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IoT based real time agriculture farming

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Abstract

The Internet of things (IOT) is remodeling the agribusiness empowering the agriculturists through the extensive range of strategies, for example, accuracy as well as practical farming to deal with challenges in the field. The paper aims making use of evolving technology i.e. IoT and smart agriculture using automation. The objective of this research paper to present tools and best practices for understanding the role of information and communication technologies in agriculture sector, motivate and make the illiterate farmers to understand the best insights given by the big data analytics using machine learning. The methodology used in this system can monitor the humidity, moisture level and can even detect motions. According to the data received from all the sensors the water pump, cutter and sprayer get automatically activated or deactivated. we investigate a remote monitoring system using Wi-Fi. These nodes send data wirelessly to a central server, which collects the data, stores it and will allow it to be analyzed then displayed as needed and can also be sent to the client mobile.

Keywords: *Agriculture, IoT, Sensors, Smart Farming, Raspberry Pi3*

1. Introduction

Most of the rural residents are depends on agriculture. Still the traditional tools and techniques have been using for agriculture in the world. Today the world is equipped with latest technology in every field including the agriculture sector. Artificial intelligence, robots, sensors and machine learning gives more knowledge in various sectors. Today the world is monitored by various types of machines including sensors [1]. Very large amount of data is being generated from various data sources like satellites, sensors etc. The land for cultivation is being decreased, because of urbanization. There is a need to increase crop product drastically. For achieving

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high yield from agriculture, there is a need to adopt latest information technology and communication technologies [2]. Big data is becoming popular for analyzing the agricultural big data. Management of agriculture and crop yield can be analyzed by big data analytics [3].

The agricultural big data collects and stores the information about farmers, crops, pest control for different crops, climate change in specific areas, water availability in different places and seasons, government support for different crops etc. The entire agricultural big data stored in various storage devices which is under the control of 3rd party vendors [4]. Here data privacy. Because the agricultural big data is a combination of public data, private data, industrial data and data from government. So, data privacy and security are required for private data and industrial data [5].

2. Existing technology

2.1 Smart agriculture

Now a days the term modern agriculture involves mentoring the whole procedure from sowing to crop harvesting and storages through cloud based iot. It's not a secret that the internet of things (iot) triumphally changes the world [6]. In fact, it has already introduced innovation in various industries, which assisted in increasing the effectiveness and cutting the costs of business operations in different aspects. And the area of agriculture fits this trend totally. Being previously dependent on human resources and hard machinery completely, it has also started applying technological solutions and modernizing its core operations [7]. And so, it is possible to discuss agriculture iot as the whole sphere. To address this task, we discover the main directions in which internet of things (iot) applications in agriculture managed to make a significant impact [8]. New trends like satellite monitoring where large farm areas are monitored. Satellites, planes and recently unmanned drones are deployed for areal imagery operations. For achieving the smart agriculture, the following tools and technologies are required.

2.2 Need of sensors in agriculture

A significant lose 10% of global food production, can happen with plant diseases and pest in commercial agricultural crops in the world [9]. Pesticides are very helpful to control the plant diseases and pests. The usage of pesticides can increase the cost for yielding the commercial crops and raises the danger of toxic residue. Once the plant diseases and pests are identified in advanced, then plant diseases and pest control would be efficient. The cost for identifying these diseases and pests using traditional approaches is more [10]. Today, the new technology came into the public. The entire agriculture fields are covered by satellites, sensors, drones etc. The farmers are using drones for collecting and maintaining the data of different crops, pests, water facilities etc. The remote sensing system provides a harmless and cost-effective techniques for identifying and quantifying the plant diseases and pests easily [11]. Types of sensors for agriculture sector

- Agriculture Sensors
- Location Sensors
- Mechanical Sensors
- Air Flow Sensors
- Electro-Chemical Sensors
- Optical Sensors
- Dielectric Soil Moisture Sensors

3. Proposed system

In this paper the updated data regarding temperature and humidity in any areas can be accessed using sensor, raspberry pi3 and iot technology [12]. The monitoring node connected with raspberry pi3 which will store and display the parameters like temp and humidity in agriculture field using script written in python language. The dht11 temperature & humidity sensor features a temperature & humidity sensor provides digital output but dht11 is mainly used for the humidity measurement. Features of sensors includes high reliability and long-term stability in this the temperature is displayed degree Celsius or Fahrenheit [13]. The data being processed by raspberry pi will be updated continuously on cloud server which fetches data and user can get information and alerts about temperature and humidity from all over world.

Advantages of proposed system

- Reduce the time and space complexity problem
- Helpful for commercial and industrial purpose
- User friendly
- 24/7 accessible
- Decision making
- Crop production increases
- Effectively utilization of resources
- Profitable in term of farmers
- Saving of resources like water and fertilizer

3.1 Block diagram

The real-time temperature and humidity is being monitored by the proposed system effectively. Here monitoring node is raspberry pi3 model b and sensing node is dht11 temperature and humidity sensor. The sensor is connected to raspberry pi3 model b with the help of jumper wires. The jumper wires must connect to gpio pins of the raspberry pi3 model b. Raspberry pi3 module is programmed using python language. The output temperature is viewed in celsius or fahrenheit as required. In this project, sqlite queries is used to retrieve data from the database [14]. By creating the tables data is stored into those tables along with date and time. Minimum, maximum and average values of the temperature and humidity over a certain period also known with the help of sql lite. The sensing data is continuously entered into database. Sql lite queries is used to retrieve those data [15]. The xming server is used to interact with raspberry pi 3 model b module. The block diagram of the proposed system is displayed below:

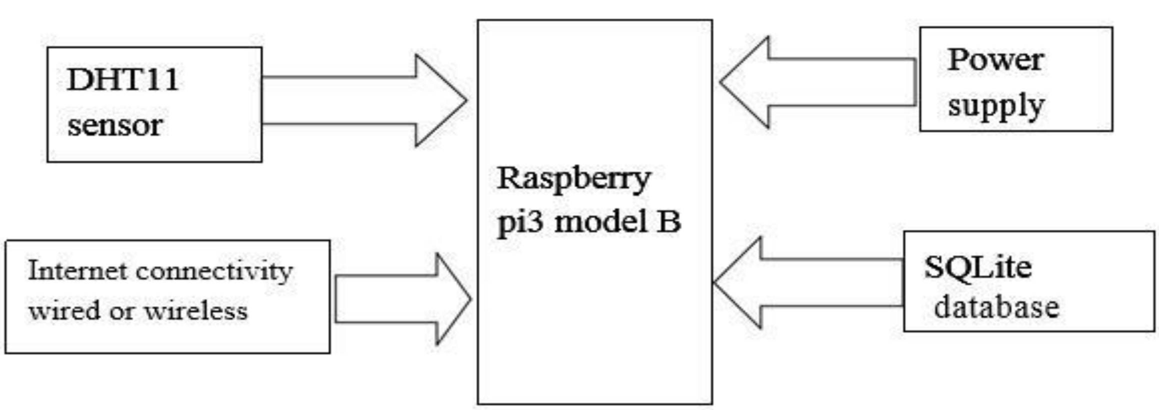

Figure 1. block diagram of raspberry pi3 model b

3.2 Sequence diagram

The sequence diagram models the collaboration of objects based on a time sequence. It shows how the object "user" interacts with others "raspberry pi" and "database".

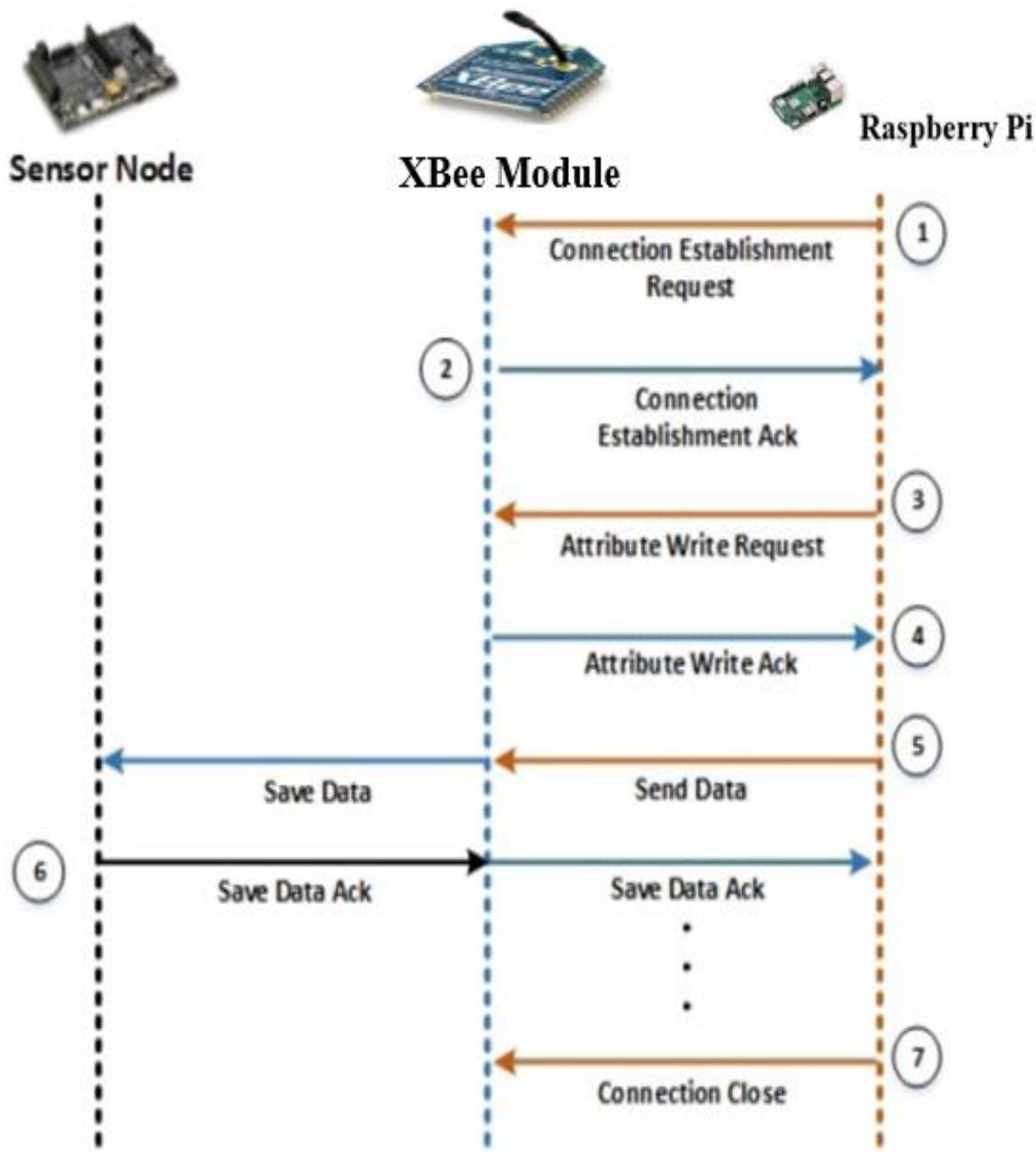

Figure 2. sequence diagram for communication for upload/download process

4. Implementation

The data is being gathered from various data sources in the world using sensors, satellites, machines etc.

Here iot plays an important role. In this paper, a simple iot implementation has been initiated for gathering temperature data and humidity data from various sensors [16]. Then the data is analyzed and give predictions to the society like what type crop is suggestable based on the current climate, based on water level, based on price supported by government etc.

4.1 Process to connect raspberry pi to laptop

- Firstly make wifi connection into shared mode.
- Connect the raspberry pi to the laptop using usb cable and ethernet cable.
- Then advanced ip scanner is used to scan the ip address of raspberry pi.
- After that putty and xming server is used to view the gui interface. Xming server

By using this GUI interface is obtained. It is act like a server for windows. It is fast, simple to install [17].

4.2 Advanced ip scanner

It scans all the ip addresses in a range of ip addresses and their ports without installing the software. It is a free and open-source terminal emulator, serial console and network file transfer application.

Figure 3. terminal for file transfer

- Enter ip address in the host name field.
- Now open ssh and in that double click x11, then enable x11 forwarding.
- Secure socket shell (ssh) provides administrators to access a remote computer securely.
- x11 forwarding can be useful when a gui is required, especially for system and configuration tools

that don't have a cli interface.

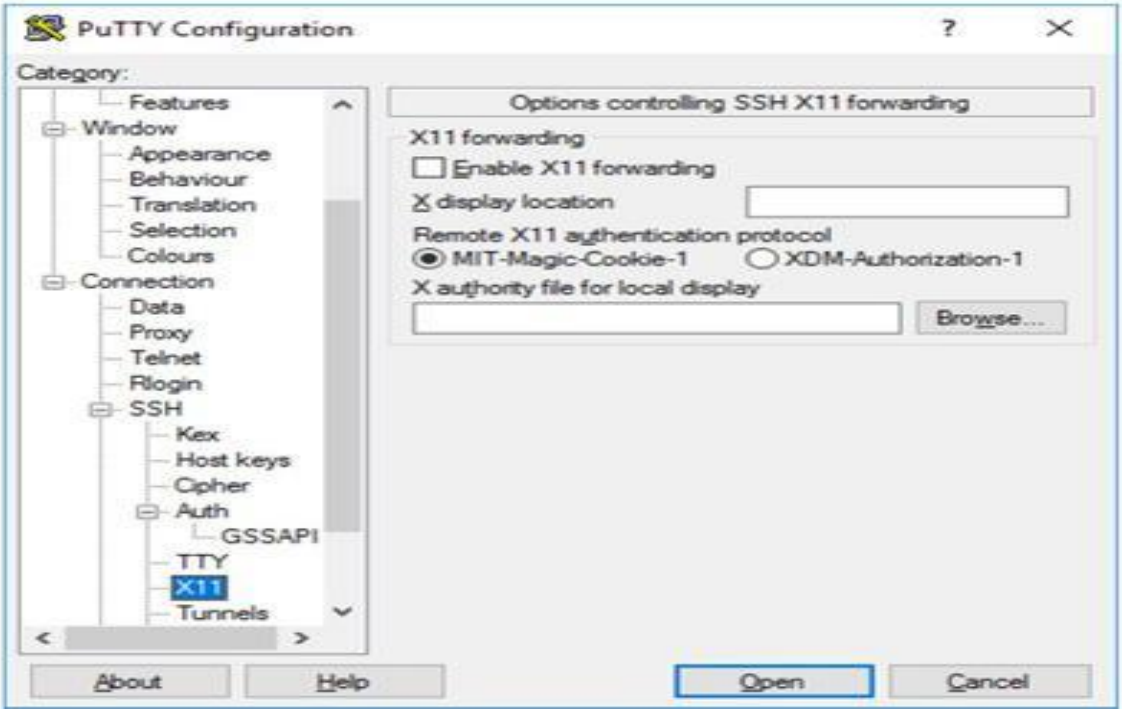

Figure 4. configuration window

After giving ip address in putty, a terminal will be displayed where we have to give login id and password. By default, login id is pi and password is raspberry but we can change the password using passwd command [18].

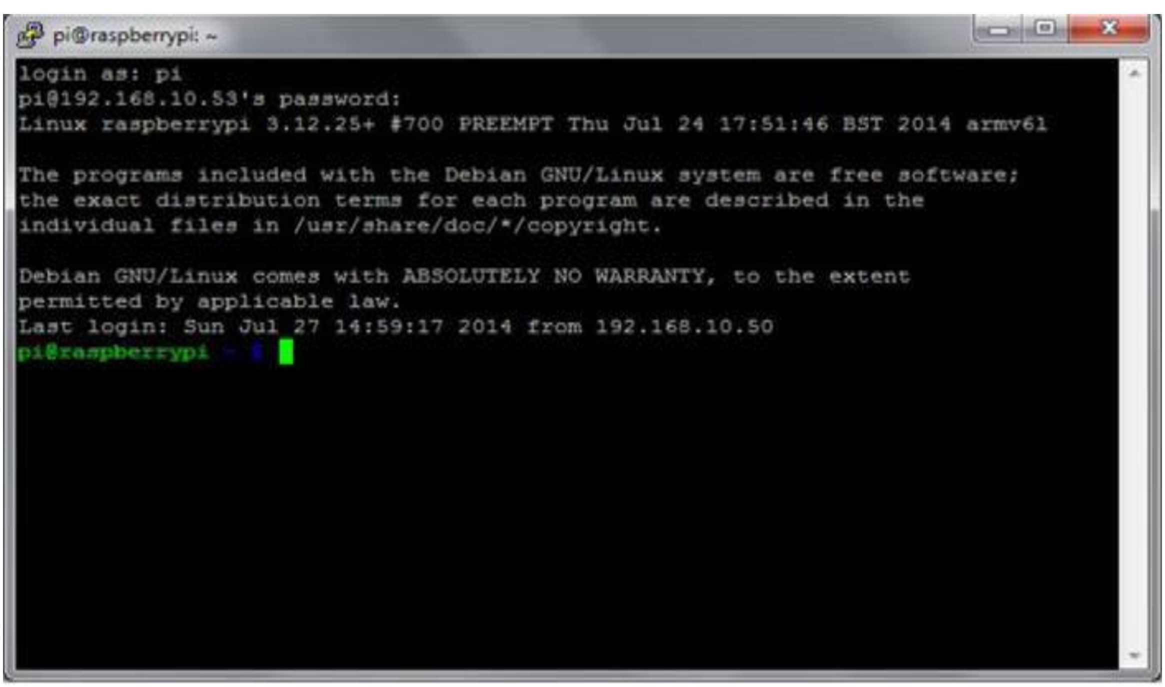

Figure 5. interface for login

Now the commands lxterminal and startlxde are used to view the gui interface connections
Now connect raspberry pi with dht11 sensor using bread board and jumper wires

Raspberrypi ———— dht11module
3.3vp1 ———————— vcc (v)
Gndp6 ———————— gnd (g)
Gpio17 p11 ——————data (s)

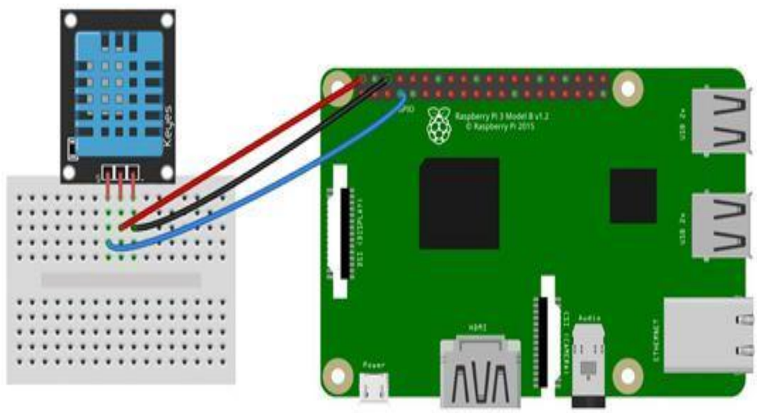

Figure 5. connections

5. Results

The data has been taken from the sensors using iot setup. The data is as follows:

Table 1. temperature and humidity from IoT devices

Date	Sample 1	Sample2	Sample 3	Max	Min	Avg
01.02.2018	Temp: 30 Humidity: 77	Temp: 31 Humidity: 78	Temp: 30 Humidity: 77	Temp: 31 Humidity: 78	Temp: 30 Humidity: 77	Temp: 30.33 Humidity: 77.05
02.02.2018	Temp: 29 Humidity: 75	Temp: 28 Humidity: 76	Temp: 30 Humidity: 77	Temp: 30 Humidity: 77	Temp: 28 Humidity: 75	Temp: 29 Humidity: 76
03.02.2018	Temp: 31 Humidity: 74	Temp: 32 Humidity: 72	Temp: 30 Humidity: 70	Temp: 32 Humidity: 74	Temp: 30 Humidity: 70	Temp: 31 Humidity: 72

From the above table, we take three samples of temperature and humidity. The sample are from three different days. Temperature and humidity are changes day to day in surrounding environment. From these three different samples calculate minimum, maximum and average values of both temperature and humidity. Below are the real time graphical representation of temperature, soil and humidity.

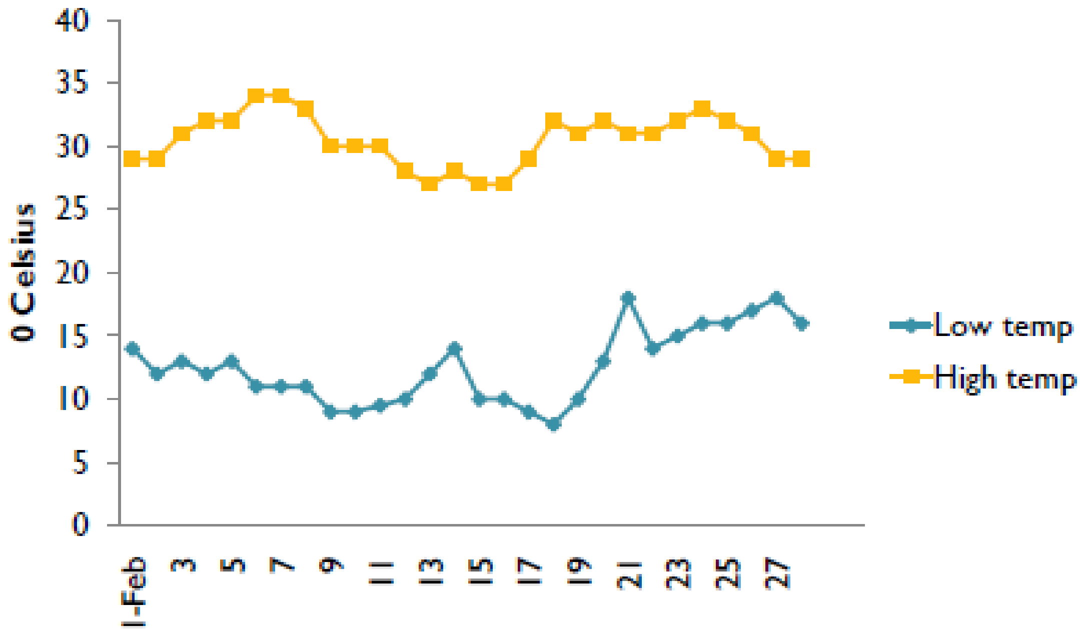

Figure 6. Temperature monitoring

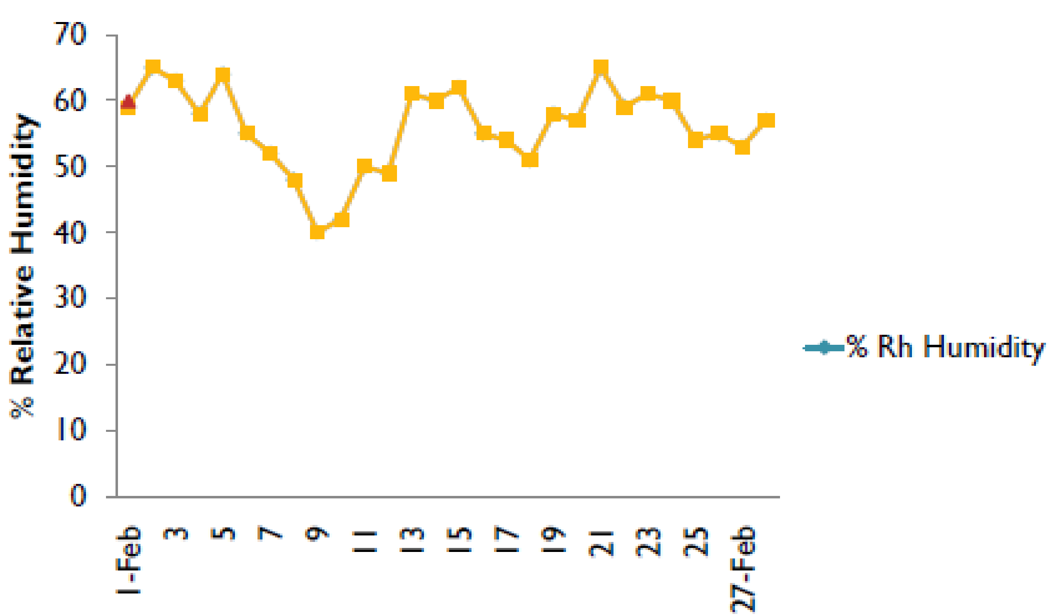

Figure 7. Humidity monitoring

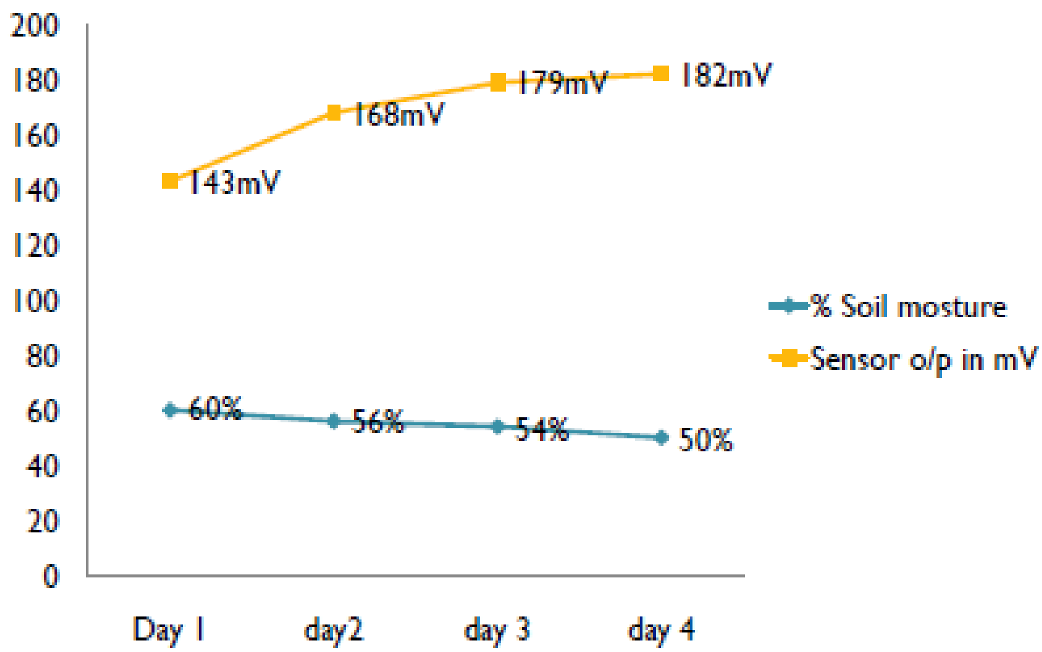

Figure 8. Soil moisture monitoring

6. Conclusion

This paper presents different tools and techniques for implementing smart farming. The output has various insights including weather forecast, pest control, suitable crops for the soil, water requirements analysis, crop price supported by government, dose of fertilizers for various crops, crop yields etc. The analysis also intimate the farmers about government current schemes, monsoon notifications, subsidies from government and private sector, latest news about various types of pests etc. The implementation in this paper gives the results about the temperature and humidity in the agricultural fields using sensors. IoT-based temperature and humidity monitoring system provide an efficient and reliable system for monitoring. The proposed methodology is able to interface the raspberry pi. Consequently, by using dht11 sensor we are able get the temperature and humidity values. And then these values are stored in the database with corresponding date. Therefore, the minimum, maximum, average values are retrieved from the database for the specified date.t he future work will be focusing on big data where all types of data is collected from various data sources using iot in the world, store the data in cloud, analyze the cloud data and apply machine learning methods for getting the desired outcome in agriculture fields.

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