1.INTRODUCTION

1.1 OVERVIEW

India is considered as a wealthy country in terms of food resources. India ranks top in worldwide when it comes to food production. As per 2018, India contributed more than 18% of country's Gross Domestic Product (GDP) [1]. The economic contribution to agriculture and low income of farmers causes steady decline in agriculture contribution towards country's GDP. Most of the times farmers are not aware of foreseen or unforeseen weather conditions, resulting crop damage. Due to lack of technology to forecast weather farmers are losing their months of hard work to heavy rains or droughts.

fig. 1 India agriculture suffers from low productivity [2]

In India irrigation systems are inadequate, leading to crop failures in some parts of the country because of lack of water. In other areas regional floods, poor seed quality and inefficient farming practices also leads to crop failures. By providing proper technology to farmers we can increase the crop yield which further increases the farmers income and provides more contribution to country's GDP.

1.2 PURPOSE

The purpose of the system is providing valuable information like soil humidity and weather to farmers and allow them to control the motors installed for irrigation so as to meet the crop water demand. This farm monitoring can also be done via application on smart phones for convenience use and time saving. The system continuously measures the soil conditions and updates the farmer through mobile application. This system also provides weather forecast of the location so that the farmer can control the water supply to the crop also through mobile application from anywhere.

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM

Problems of a farmer are mainly infrastructural and economic. The biggest hurdle to all this is the absence of technological resources and education. To make a farmer understand the working of big labour machines and tech-devices we need to educate them first. After that we need to bring more power- from all kinds of sources- be it nuclear, coal, water, solar. Put your weight behind in investing in all the power sources so that there is better infrastructure.

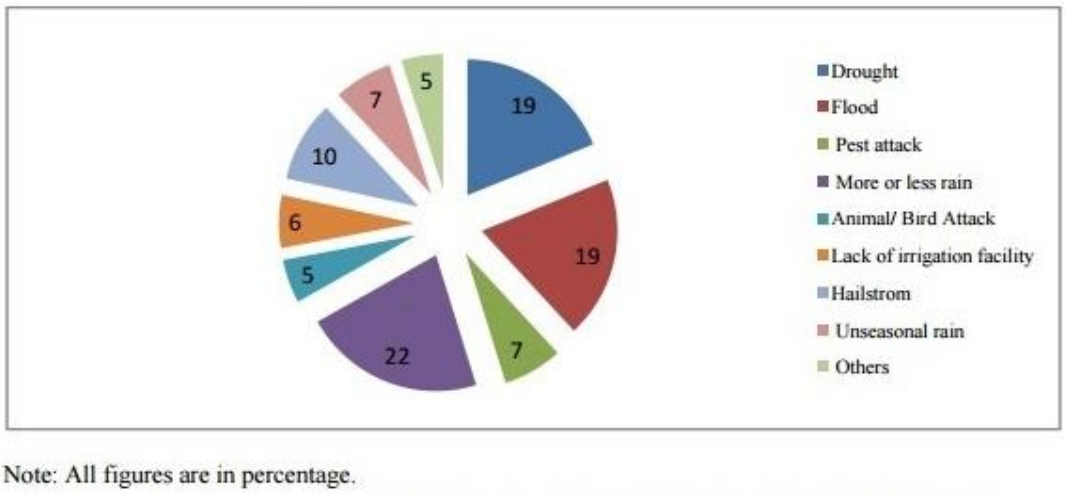

fig. 2 Graph showing reasons for crop damage [3]

The main problem faced by farmers are natural disasters. Due to lack of technology farmers forecast the weather with previous experience and based on that they water their crops. Not always the expectations meet the reality, heavy rains or drought damages the crops.

Another problem is poor irrigation technologies. Governments provide power supply to the farmers based on the load demand of industries. When the government provide supply to the farmers, they need to utilize that power to draw the water from nearby water source. A farmer may not be available at the location when the government gives the power, he may lose the chance of watering the crops.

We can make use of technology to help resolve these above issues. We can utilize mobile application to inform farmers about weather conditions. By using the internet of things, the farmer may control the motor devices from anywhere through his mobile.

2.1 PROPOSED SOLUTION

By adopting the latest technologies of IoT in agriculture practices, every aspect of traditional farming method can be changed from roots. Currently, integration of sensors and the IoT in smart agriculture can raise agriculture to levels which were previously unimaginable.

In a journal “Internet-of-Things (IoT)-Based Smart Agriculture: Toward Making the Fields Talk” by Muhammad Ayaz, Mohammad Ammad-Uddin, Zubair Sharif, Ali Mansour , El-Hadi M. Aggoune [4] they proposed that by constantly measuring soil parameters like soil type, nutrient presence, flow of irrigation, pest resistance, etc we can prepare a report, based on that report a farmer may crop seeds which are suitable to that land. Furthermore, the use of unmanned aerial vehicles for crop surveillance are favourable for optimizing crop yield.

In our proposed system the IoT device derives the values from humidity and temperature

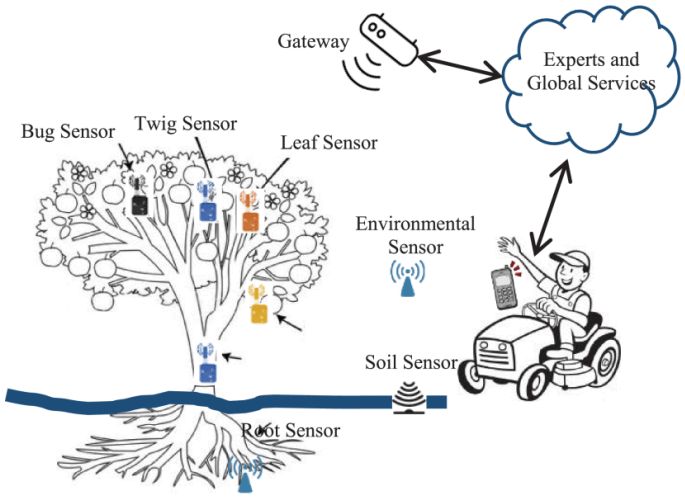

fig. 3 An IoT based farm area network (FAN) [4]

sensors buried in the ground. The device reports these values to the user. With the help of mobile application or webpage user can see these values in the dashboard. The IoT device is also integrated with weather forecast services so that user, farmer in our case always updated with the weather in that location. By using state-of-art sensors we can precisely measure soil parameters and report these back to farmer, with his experience he may plant a crop which is suitable to that land or we can use artificial intelligence to suggest the farmer for a suitable crop.We can also control flow of water into the crops by using IoT device. With help of relays we can control the motor from mobile application with a single click from anywhere we can also suggest the farmer when to turn on the motor based on availability of water in soil with the help of artificial intelligence.

3. THEORITICAL ANALYSIS

3.1 BLOCK DIAGRAM

Initially the IBM Watson Cloud receives the temperature and humidity values from sensors and reports these values to the user through mobile application or webpage. With the help of weather service API, the IBM Watson gets the weather forecasting data from weather service providers and updates the user with weather of the user location. Based on these data farmer can either turn on or turn off his motor from mobile application.

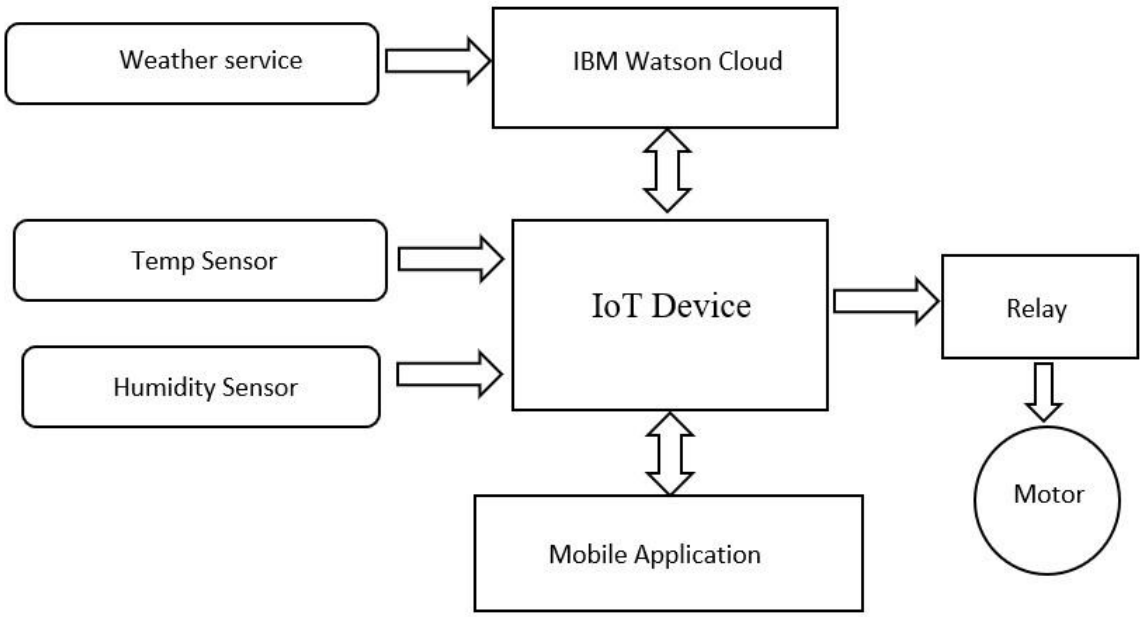

fig. 4 Block diagram of Smart Agriculture System

3.2 HARDWARE / SOFTWARE DESIGNING

The hardware part of the system is quite simple. The temperature and humidity sensors are connected to the analog input pins of IoT device like Arduino or NodeMcu. In case of RaspberryPi we need to use a Digital to Analog converter to get values from analog sensor. The digital out pin of IoT device is connected to water motor through relay.

In software part we need to configure our IoT device with IBM Watson cloud service so that we can visualize the sensor data to the user. In order to configure the IoT device first we need

create an IBM account. Once account is created add a device in IoT Watson platform and connect that device to our IoT device.

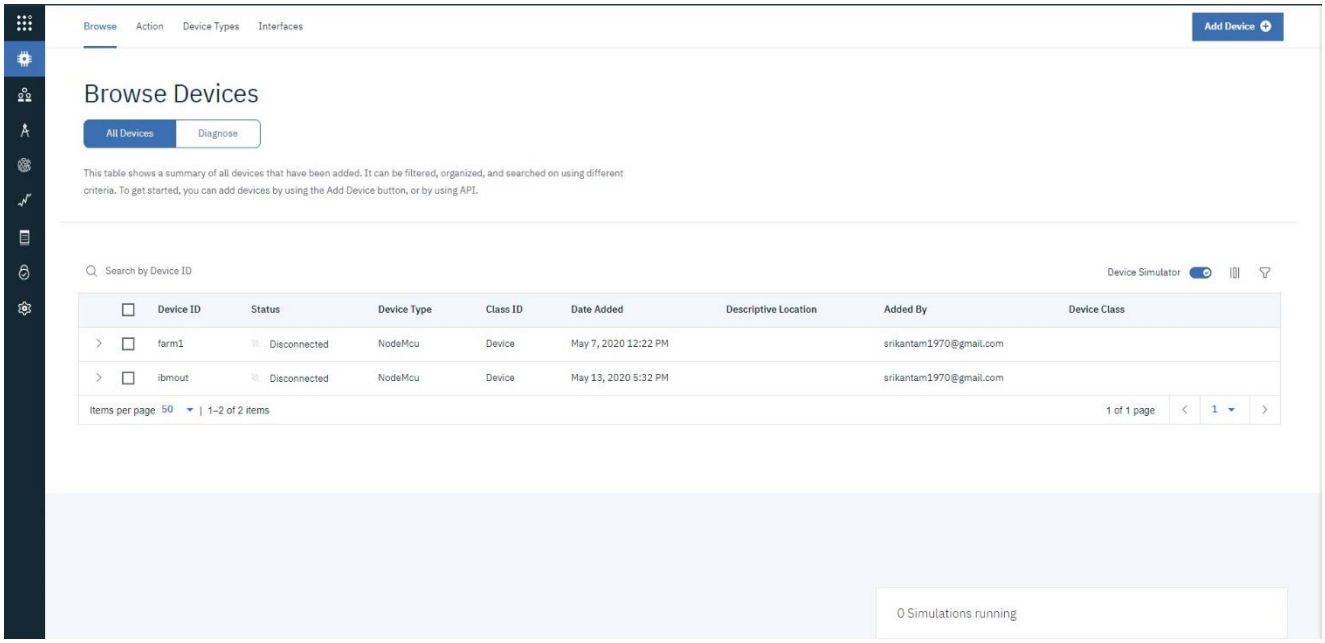

fig. 5 IBM Watson Platform

In order to visualize that sensor data to the user we need to use Node-Red tool. In Node-Red tool add the IBM palette and configure those IBM nodes to the device we just created in IBM platform.

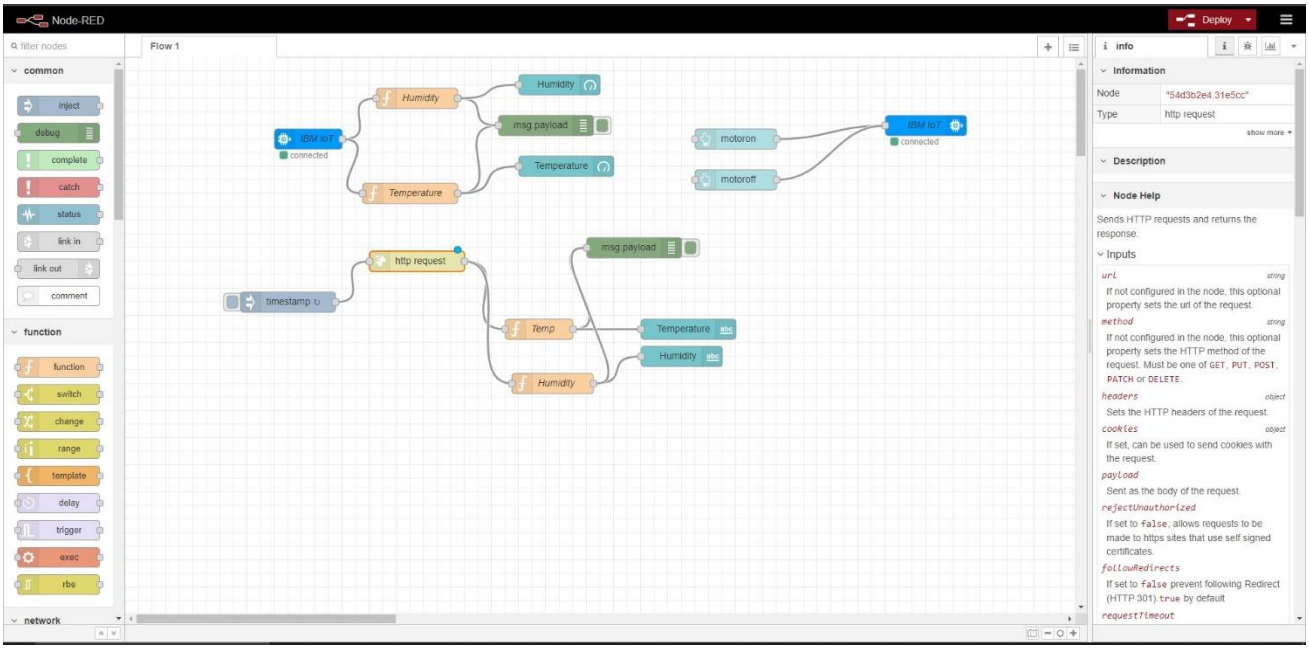

fig. 6 Node-Red with IBM palette

4. EXPERIMENTAL INVESTIGATIONS

By using IBM Bluemix, we can simulate working of temperature and humidity sensors. Once sensors are simulated, we can connect those sensors to the device that we have created in IBM Watson platform. Sensor simulator is shown in fig. 7.

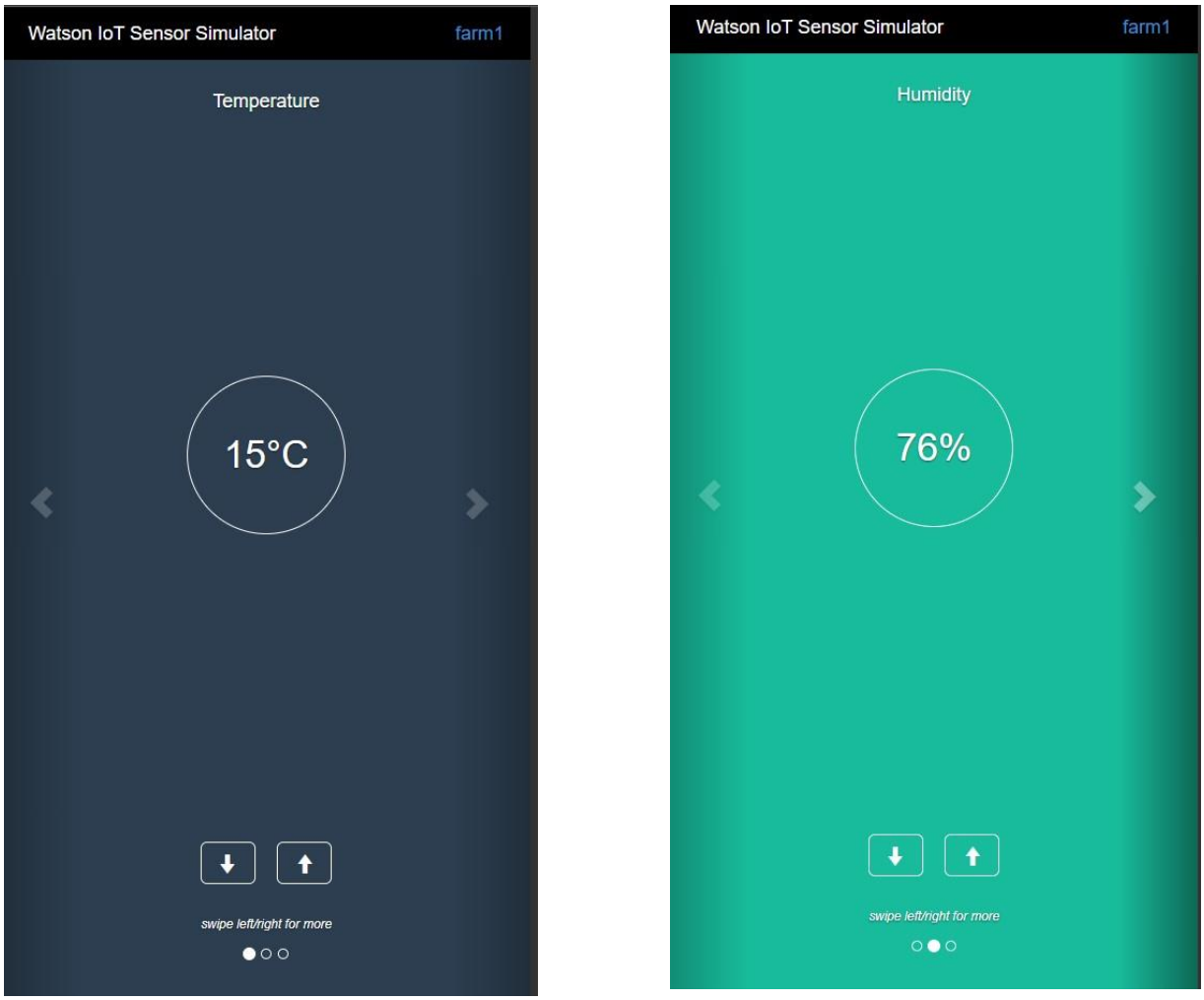

fig. 7 IoT Sensor Simulator

By using Node-Red palette we can visualize those sensors values in a dashboard. We can also configure a weather service provider by using http request node. By connecting all the nodes in node-red and deploying the flow we will get reading as shown in fig.8

We control the motor by sending digital signals to relay from dashboard by using IBMout and button nodes in node-red once all these flows are deployed the system starts showing weather forecast and sensor data.

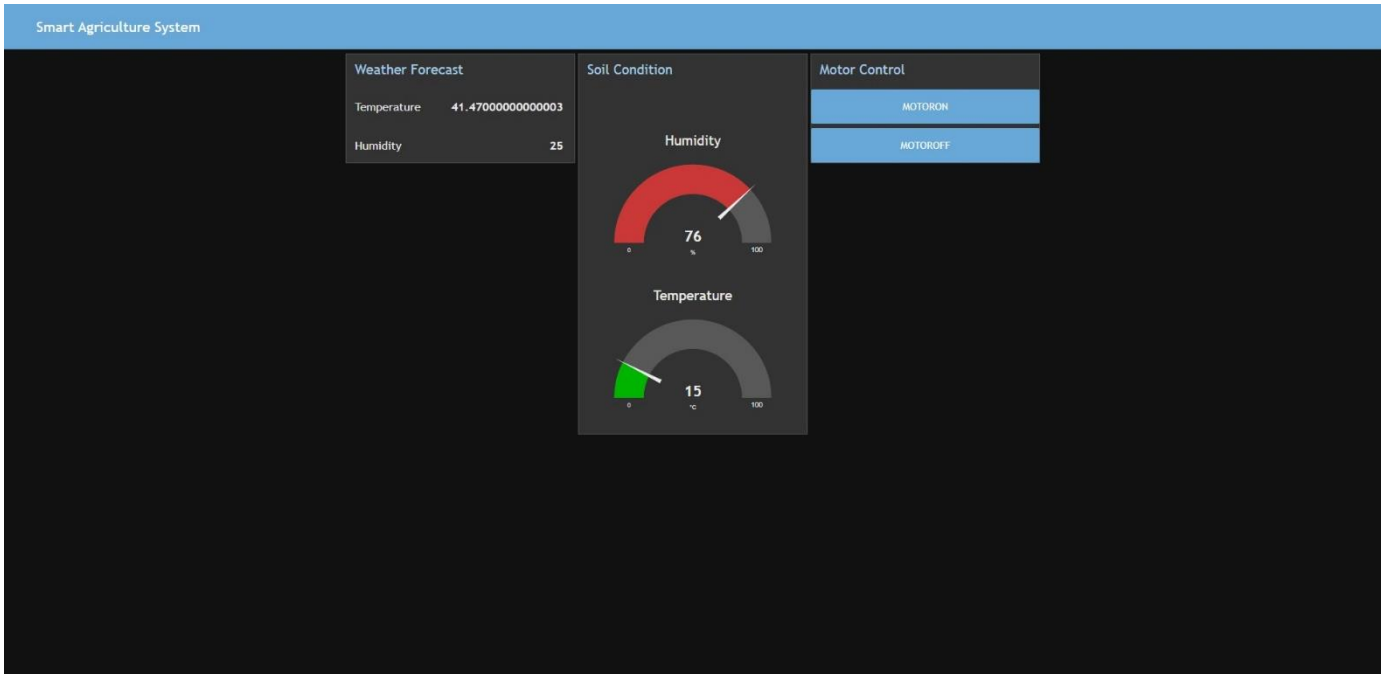

fig. 8 Node-Red dashboard

5.FLOW CHART

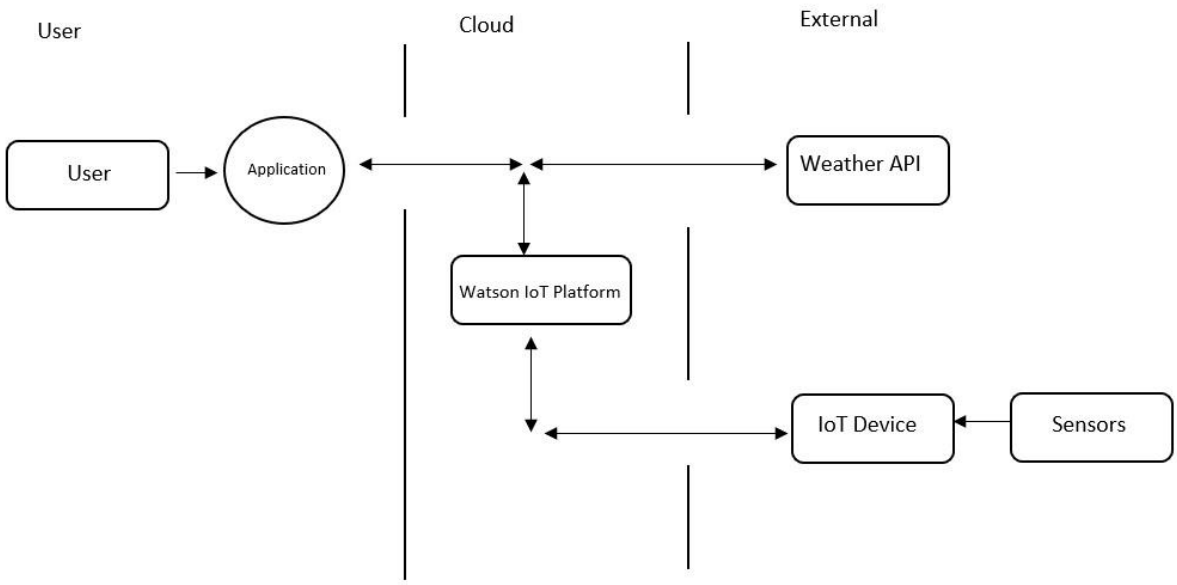

fig. 9 Flow of Smart Agriculture system

When the user opens the application, weather forecast from the weather service provider is shown in dash board. User can also see the sensor data in gauges (shown in fig 8) with the help of IBM nodes in node-red. The Watson platform derives the sensors data from IoT device and visualizes that data to the user. The Watson platform continuously updates the weather of the location. Based on these data user can turn on or turn off his motor by pressing respective buttons in the application

6.RESULT

By using the above technology, we can increase the crop yield and also helps the farmers to understand their land. Farmers can monitor their lands from anywhere with their smartphones. From all the sensor data and weather conditions he can come to a conclusion about watering the crop, this helps in saving crops from excessive or inadequate water.

ADVANTAGES

- Allows farmers to continuously monitor soil parameters.
- Weather forecasting of crop location
- Farmers can control their motor from anywhere

DISADVANTAGES

- Network error can cause device to disconnect.
- Weather forecast may not be accurate.

7. CONCLUSION AND FUTURE SCOPE

By using this system farmers can effectively produce more yield and can save water from wastage. With help of weather forecast service farmer can water their land as per weather. He can also turn off motor when water content in soil is sufficient.

FUTURE SCOPE

- With help of artificial intelligence, we can suggest farmers to grow a particular crop based on soil data from the sensors.
- We can also control the water supply to crops with help of artificial learning based on soil moisture.

8.REFERENCES

[1] https://en.wikipedia.org/wiki/Agriculture_in_India

[2] https://www.livemint.com/Opinion/nw9JKiPrDPpqCuWfmoibPN/Indias-agricultural-yield-suffers-from-low-productivity.html

[3] http://www.lokniti.org/pdf/Farmers_Report_Final.pdf

[4] "Internet-of-Things (IoT)-Based Smart Agriculture: Toward Making the Fields Talk" by Muhammad Ayaz, Mohammad Ammad-Uddin, Zubair Sharif, Ali Mansour , El-Hadi M. Aggoune, IEEE, VOL 7, JUNE 2019.