Smart Agriculture system based on IoT

An Internship Report

Submitted by

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A report submitted to:

Smart Bridge

SMARTBRIDGE
Let's Bridge the Gap

ACKNOWLEDGMENT:

The success and outcome of this project required guidance and assistance from **Smart Bridge**. I am extremely privileged to have got this all along with the completion of my project. All that I have done is only due to such supervision and assistance and I would not forget to thank them.

I thank **Smart Bridge**, for providing me an opportunity to do the project work in the internship **Smart Agriculture system based on IoT** and giving me all support and guidance which made me complete the project duly. I am extremely thankful to smart bridge for providing such a nice support and guidance.

Introduction:

1.1 overview:

In this project I have developed a mobile application using which a farmer can monitor the temperature, humidity, pressure and soil moisture parameters along with weather forecasting details. Based on these details he can water the crops by controlling the motors through the app and the app gives an alert message if temperature or humidty goes beyond a threshold value.

1.2 Purpose:

Agriculture plays a crucial role in the life of an economy. It is the backbone of our economic system, so improving the quality and way of production is crucial. Here comes the Smart Agriculture system. Smart agriculture helps in automated farming, collection of data from the field and then analyses it so that the farmer can make accurate decision in order to grow high quality crop.

IoT based Smart Farming improves the entire Agriculture system by monitoring the field in real-time. With the help of sensors and interconnectivity, the Internet of Things in Agriculture has not only saved the time of the farmers but has also reduced the extravagant use of resources such as Water. and Electricity.

Literature Survey:

2.1 Existing problem

Agriculture is extremely dependent on the climate. Temperature increases and carbon dioxide can boost some crop yields depending on the location; but other conditions must also exist, such as humidity, pressure, and water availability. Although slight warming and more carbon dioxide in the atmosphere could benefit some plants to grow faster, severe warming, floods, and drought would reduce yields. Farmer need to spend a lot of time to maintain these.

Heat is not the only extreme weather. Extreme cold can benefit farmers by freezing the soil deep beneath the ground. In parts of the upper Midwest, frost depths exceed 40 inches. A deep frost depth can aid farmers in diverse ways. The cold helps nitrogen that is applied in the fall from vaporizing during the winter. The cycle of freezing and thawing of water helps soften the soil after the thaw. Extreme cold and frozen soils also reduce the survival rate of some insects.

Severe weather other than heat and cold can cause loss and devastation to a farm. Most farmers can't avoid the results of extreme weather. Diverse extreme weather can affect farms in different ways. Because of this, it's important that farmers have a proper system and need a mobile application to monitor the weather changes and to control the motor.

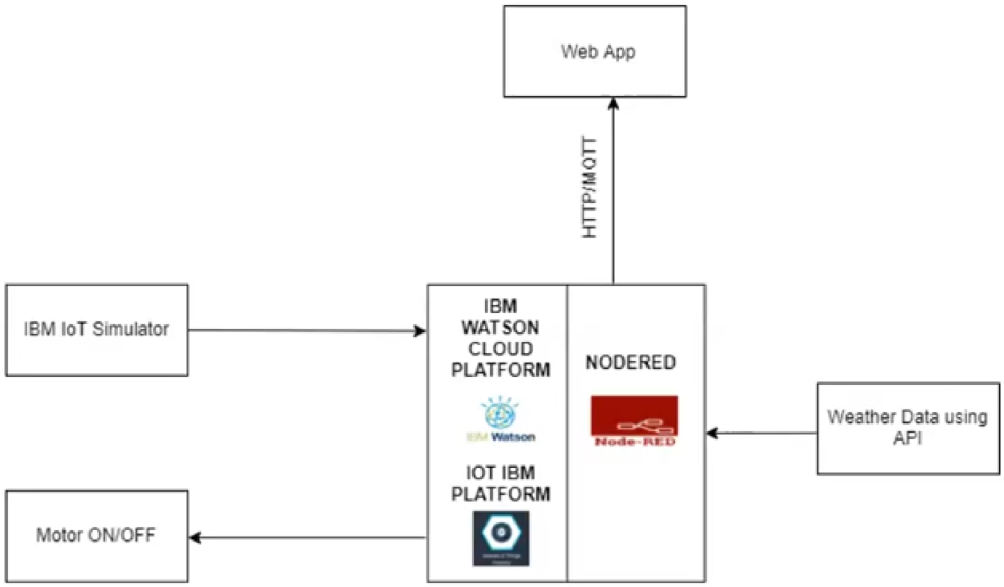
2.2 Proposed solution

As the climates are changing rapidly and weather is unpredictable, so farmers are facing difficulties so they need a system to tackle this, here we use "open weather API" to get weather information such as temperature, pressure, humidity and weather description at their current location.

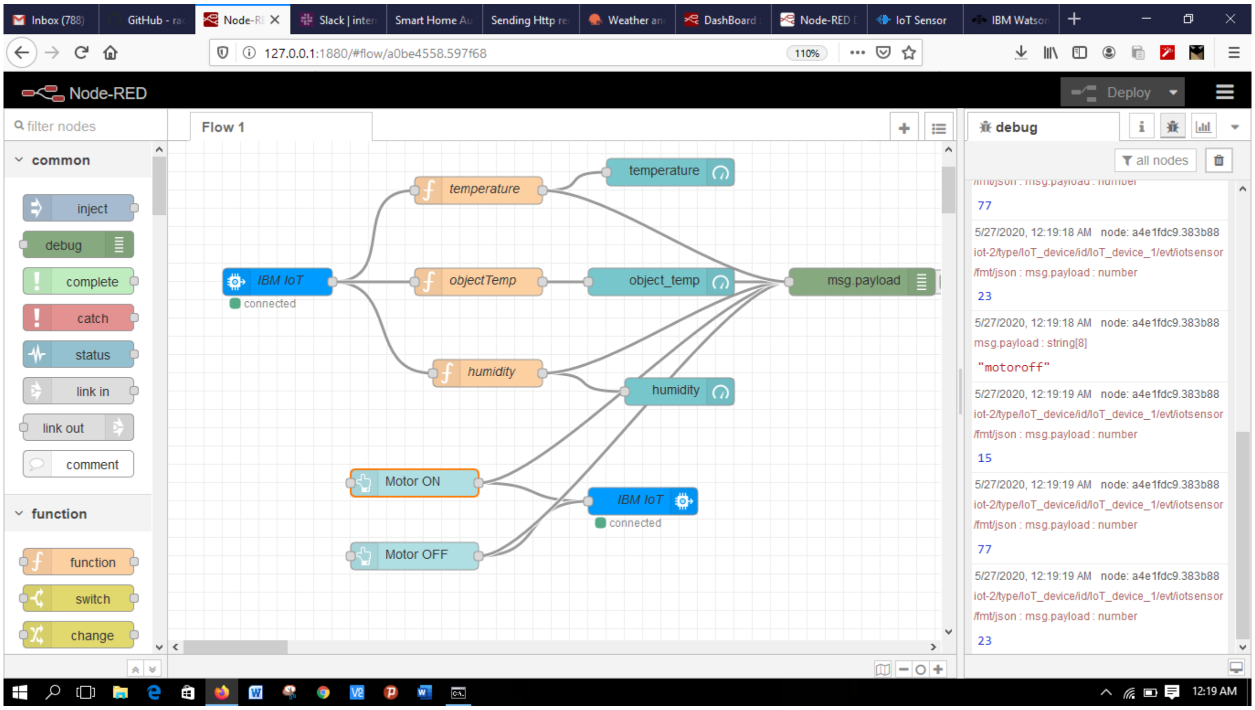
Based on which they can decide whether to turn on the motors or turn off the motor if needed temperature and moisture sensors from IBM simulator is displayed on UI for monitoring the weather. An algorithm developed with threshold values of temperature, pressure, humidity is programmed to intimate the farmer if weather conditions go bad. He can control motors remotely from any place through IoT. Internet interface that allow data inspection and irrigation scheduling to be programmed through mobile application or Node-RED UI. The technological development in software and hardware make it easy to develop this which can make better monitoring and wireless network made it possible to use in monitoring and control of greenhouse parameter in precision agriculture.

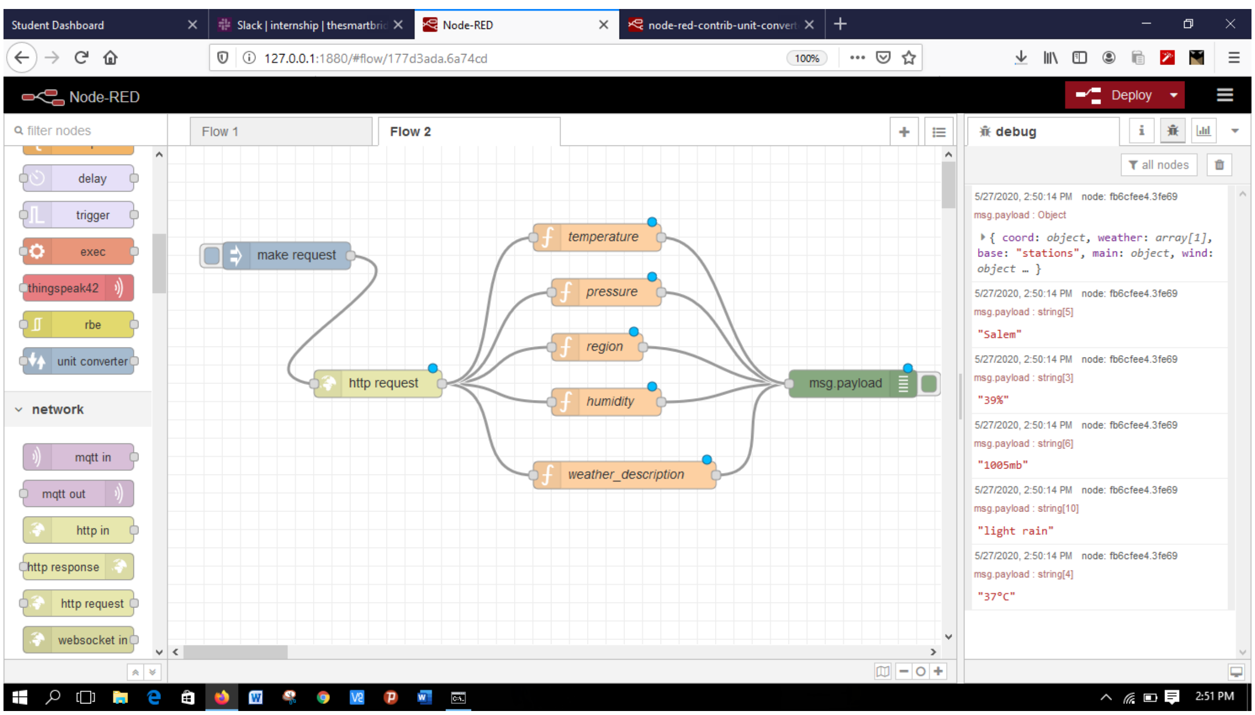
Theoritical Analysis:

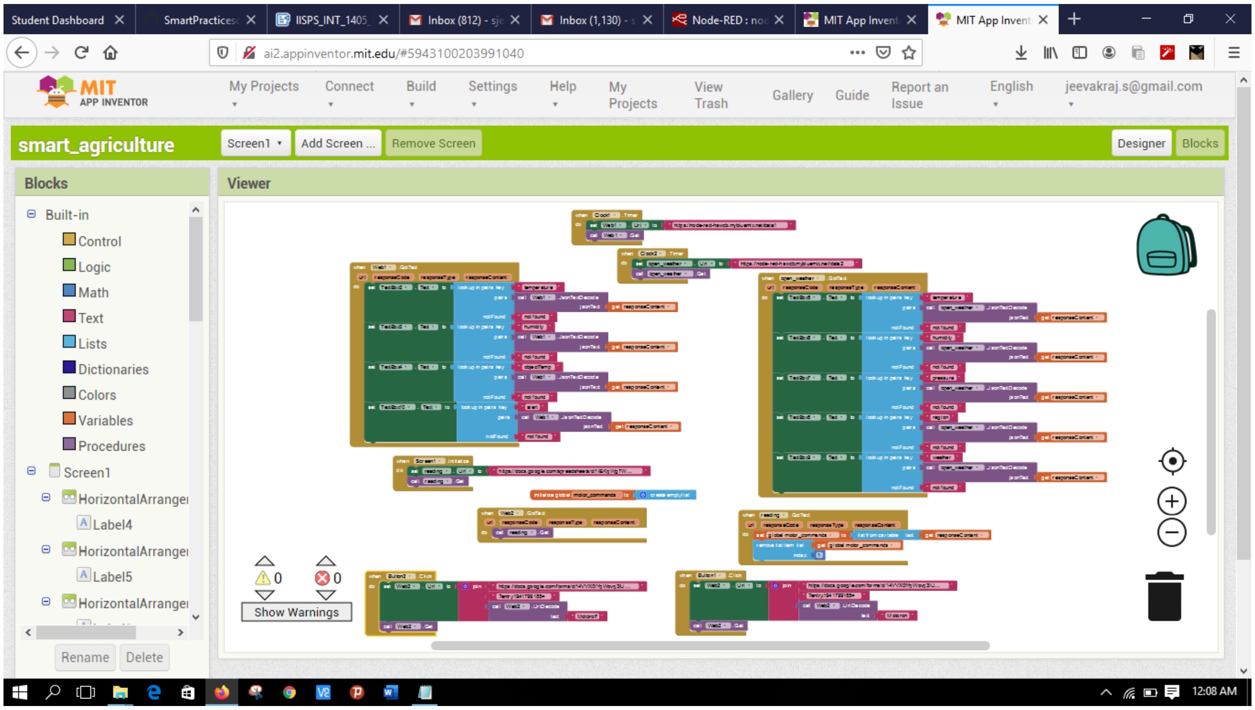
3.1 Block diagram



3.2 Software designing

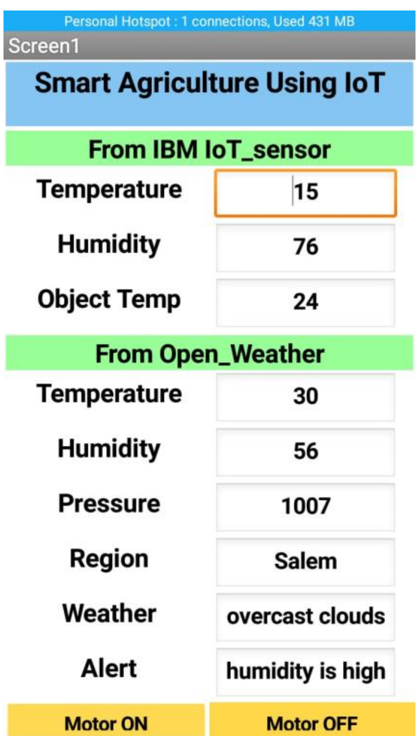

127.0.0.1:1880/#flow/a0be4558.597f68
Node-RED
Deploy
filter nodes
Flow 1
common
inject
debug
complete
catch
status
link in
link out
comment
function
function
switch
change
temperature
temperature
IBM IoT
connected
objectTemp
object_temp
msg.payload
humidity
humidity
Motor ON
IBM IoT
connected
Motor OFF
debug
all nodes
77
5/27/2020, 12:19:18 AM node: a4e1fdc9.383b88
iot-2/type/IoT_device/id/IoT_device_1/evt/iotsensor/fmt/json : msg.payload : number
23
5/27/2020, 12:19:18 AM node: a4e1fdc9.383b88
msg.payload : string[8]
"motoroff"
5/27/2020, 12:19:19 AM node: a4e1fdc9.383b88
iot-2/type/IoT_device/id/IoT_device_1/evt/iotsensor/fmt/json : msg.payload : number
15
5/27/2020, 12:19:19 AM node: a4e1fdc9.383b88
iot-2/type/IoT_device/id/IoT_device_1/evt/iotsensor/fmt/json : msg.payload : number
77
5/27/2020, 12:19:19 AM node: a4e1fdc9.383b88
iot-2/type/IoT_device/id/IoT_device_1/evt/iotsensor/fmt/json : msg.payload : number
23
12:19 AM


Student Dashboard
Slack | internship | thesmartbric
Node-RED
node-red-contrib-unit-convert
127.0.0.1:1880/#flow/177d3ada.6a74cd
Node-RED
Deploy
filter nodes
Flow 1
Flow 2
delay
trigger
exec
thingspeak42
rbe
unit converter
network
mqtt in
mqtt out
http in
http response
http request
websocket in
make request
http request
temperature
pressure
region
humidity
weather_description
msg.payload
debug
all nodes
5/27/2020, 2:50:14 PM node: fb6cfee4.3fe69
msg.payload : Object
{ coord: object, weather: array[1], base: "stations", main: object, wind: object … }
5/27/2020, 2:50:14 PM node: fb6cfee4.3fe69
msg.payload : string[5]
"Salem"
5/27/2020, 2:50:14 PM node: fb6cfee4.3fe69
msg.payload : string[3]
"39%"
5/27/2020, 2:50:14 PM node: fb6cfee4.3fe69
msg.payload : string[6]
"1005mb"
5/27/2020, 2:50:14 PM node: fb6cfee4.3fe69
msg.payload : string[10]
"light rain"
5/27/2020, 2:50:14 PM node: fb6cfee4.3fe69
msg.payload : string[4]
"37°C"
2:51 PM

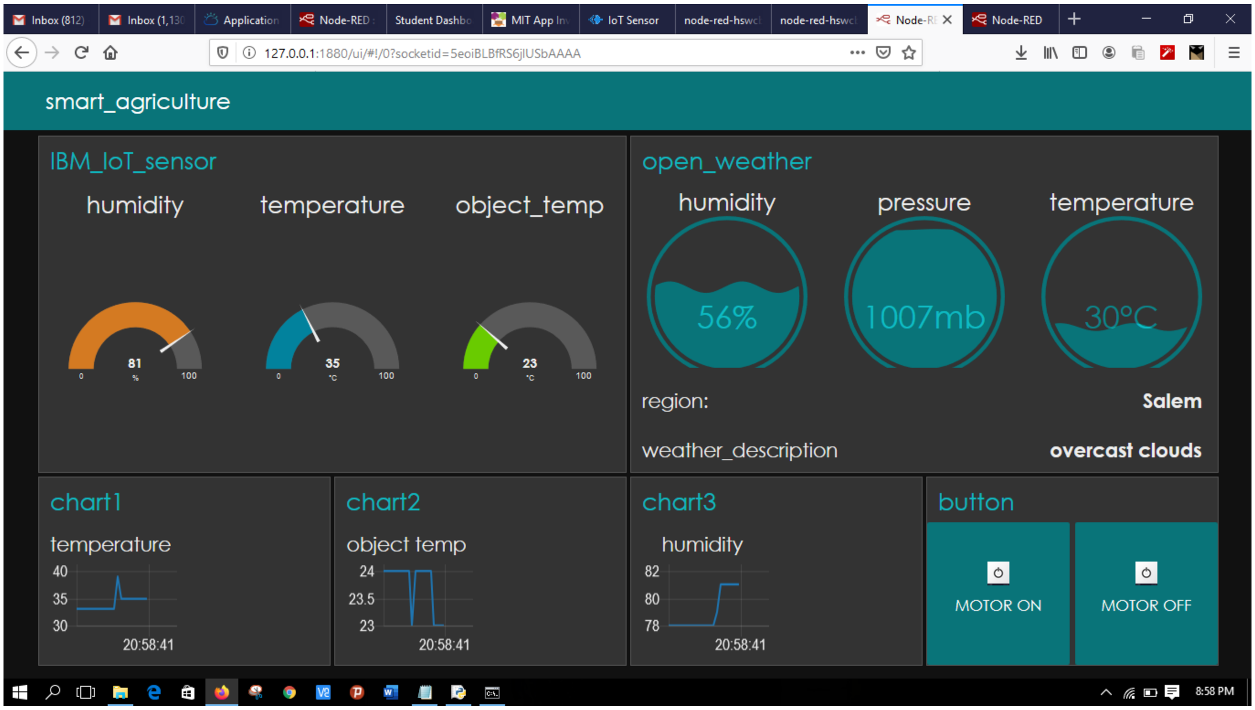


Final UI's:

APP:



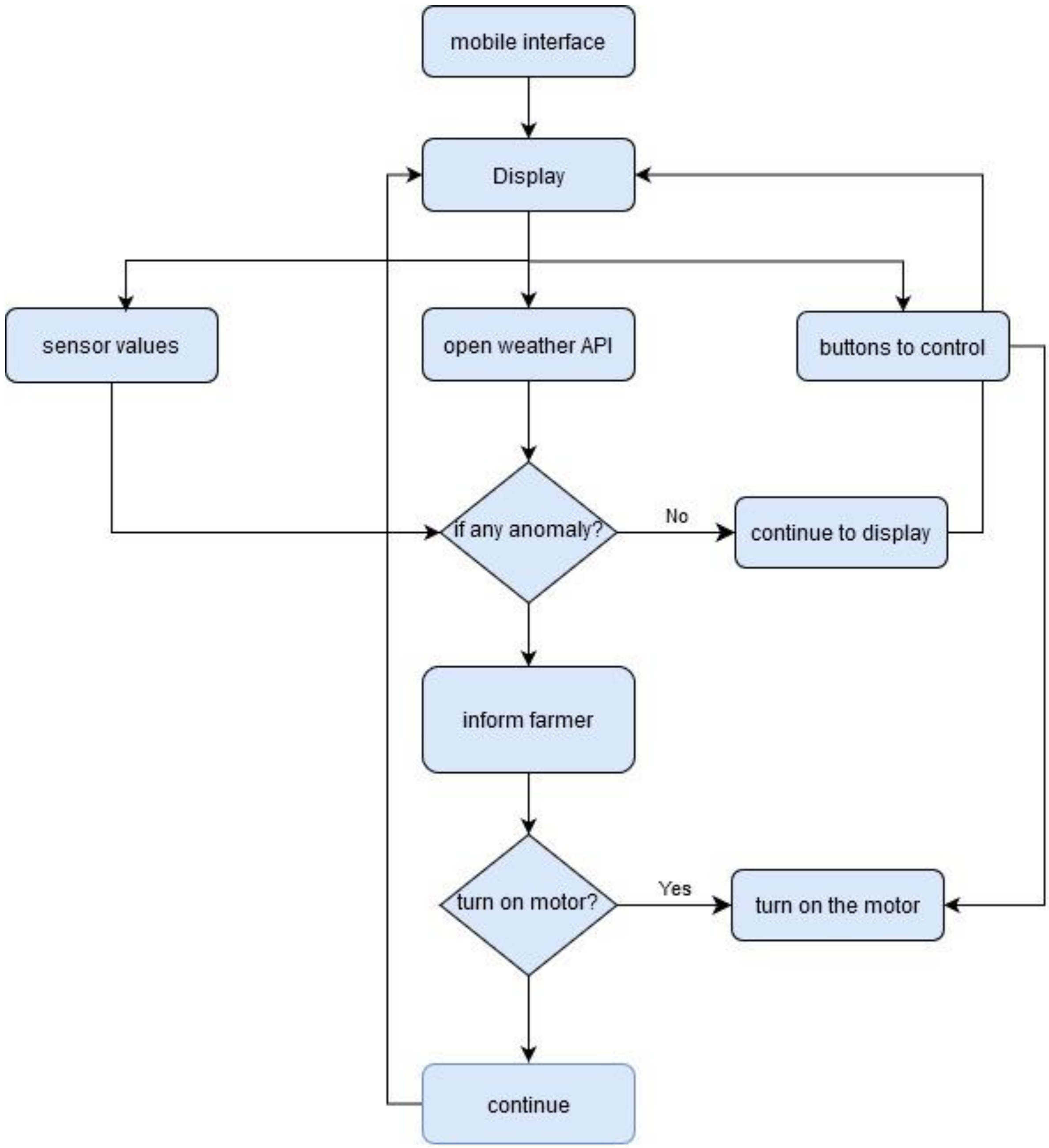
Node-Red UI:



Experimental Investigations:

The weather forecast is obtained from the Open weather API and is displayed in the node-red UI to the farmer and a threshold is set, if temperature, pressure, humidity and soil moisture goes beyond certain value the farmer get intimated and he can turn on/off the motor accordingly.

Flowchart:



mobile interface
Display
sensor values
open weather API
buttons to control
if any anomaly?
No
continue to display
inform farmer
turn on motor?
Yes
turn on the motor
continue

Result:

Hence a helpful and useful system is built for farmers to assist them in farming and also prevent them from natural calamities. It also saves farmers time to maintain all these things as this is working on cloud he can turn on/off motor from anywhere so basically it helps farmers and make them relived thus helping our economy to grow.

Advantages & Disadvantages:

Advantage:

- monitoring weather parameters such as temperature, pressure, humidity, soil moisture remotely
- controlling motors easily through buttons
- alert farmers in case of any calamities
- threshold values are set any anomalies will be reported to the farmer
- user friendly and efficient
- low cost

Disadvantage:

- sensors may sometime malfunction
- maybe inaccurate sometimes
- farmer needs internet connectivity
- farmer must have a phone and have basic knowledge to operate it

Applications:

Monitoring of Climate Conditions

Probably the most popular smart agriculture gadgets are weather stations, combining various smart farming sensors. Located across the field, they collect various data from the environment and send it to the cloud. The provided measurements can be used to map the climate conditions, choose the appropriate crops, and take the required measures to improve their capacity (i.e. precision farming).

Greenhouse Automation

In addition to sourcing environmental data, weather stations can automatically adjust the conditions to match the given parameters. Specifically, greenhouse automation systems use a similar principle.

Crop Management

One more type of IoT product in agriculture and another element of precision farming is crop management devices. Just like weather stations, they should be placed in the field to collect data specific to crop farming; from temperature and precipitation to leaf water potential and overall crop health, these can all be used to readily collect data and information for improved farming practices.

Cattle Monitoring and Management

Just like crop monitoring, there are IoT agriculture sensors that can be attached to the animals on a farm to monitor their health and log performance. This works similarly to IoT devices for pet care.

End-to-End Farm Management Systems

A more complex approach to IoT products in agriculture can be represented by the so-called farm productivity management systems. They usually include a number of agriculture IoT devices and sensors, installed on the premises as well as a powerful dashboard with analytical capabilities and in-built accounting/reporting features.

Conclusion:

Smart Farming and IoT-driven agriculture are paving the way for what can be called a Third Green Revolution.

The Third Green Revolution is taking over agriculture. That revolution draws upon the combined application of data-driven analytics technologies, such as precision farming equipment, IoT, “big data” analytics, Unmanned Aerial Vehicles (UAVs or drones), robotics, *etc*.

In the future this smart farming revolution depicts, pesticide and fertilizer use will drop while overall efficiency will rise. IoT technologies will enable better food traceability, which in turn will lead to increased food safety. It will also be beneficial for the environment, for example, more efficient use of water, or optimization of treatments and inputs.

Therefore, smart farming has a real potential to deliver a more productive and sustainable form of agricultural production, based on a more precise and resource-efficient approach. New farms will finally realize the eternal dream of mankind.

Future Scope:

With the exponential growth of world population, according to the UN Food and Agriculture Organization, the world will need to produce 70% more food in 2050, shrinking agricultural lands, and depletion of finite natural resources, the need to enhance farm yield has become critical. Limited availability of natural resources such as fresh water and arable land along with slowing yield trends in several staple crops, have further aggravated the problem. Another impeding concern over the farming industry is the shifting structure of agricultural workforce. Moreover, agricultural labor in most of the countries has declined. As a result of the declining agricultural workforce, adoption of internet connectivity solutions in farming practices has been triggered, to reduce the need for manual labor.

IoT solutions are focused on helping farmers close the supply demand gap, by ensuring high yields, profitability, and protection of the environment. The approach of using IoT technology to ensure optimum application of resources to achieve high crop yields and reduce operational costs is called precision agriculture. IoT in agriculture technologies comprise specialized equipment, wireless connectivity, software and IT services.

Bibliography:

https://cloud.ibm.com/login

https://openweathermap.org/

https://smartinternz.com/assets/docs/Sending%20Http%20request%20to%20Open%20weather%20map%20website%20to%20get%20the%20weather%20forecast.pdf

https://www.youtube.com/watch?v=cicTw4SEdxk

Appendix:

Python code for the motor is:

https://github.com/rachuriharish23/ibmsubscribe

FOR UI:

https://smartinternz.com/assets/docs/Smart%20Home%20Automation%20using%20IBM%20cloud%20Services%20(1).pdf

https://smartinternz.com/assets/docs/Smart%20Home%20Automation%20using%20IBM%20cloud%20Services%20(1).pdf