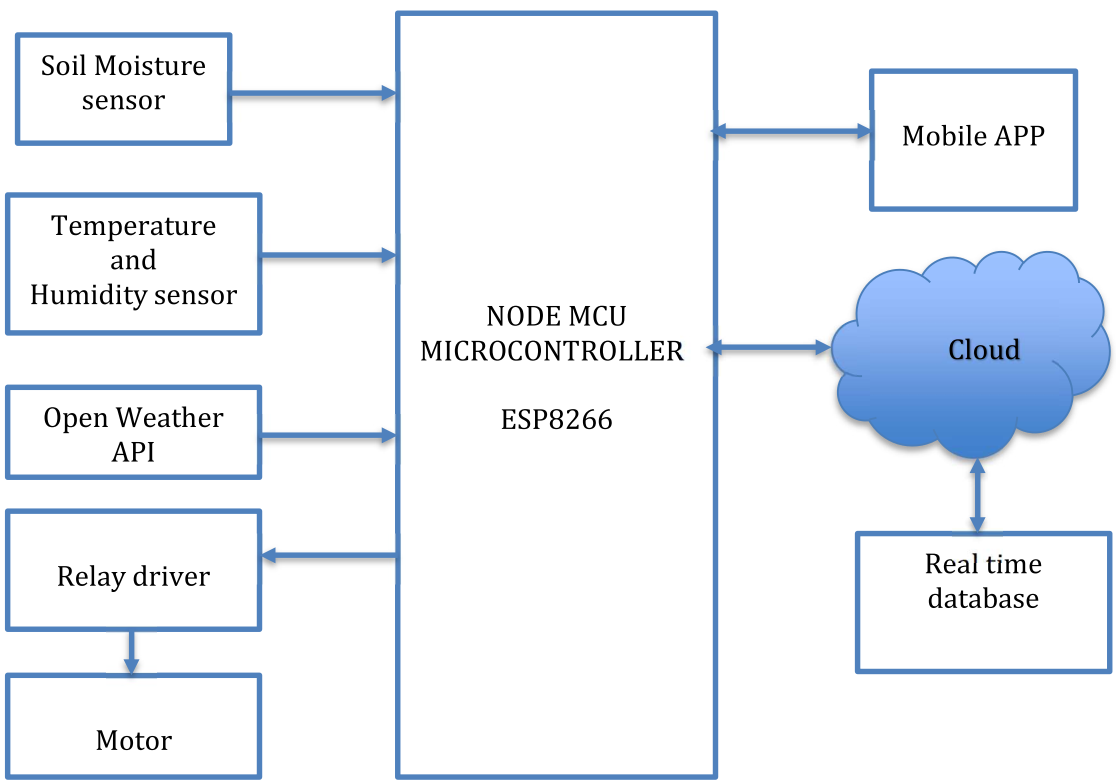


Fig. 3.1 Block diagram of Sprinkler System

3.2 Hardware / Software designing

Hardware:

The hardware requirements for this project include the node MCU microcontroller (ESP8266), sensors, relays, motors and the power supply. The circuit diagram showing the connections between the microcontroller and the sensors/motor is shown in Fig 3.2.

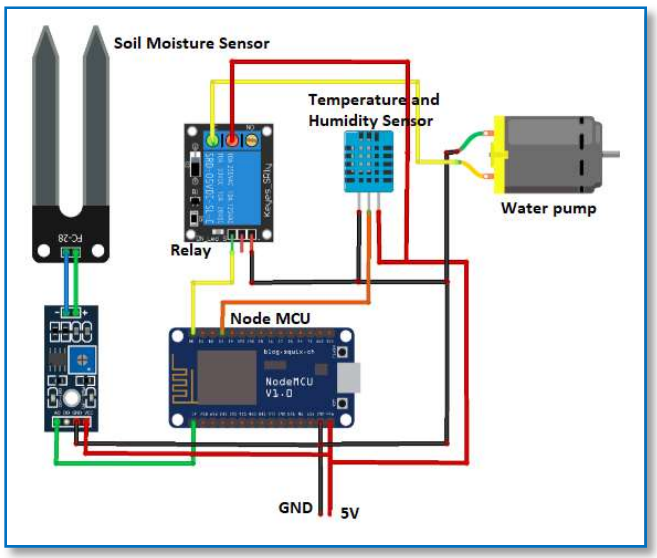


Fig 3.2 Circuit diagram for Smart Sprinkler System

Software:

The Arduino IDE is used to program the node MCU. For this project the hardware section is simulated using IBM Watson IoT platform, where node MCU and the sensor values and simulated.

A Node red flow is designed to get the sensor data from IBM Watson IoT platform and to store these data in IBM cloud. A mobile application is designed using MIT APP Inventor to visualize the sensor data and to control the sprinkler system.

The system level block diagram of the Smart Sprinkler System is shown in Fig 3.3.

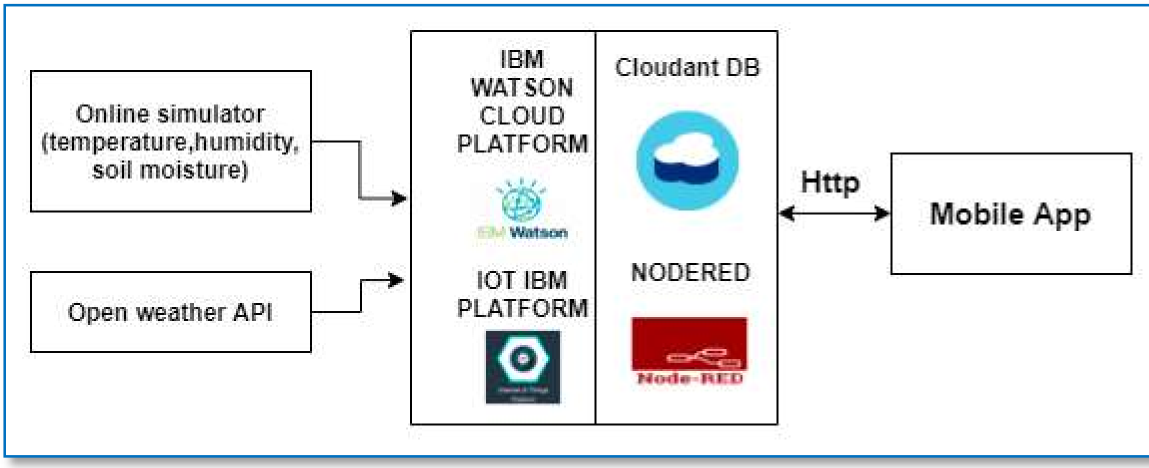


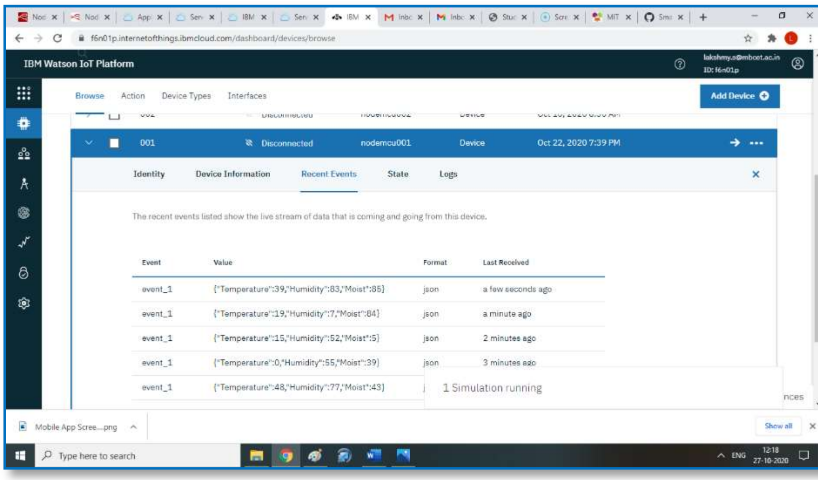
Fig 3.2 System level block diagram of the Smart Sprinkler System

4. EXPERIMENTAL INVESTIGATIONS

The algorithm of the proposed system is given below.

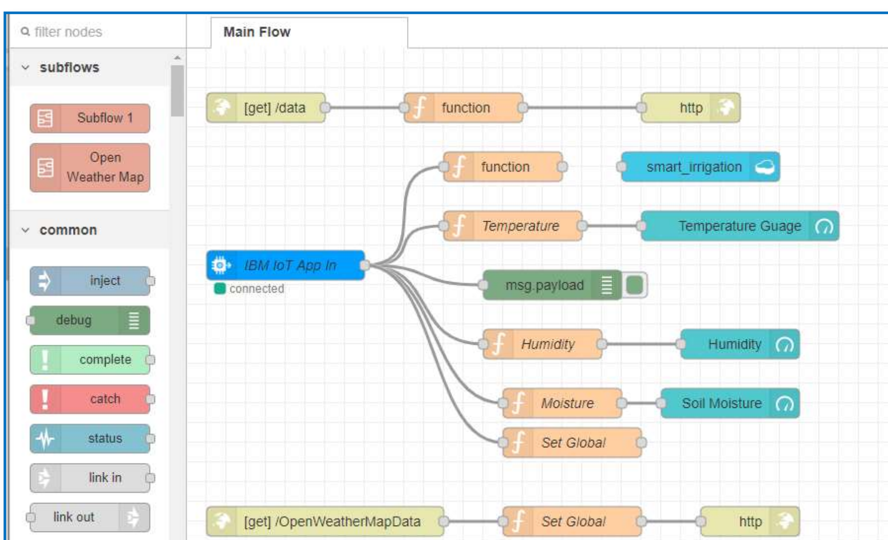
Step 1:

Configure and connect the online simulator to publish temperature, humidity and soil moisture values to IBM IoT Platform.



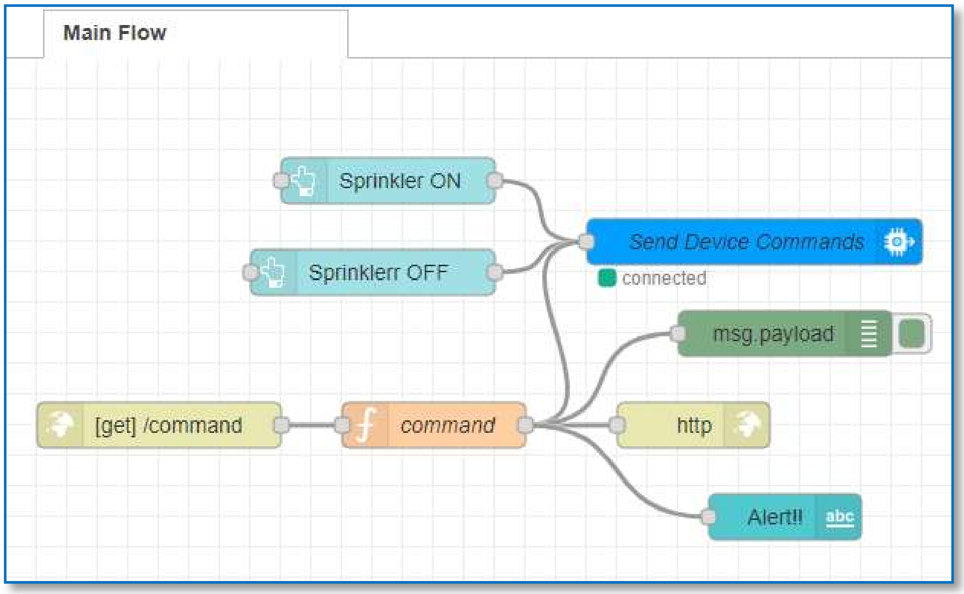
Step 2:

Create a Node-RED flows to get the data from IBM IoT platform and store it in Cloudant DB.



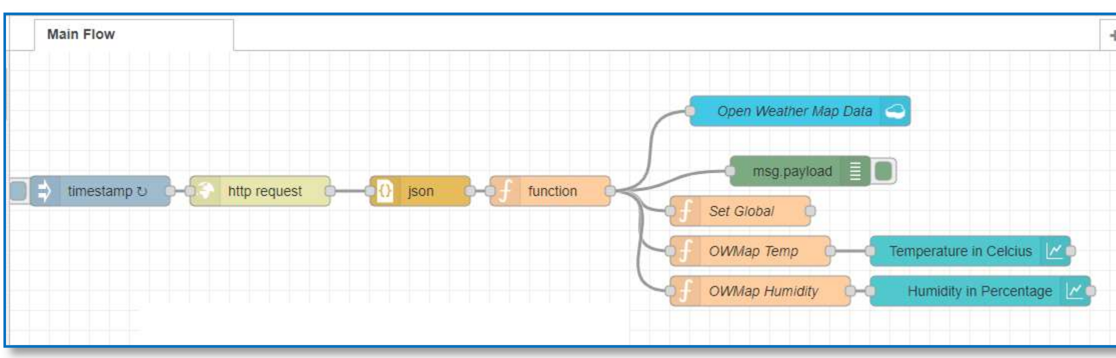
Step 3:

Create HTTP API's in Node-RED to send the sensor data to mobile app and also to get the commands from mobile application.



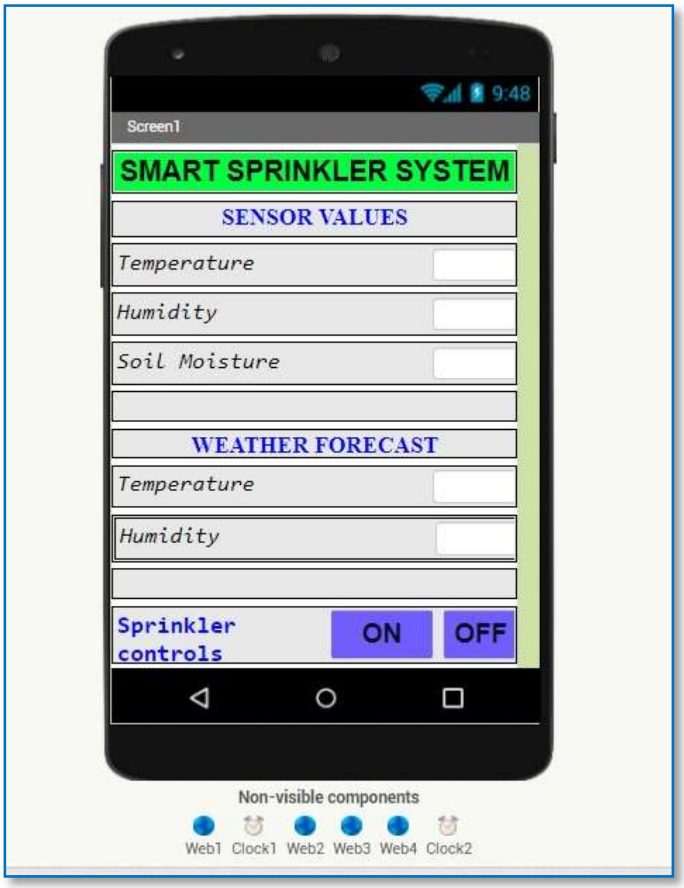
Step 4:

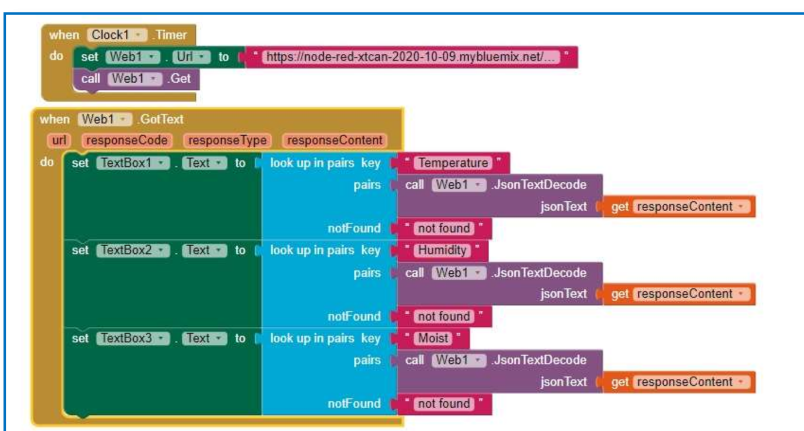
Create a mobile app to visualize the sensor parameters and also to get the open weather data.

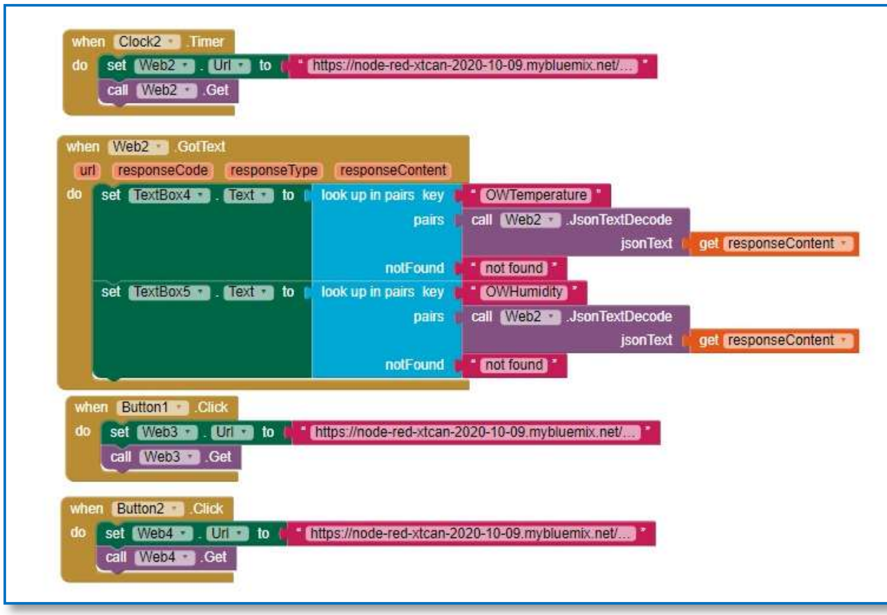


Step 5:

Configure the mobile app to send commands to IBM IoT Platform to control the sprinklers based on the sensor values and weather details.






when Clock2 .Timer
do set Web2 . Url to "https://node-red-xtcan-2020-10-09.mybluemix.net/..."
call Web2 .Get
when Web2 .GotText
url responseCode responseType responseContent
do set TextBox4 . Text to look up in pairs key "OWTemperature"
pairs call Web2 .JsonTextDecode
jsonText get responseContent
notFound "not found"
set TextBox5 . Text to look up in pairs key "OWHumidity"
pairs call Web2 .JsonTextDecode
jsonText get responseContent
notFound "not found"
when Button1 .Click
do set Web3 . Url to "https://node-red-xtcan-2020-10-09.mybluemix.net/..."
call Web3 .Get
when Button2 .Click
do set Web4 . Url to "https://node-red-xtcan-2020-10-09.mybluemix.net/..."
call Web4 .Get

5. RESULT

A smart sprinkler system was designed using IBM Watson IoT platform and Cloudant DB. A web app was designed using Node red to visualize the data from sensors and from Open weather map portal. The web app UI is shown in Fig 5.1. A mobile app was designed using MIT APP Inventor and the its UI is shown in Fig. 5.2.

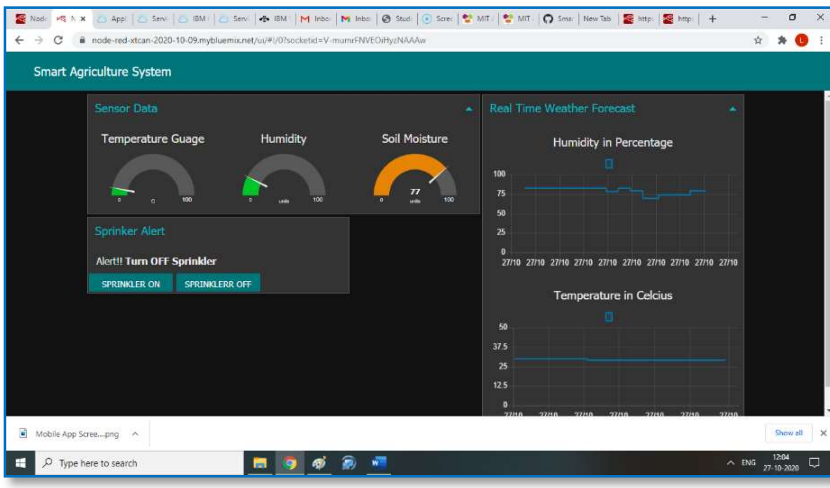


Fig.5.1. Web App UI using Node red

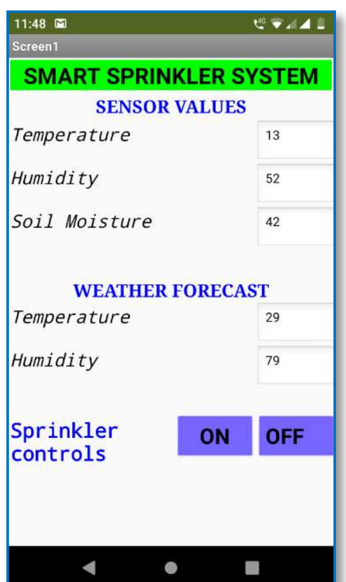


Fig.5.2. Mobile App UI

6. CONCLUSION AND FUTURE SCOPE

A real-time weather based smart sprinkler system using data from soil sensor and weather from Open Weather Map has been developed. The wastage of water is reduced by including real time weather data into the system.

The amount of water required for various types of plants is different and the data based on soil moisture sensor may not work properly for a large area of land. Therefore, we may need to consider different levels of watering for different types of plants. It may also vary with type of soil.

7. BIBILOGRAPHY

1. M Monica; B. Yeshika; G.S Abhishek; H.A Sanjay; Sankar Dasiga, IoT based control and automation of smart irrigation system: An automated irrigation system using sensors, GSM, Bluetooth and cloud technology, International Conference on Recent Innovations in Signal processing and Embedded Systems (RISE),2017

2. Laura García, Lorena Parra, Jose M. Jimenez, Jaime Lloret, and Pascal Lorenz, IoT-Based Smart Irrigation Systems: An Overview on the Recent Trends on Sensors and IoT Systems for Irrigation in Precision Agriculture, *Sensors* 2020