Department of Electronic and Telecommunication Engineering
University of Moratuwa

Internet of Things Design and Competition

EN2560

Course Project

Smart water supply system for agriculture

Group 02
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➢ Problem intended to be solved

Agriculture is an essential field for the existence of the humankind. Collapsing of it can cause severe impacts on the economy, health, and food sectors of a country. With the growth of human population, it is expected that production of food has to be boosted in the near future in order to achieve the demand. But some causes like excessiveness or lacking of water, variation of soil moisture and changes in temperature and humidity can affect to ruin a crop cultivation and reduce productivity. If these necessary factors can be supplied in adequate amounts, more yield can be obtained and damage to the crops can be minimized. When considering water supply, adding water more or less than the required amount for the plant can harm it. When irrigation is done manually, it is difficult for the farmer to get an exact idea about the amount of water that should be supplied. And the farmer should be at the farm to control the motors making it hard to provide water while he is away.

➢ System overview and operation

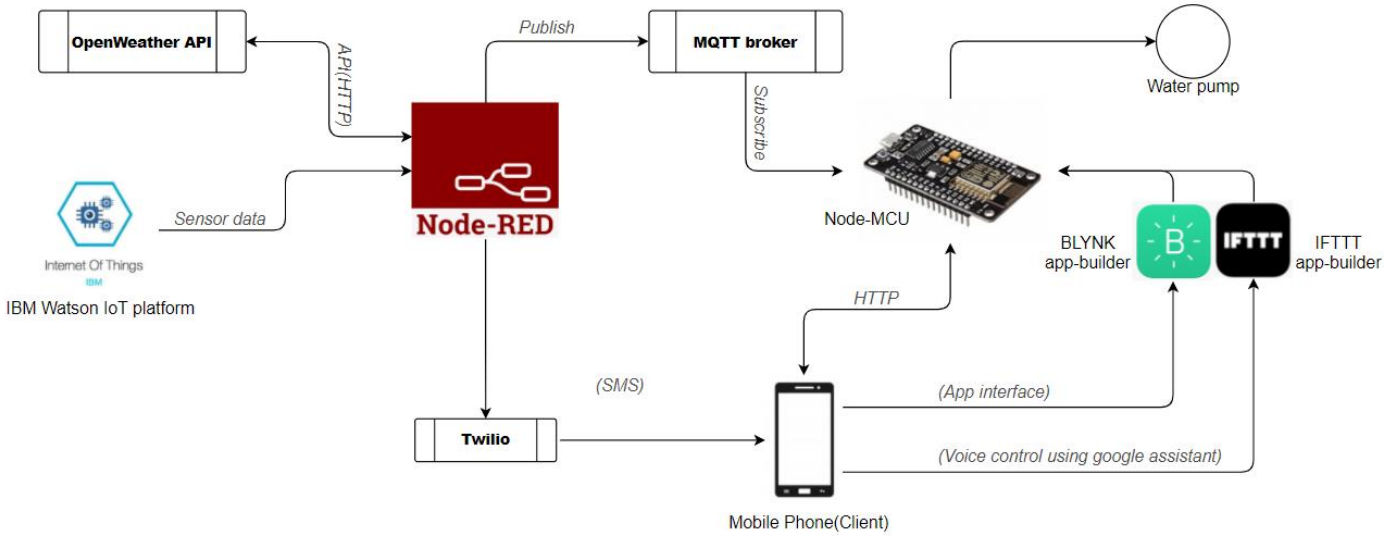
Soil moisture content, humidity and temperature are measured by the on-filed sensors in the farm. When they go out of a specified range, the user receives an SMS informing it. In this project user receives an SMS saying to turn on the water supply when soil moisture gets lower than the lower limit and he has been given the ability to turn the water supply mechanism on using his smartphone. When the soil moisture reached in to the defined range, another SMS is sent to the user telling to turn the water supply off and it can also be done by the smartphone. By this way, soil moisture level remains in a suitable value for the plants and the user can remotely control the water supply mechanism.

➢ Implementation

- Hardware

1. Soil moisture, humidity, and temperature sensors (sensors are simulated using IBM Watson IoT platform for this project)
2. Node-MCU

- Software flow



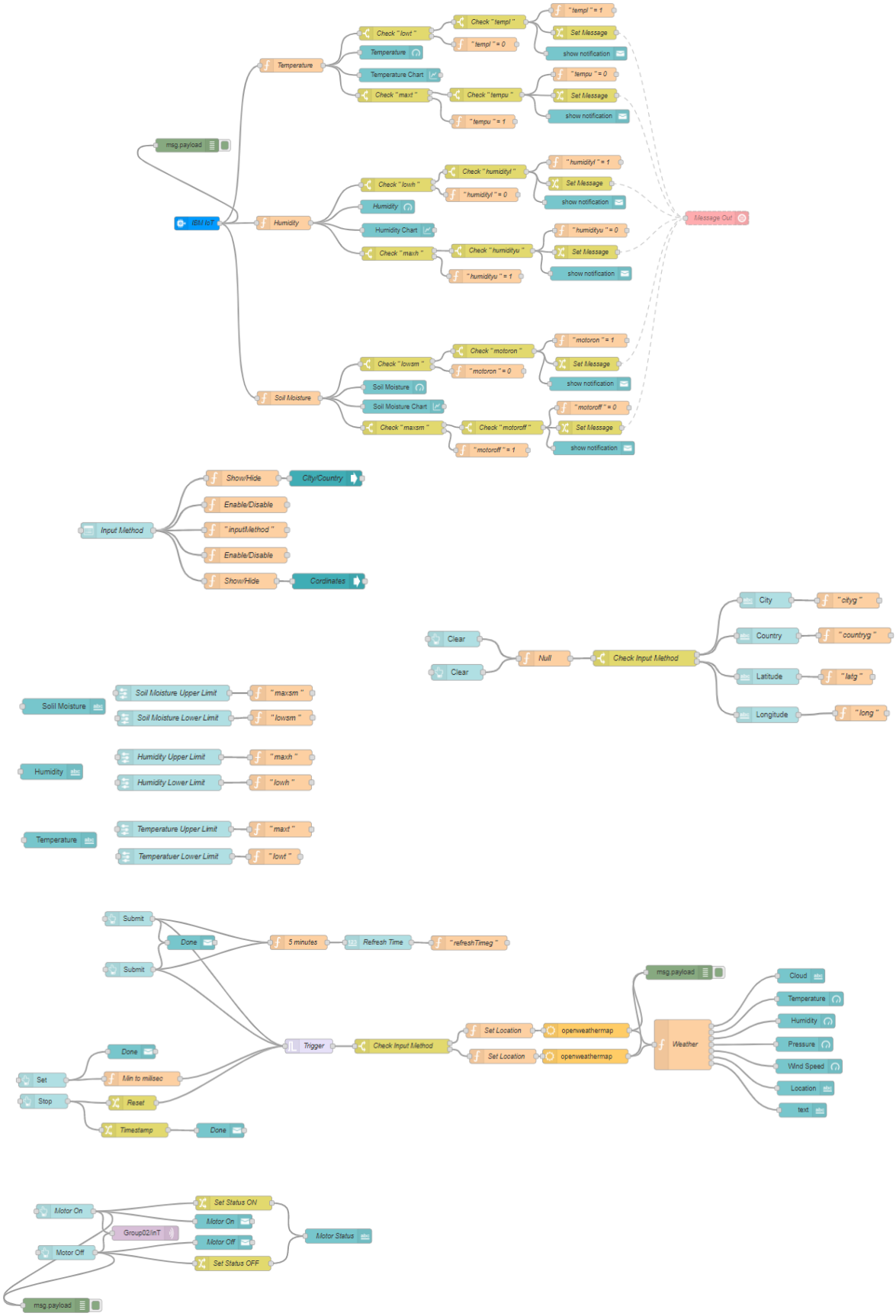
1.Watson IoT platform

A device is created in Watson IoT platform to store sensor data and send them to Node-RED. Values of soil moisture, humidity and temperature are obtained from this device and an IoT simulator is used for assigning values for the corresponding parameter since actual sensors are not used.

2.Node-RED

Node-RED is run on the IBM cloud and flows in it are arranged to receive sensor data from Watson IoT platform and check whether those values are in the specified range. If not, it sends an SMS

to the user telling to turn the water supply on and to off when values are reached in to the given range using Twilio service. Moreover, weather details are obtained from OpenWeather and they are displayed in the user interface (web app) along with the readings of the sensors. The UI takes the location of the cultivation land as inputs to get the weather details from OpenWeather and contains buttons to turn the water supply on and off. Node-RED sends values to an MQTT broker to turn the water supply on/off when buttons in the web page are clicked.



Node-RED flows

3.Web app

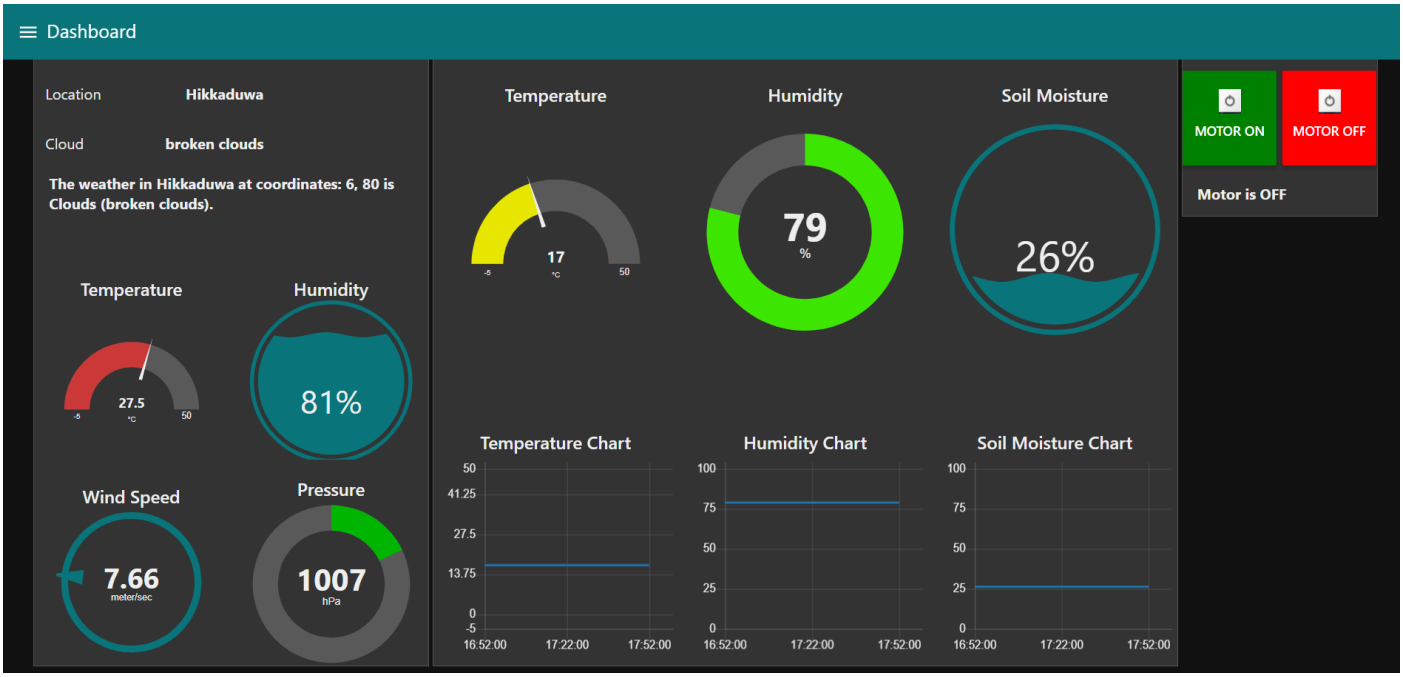
The web app shows the current soil moisture, humidity and temperature of the cultivation and the weather details obtained from OpenWeather. It has text boxes to enter the location of the farm and buttons to turn the water supply on/off. (In addition to the web app, the user can do the switching by **B**lynk app, voice command through google assistant or http web interface too.)

- Protocols: MQTT, HTTP
- Online resources

  Node-RED, OpenWeather API, Twilio, IBM cloud platform, IBM Watson IoT platform, IBM IoT simulator, Blynk and IFTT app builders

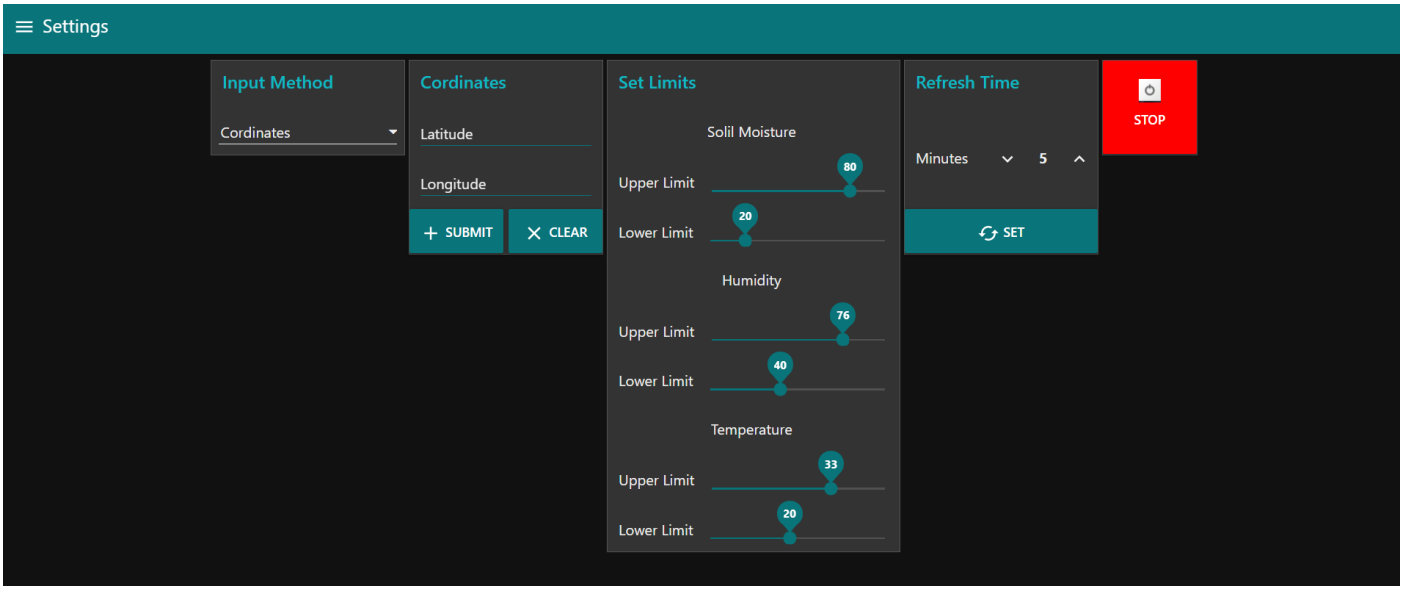
➢ System functionality

Web app URL: https://smartagricultureapp.mybluemix.net/ui



Dashboard tab of the web app

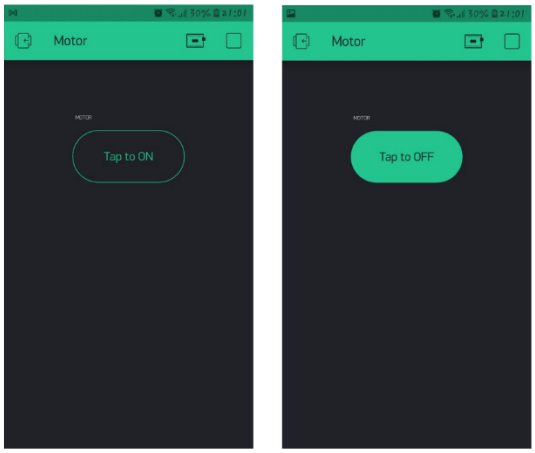
Dashboard tab of the web interface contains weather data obtained from OpenWeather, data obtained from the sensor simulator and buttons to turn the motor on/off. Charts show the variation of temperature, humidity and soil moisture with time.



Settings tab of the web app

Settings tab contains fields to enter the location of the farm as city/country or latitudes/longitudes, to set limits for soil moisture, humidity, and temperature and to set the refresh time.

http web interface



Customized button in Blynk app

Control by voice using google assistant

➢ Advantages and disadvantages

- Advantages:
  - Plants receive the adequate amount of water and productivity is increased as a result.
  - User can remotely control the water supply system.
  - Easy to use because of the web interface to control the water supply mechanism.
  - Low cost.
  - Efficient.

- Disadvantages:
  - Farm needs to have an internet connection.
  - Sensors may malfunction.
  - Farmer needs to have a smartphone and basic knowledge about how to use it.

➢ Future scope

Currently this system is set up only to manage water supply, but it can be further developed to control factors such as humidity, temperature, light intensity etc. which affect highly toward the productivity specially in closed farms like greenhouses. The system can be modified to handle several farms at different locations simultaneously which makes it easy for the user to handle all his cultivations being at a single place. By using IoT systems to agriculture, scares resources like water can be used efficiently increasing the yield at the same time.

Demonstration videos: https://drive.google.com/folderview?id=10m7q_mpv4izIEOLywL5I45lwaxJJo2sa

References:

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