PROJECT REPORT:-

REPORT ON SMART AGRICULTURE USING IOT

1.0 Introduction

Knowledge and capital are essential for any innovation. There are innovations and discoveries happening in each and every field, now its time to update our farmers and innovate things in farming field too.New farming technologies require more and more professional skills.Internet of Things (IoT) technology has brought revolution to each and every field making everything smart and intelligent.The development of Intelligent Smart Farming IoT based devices is necessary to improve the face of agriculture production by not only enhancing it but also making it cost-effective and reducing wastage.

1.1 Overiew

The aim / objective of this report is to propose IoT based Smart Farming System assisting farmers in getting Live Data (Temperature,Humidity, Soil Moisture) for efficient environment monitoring which will enable them to increase their overall yield and quality of products and also make them ready for sudden climatic changes. The IoT based Smart Farming System being proposed via this report is integrated with IBM cloud Technology mixed with different online Sensors producing live data feed that can be obtained online from openweathermap.org. The product being proposed is an online module and is not tested on real time environment but the weather conditions obtained from openweathermaps are live weather updates of a particular area.

1.2 Purpose

As per the report submiitted by Forbes the world will be more than 9.6 billion consequently leading to 70% increase in food consumption by 2050.The agricultural sector is going to face enormous challenges in order to feed the 9.6 billion people are going to inhabit the planet by 2050 in order to tackle this food production must increase by 70% by 2050, and this has to be achieved in spite of the limited availability of arable lands, the increasing need for freshwater (agriculture consumes 70 percent of the world's freshwater supply) and other less predictable factors, such as the impact of climate change. At that point of time we cannot afford to loose crops due to any sort of natural disasters.Hence to avoid few of such factors like climatic changes and in time water supply we came up with this solution.

Need of automatic irrigation:

Simple an easy to install and configure.
Saving energy and resources, so that it can be utilized in proper way and amount.
Farmers would be able to smear to right amount of water at the right time by automatic irrigation.
Automated irrigation system uses vales to turn motor ON and OFF. Motors can be automated easily by using controllers and no need of labour to turn motor ON an OFF.
It is precise method for irrigation and a valuable tool for accurate soil moisture control in highly specialized greenhouse vegetable production.
It is time saving, the human error elimination in adjusting available soil moisture levels.

2.0 Literature Survey

Anupriya Tuli et.al proposed Farm Management Information System (FMIS) through the web-based approach to fulfilling the requirements of farming in an advanced manner. This system requires a farmer to know and use web-based applications which it may not be feasible for the farmers of underdeveloped/developing countries. Burdens on farmers are minimized by connecting farming work with IoT .

Ruchita et al. used Web-based IoT with Radio Frequency Identification (RFID) to control farming devices. Suma et al.They have concentrated on crop monitoring, information of temperature and rainfall is collected as initial spatial data and analysed to reduce the crop losses and to improve the crop production.

Prof. K.A.Patil and Prof. N.R.Kale propose a wise agricultural model in irrigation with ICT (Information Communication Technology).The complete real-time and historical environment is expected to help to achieve efficient management and utilization of resources.This Smart Agriculture System consists various features like GPS based remote controlled monitoring, moisture and temperature sensing proper irrigation facilities.

Mahammad shareef Mekala, Dr.P.Viswanathan demonstrated some typical application of Agriculture IOT Sensor Monitoring Network Technologies using Cloud computing as the backbone.

Nelson Sales experimented with interconnection of smart objects embedded with sensors that enabled them tointeract with the environment and among themselves, forming a Wireless Sensor Network (WSN). This network collects and analyse the data, such as temperature and soil moisture. This type of data can be applied to automate the irrigation process in agriculture for decrease water consumption.

2.1 Existing problems

As we all know farmers majorly depend on the climate for their crop production. But not all the times they are correct. There are cases where farmers. Climate change could hurt farmers' income by up to 20-25% some times he might loose 100% too, thats a huge loss.Extreme temperature shocks, when a district is significantly hotter than usual, results in a 4.7% decline in agricultural yields. Similarly, when it rains significantly less than usual there is a 12.8% decline.Lower yields mean lower incomes for farmers. In a year where temperatures are 1℃ higher, farmers' incomes would fall by 6.2% in unirrigated districts. Temperatures in India are likely to rise by 3 to 4℃ by the end of the 21st century. More over if there is no in time irrigation waterthere is also a change of crops getting dry. It follows that in the absence of any adaptation by farmers, farm incomes will be lower by 20 to 25% on average in the coming years.

2.2 Proposed Solution

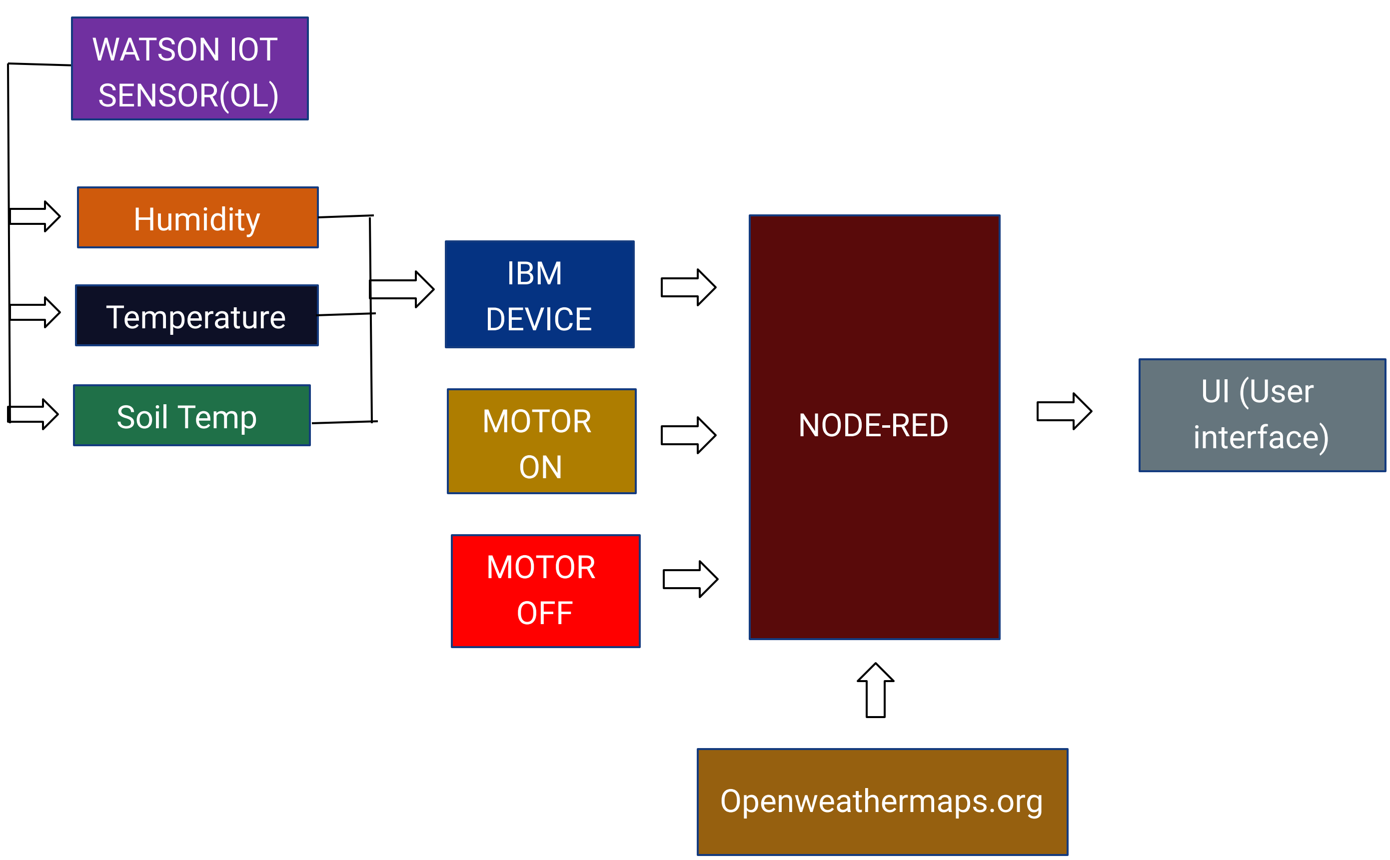
In order to control this problems, improve the crop production and increase the crop quality we have come with a an IOT application which can serve farmers with a all the necessary information like temperature, humidity, soil moisture which they need , with time to time updated information to improve the crop production we need to plant temperature, humidity and soil moisture sensors in the field to have a better and more accurate values to take necessary preventive measures in time . This application feeds us with sensor data placed in the field as well as the most recent weather data of that particular area using the openweathermaps.org are also provided.We collect all the most recent data obtained and update it in the user interface designed by the Node-red. With this data we can have an eye on the climatic conditions of that area.When ever

there is a clear sign of heavy rainfall or sunny, farmers can take necessary precautions by watering plants or removing of excess amount of water from the field based on the weather condtions before the damage happens.
We have also provided a facility to control the irrigation motor (ON,OFF) from ur convinience through internet from anywhere and anytime. These buttons are displayed on the node red interface on front end, Back-end they work based on a python program. With this the crops do not get dry and farmer need not go all the way to the farm only to switch on the motor. This reduces the physical burden of farmers, as well as plants don't get dry. In this way we can help farmers from reducing physical work and reducing crop damage.

3.0 Theoritical analysis

Smart agriculture also known as precision agriculture allows farmers to maximize yiels using minimal resources such as water, fertilizer and seeds. By deploying sensors and mapping fields farmers can begin to understand their crops at a microscale,conserve resources and reduce impact in the environment. Advances in sensor technology has also proven beneficial to the agricultural industry through its application.

3.1 Block Diagram:



3.2 Hardware / Software designing

The architecture above shows how the sensors and various components of system are connected to the Node-Red flow which is an Online programming tool. In this, we have used various sensors like soil moisture sensors, temperature sensors and Humidity sensor which continuously monitor the field. The data received from the sensors is send to the web server through the Node-Red using the IBM Cloud software. The web server is designed to analyze the data received and to check the values of moisture and temperature. The above diagram also shows how the data will be send to the web server. The motor would be turn off/on as per the instructions given by the farmer.

1) **IBM Cloud:**

IBM Cloud is an online cloud computing service which provides us with Infrastructure as a service(IAAS) and Platform as a service(PAAS). This service is provided by the company IBM. There are many services provided by the ibm cloud for the Lite users which is free of cost. With IBM IAAS platform we can access many resources like storage,networking computing power and many more.Usiing PAAS we can develop many applications, we can create, manage, run and deploy applications in this platform.IBM supports many programing like Java, Node.js, PHP and Python and extends to support other languages.It also supports various iBM services like IBM Watson and IBM Bluemix sensor.IBM Cloud catalog provides us with more than 100+ services and software which are available any time for our usage.Docs help us with how to use ibm cloud how to navigate console and mainly focus to provide step by step procedure to achieve things without any problem.IBM offers three deployment models for its cloud platform they are public,private,dedicated(A single tenant private cloud).These are the various features and services provided by IBM cloud (https://cloud.ibm.com/).

2) **IBM Waston IOT Platform**

IBM Watson is an artificial intelligence system that uses machine learning and can process natural language.IBM Watson IOT platform is an online platform as a service(PAAS) service provided by IBM cloud for performing various IOT projects. We have created device type, device from this platform and used them to receive updates from bluew=mix online sensor simulatorWe need to provide device type name, device ID, serial no, etc, necessary details to create device type. After device type creation we need to do device registration in order to do a specific device providing device name, serial no, model, Manfacturer , device class etc . One the device is created we are provided with necessary device credentials which need to be preserved for later use..By using these credentials we connect the device to an online blue mix sensor, By switching on the device simulator and connecting it to sesnor we will be able to receive the temperature, humidity , soil moisture values of sensor to the device which can be seen under the status menu. These day are provided in .Json format.We have a board (https://hfn7io.internetofthings.ibmcloud.com/dashboard/boards/) concept in IOT platform() using which we can pictorially sepresent any data received by the device, Using these we represent the temperature, humidity , soil moisture values in a gauge format.These are the few feature we have utilized in this project.

3) Node-Red

Node-RED is a programming tool for wiring together hardware devices, APIs and online services in new and interesting ways. It provides a browser-based editor.We can either use it from online or download it for better storage capacity.There are 100s of Node pallets for our use which are well catorgorised under different domains.for our project we have used pallets like https request,Button,IBM IoT etc and configured them according to the requirement,and arranged them in the flow.

4) Watson IOT Sensor

Watson IOT Bluemix is an online simulator which provides with random sensor values. They are not accurate and randomly generated. We can even adjust the values as our wish. In order to access the Simluator we need to provide the necessary credentials of the device which is created in the IBM Watson IOT platform. By doing this all the sensor values will be sent to the IBM Cloud which will be shown in the status menu of the device in .json format. In this Watson IOT sensor provides with randomly generated temperature ,humidity and soil temperature values.

5) OpenWeatherMap

Openweathermap is an online service which provides with weather data.It is owned by OpenWeather Ltd . It can be accessed by anyone free of cost. All we need to do is create an openweathermap account and an default API is generated. Using the Get started option from menu it provides with all the necessary steps to create the account. Using option API it provides with various subscriptions. By using API doc option shown on left side ofthe subscription it provides us with the format of the link which can be used to obtain any area weather forcecast all we need to do is edit area name and API key.In this open weather api is used to obtain various area Weatger forecast.Format of link(http://history.openweathermap.org/data/2.5/history/city?q={city ID},{country code}&type=hour&start={start}&end={end}&appid={YOUR_API_KEY})

4.0 Experimental Investigations

IBM cloud:

Experimented withthe cloud foundery apps service. Tried to develop an app of my own. 60% of the work is done.and also started to work on Watson Asisitant too.

IBM Watson IOT Platform:

Created a new gateway device type and explored all different features present there.Created a device for the gateway. Experimented on different boards and graphs available.Added my team members to my account and attached their role.

Node-Red:

Experimented on using new node palettes. Tried to make a new flow for open energy monitor using the similar concepts and tried to make the user interface as attractive and easy to understand.

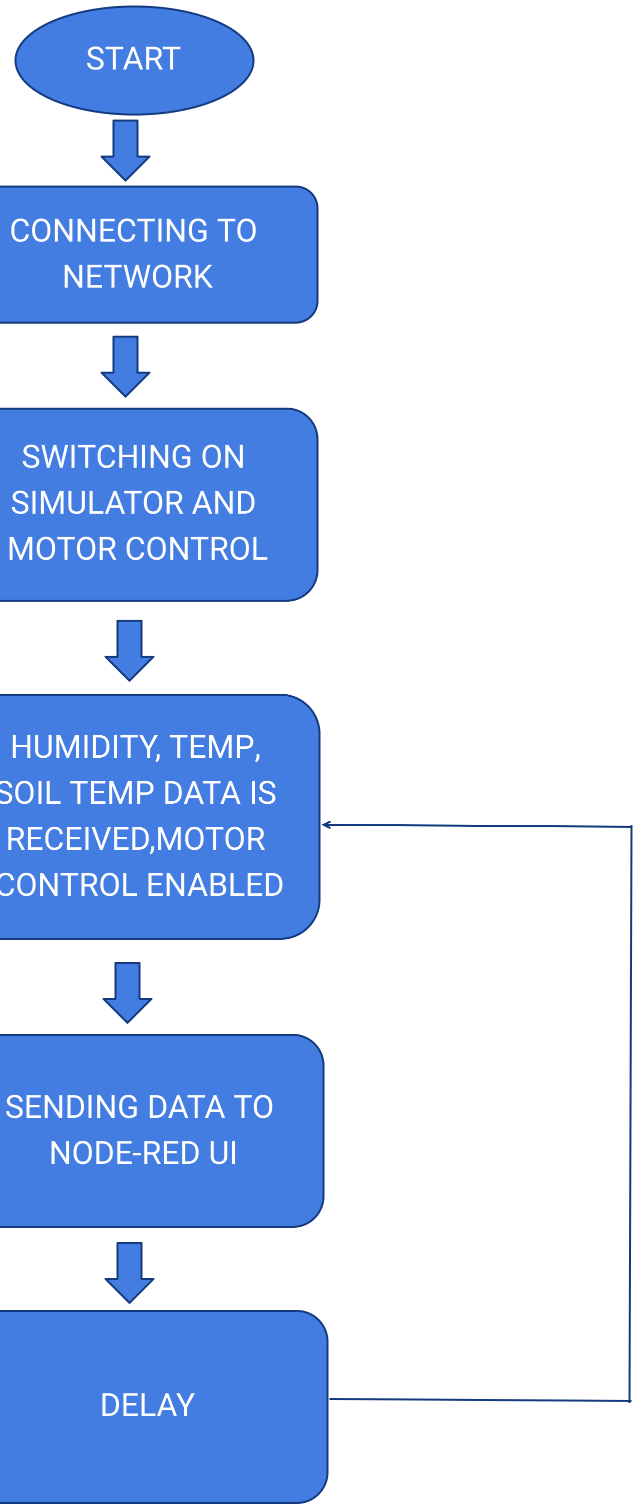
Watson IOT Sensor:

Connected the simulator to diff devices and verified .And also created new boards and connected them. Adjusted the values and also connected them the node red interface and verified their values.

Openweathermap:

Generated Multiple API as tested their working. Searched for different area and identified their weather forecast and tallied with other google search results. Used maps to identify world wide weather forecast and read few articles from the Blog.

5.0 Flowchart



6.0 Result:

By taking the different criteria on smart automation irrigation, there are several in the agricultural sector. Out of which we tried to solve few problems.By using sensors(Online) and IOT device(Online) we made this online simulated product. The system is not tested in real life conditions.The system works properly and senses the soil moisture, Humidity , Temperature sent by the online simulator. The control unit also works accurately to ON and OFF the water pump.It works accurately in online platform and need to be tested in real life conditions

7.0 Advantages & Disadvantages

Advantages:

It is very cost efficient.
It is very easy to use.
Water will be used efficiently.
Healthy crop production.
Increase crop quality.
Decreases Crop Losses.

Disadvantages:

The more the property size the higher the cost.
Technical failures may lead to heavy loss.
Pests or insects may damage the sensors.
Power consumption increases.
Need to modify the motor which might charge.

8.0 Applications

1) Time to time weather updates to take care of crops.
2) Easy in predicting weather with the provided data.
3) A smart irrigation technique is used for automatic water supply to fields.

4) Automatic irrigation is used for getting high yields in any crop.
5) Smart irrigation techniques are future agricultural techniques.

9.0 Conclusion

IoT based SMART FARMING SYSTEM for Live Monitoring of Temperature, Humidity and Soil Moisture has been proposed using IBM Cloud and Node-Red . The System has high efficiency and accuracy in fetching the live data of temperature and soil moisture. The IoT based smart farming System being proposed via this report will assist farmers in increasing the agriculture yield and take efficient care of food production as the System will always provide helping hand to farmers for getting accurate live feed of environmental temperature and soil moisture as well as Control the Motor from any location anytime just with internet facility with accurate results.

10.0 Future Scope

Future work would be focused more on increasing sensors for more accurate values , analyse crop quality, identifying suitable crop for the land and try setting upa virtual crop growing environment. Increasing focus on Pest Control and by also integrating GPS module in this system to enhance this Agriculture IoT Technology to full-fledged Agriculture Precision ready product.

11.0 Bibilography

1. https//:www.researchgate.net

2. https//:www.wikipedia.org

3. https//:www.rapidonline.com

4. https//:www.schematics.com

5. https//:www.batteryuniversity.com

6. https//:www.thingspeak.com

7. https//:www.youtube.com

https://www.iotforall.com/iot-applications-in-agriculture/

Anand Nayyar, Er. Vikram Puri, “IoT Based Smart Sensors Agriculture Stick for Live Temperature and Moisture Monitoring using Arduino, Cloud Computing & Solar Technology” May 2015

Chandan kumar sahu, Pramitee Behera, “A Low Cost Smart Irrigation Control System”, IEEE sponsored 2nd International conference on electronics and communication system (ICECS2015)

Apurva C. Pusatkar, Vijay S. Gulhane, “Implementation of Wireless Sensor Network for Real Time Monitoring of Agriculture”, International research journal of engineering and technology (IRJET). Volume: 03 issue: 05 | May-2016

Rajeswari, S., Suthendran, K., and Rajakumar, K., 2017, A Smart Agricultural Model by Integrating IoT, Mobile and Cloud-based Big Data Analytics, International Conference on Intelligent Computing and Control(12C2), pp. 1-5.

He, W., Cai, M., Wang, Y., and Wang, X., 2010, Automatic Water Supply Control System of Graded Constant Pressure by Variable Frequency Speed and Its Application to Pipeline Irrigation, WRI Global Congress on Intelligent systems, 385-388.

APPENDIX

A. Source code

```
import time
import sys
import ibmiotf.application # to install pip install ibmiotf
```

```
import ibmiotf.device

#Provide your IBM Watson Device Credentials
organization = "******" #replace the ORG ID
deviceType = "********"#replace the Device type wi
deviceId = "*******"#replace Device ID
authMethod = "token"
authToken = "**********" #Replace the authtoken

def myCommandCallback(cmd): # function for Callback
	print("Command received: %s" % cmd.data)
	if cmd.data['command']=='MotorON':
		print("MOTOR ON IS RECEIVED")

	elif cmd.data['command']=='MotorOFF':
		print("MOTOR OFF IS RECEIVED")

	if cmd.command == "setInterval":

		if 'interval' not in cmd.data:
			print("Error - command is missing required information:
'interval'")
		else:
			interval = cmd.data['interval']
	elif cmd.command == "print":
		if 'message' not in cmd.data:
			print("Error - command is missing required information:
'message'")
		else:
			output=cmd.data['message']
			print(output)
```

```
try:
 deviceOptions = {"org": organization, "type": deviceType, "id": deviceId,
"auth-method": authMethod, "auth-token": authToken}
 deviceCli = ibmiotf.device.Client(deviceOptions)
 #..............................................

except Exception as e:
 print("Caught exception connecting device: %s" % str(e))
 sys.exit()

# Connect and send a datapoint "hello" with value "world" into the cloud as
an event of type "greeting" 10 times
deviceCli.connect()

while True:

        deviceCli.commandCallback = myCommandCallback

# Disconnect the device and application from the cloud
deviceCli.disconnect()
```

.