IOT Based Smart Farming Application

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Abstract. Smart agriculture is one of the Internet of Things' most important uses. Water, fertilizer, and crop yield waste are all reduced via smart agriculture. The manual detection of specifications like temperature, moisture, and humidity in the existing agricultural system drives up labor costs, and continuous monitoring is not possible. The irrigation procedure is carried out automatically in this study utilizing various sensors, which reduces manual work. It is suggested to utilize a sensor-based monitoring system for crop fields. It would entail gathering information on the soil moisture, humidity, and temperature. Automation of irrigation is possible by keeping an eye on all these variables. Unquestionably, smart farming is a key facilitator in providing more food with less resources for a growing global population. While this is essential to feeding the world's expanding population responsibly, smart farming also offers producers and communities throughout the world additional advantages. Farmers may raise yields and improve environmental management by using these strategies. By monitoring the field, IoT-based smart agriculture enhances the overall farming system. The Internet of Things in agriculture helps farmers save time and lessen the usage of resources like water thanks to sensors and connections. electricity, internet-connected temperature monitoring.

1 Introduction

The increase in world population requires improved production to provide food in all areas, especially in agriculture. However, there are instances when demand and supply are not balanced. Improving agricultural output still faces significant challenges in managing and retaining personnel and capital. A superior choice for enhancing food production, resource management, and labour is smart farming. The increase in world population requires improved production to provide food in all areas, especially in agriculture. However, at certain times, supply and Demand won't equal supply. Improving agricultural output still faces significant challenges in managing and retaining personnel and capital. A superior

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strategy for boosting food production, resource management, and labour is smart farming. The IoT based farming system helps the farmer to monitor various parameters in his field such as humidity, temperature, and soil moisture using certain sensors [1]. Farmers can use certain sensors to monitor various conditions in the field, such as soil moisture, temperature, and humidity, using an IoT based farming system [2]. Even when far from their fields, farmers can use the web or mobile app to track all sensor information. One of the essential tasks of farmers is to water their crops. By monitoring sensor parameters and managing the pump motor from the mobile app, they can decide whether to water crops or delay watering.

2 Literature survey

An introduction relating to the Internet of Things (IoT), its use in agriculture to improve productivity and quality by reducing costs is provided. The sensors used in the architecture are briefly discussed and the data transfer process from the agricultural domain to the central system is explained [3-4]. The advantages of the recommendation system are included. In addition, open research issues, challenges, and the future of IoT in agriculture are also highlighted. G.Suciu et.al[5-6] proposed the concept is basically developed based on an idea, in which many things or objects - such as Arduino, sensors, GSM models, LCD screens, etc., are connected to the Internet. Each object has a different address and can interact with other elements. Things or objects that cooperate with each other to achieve a common goal. Build a smart agricultural monitoring system that can collect important agricultural data and send it to an IoT platform called Thing speak in real time, where the data can be recorded and analyzed [7]. Data is recorded on Thing speak in a graphical format, a botanist or farmer with reasonable knowledge can analyze the data (from anywhere in the world) to make changes sensitive to the resources provided (for crops) to achieve productivity High caliber. P. Padalalu et.al [12] explains an emerging technological idea known as "Smart Agriculture" refers to the collection of data from numerous small to large-scale agricultural fields as well as the surrounding environment utilizing sophisticated electronic sensors. Local experts and farmers examine the data collected to make short- and long-term predictions regarding weather patterns, soil fertility, the quality of the present crop, and how much water will be required for the crop. subsequent weeks, months, etc.

3 Problem statement

An introduction to the Internet of Things (IoT) is given, along with information on how technology might be used in agriculture to increase production and quality while cutting costs [8]. A brief discussion of the sensors utilized in the design is followed by an explanation of how data is sent from the agricultural area to the central system. The advantages of the recommendation system are included [9]. In addition, open research issues, challenges, and the future of IoT in agriculture are also highlighted. This concept is basically developed based on an idea, where there are many things or objects - like Arduino, sensor, GSM model, LCD screen, etc., connected to the internet. Each object has a different address and can interact with other elements [10].

4 Product design

4.1 Schematics of data flow

A data flow diagram (DFD) is a common visual depiction of how information moves through a system. The right number of system needs can be graphically represented by a

clear and precise DFD. It demonstrates how information enters and exits a network, what alters information, and where information It demonstrates how information enters and exits the system, what modifies the data, and where it is kept [11].

4.2 Functional Requirement

Each item that can be controlled over the internet is considered an IoT device. IoT devices are becoming readily accessible to consumers because to wearable IoT products (Internet of Wearable Things), like smart watches, and home management solutions, like Google Home. use. More than 30 billion devices are expected to be connected to the Internet of Things by the year 2020. A few requirements are necessary for the IOT based intelligent agricultural system to function properly and decrease output loss [13]. Some of these demands are included in the list below. Farmland first had monitoring devices placed. The user may customize the range for each sensor using the web interface. Since, for instance, some crops need a certain temperature, each sensor is then set to a current value or range [14].

4.3 Solution and technical architecture

Different soil parameters, temperature, soil moisture, and then moisture are detected by different sensors and the obtained value is stored in the IBM cloud. Arduino UNO is used as a processing unit that processes data obtained from sensors and weather data from the Weather API [15-16]. NODE-RED is used as a programming tool to write hardware, software, and APIs. The MQTT protocol is followed for communication. All collected data is made available to users through a mobile application developed with the help of MIT app inventors [17]. The user can decide, through an app, whether to water the plants based on the sensor's values. Using the app,they can operate the motor switch remotely.The above processes are briefly explained as a block diagram in the Fig 1.Technical Architecture [18]. IOT Device is connected with the IBM Watson Platform which contains the unique username and passkey which are used to access the node points in the node red platform as in (Connections made in the preferred website of Node red) and send information from the web UI to the app controlled by the user as represented in Fig.1 Technical Architecture.

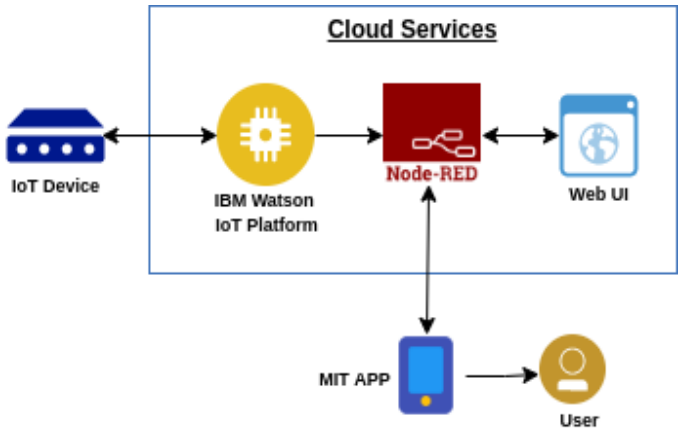

Fig. 1. Technical Architecture

5 Existing system

Several enabling technologies, including as wireless sensor networks, cloud computing, big data, embedded systems, protocols, and architectural frameworks, provide as a solid basis for the present Internet of Things methodologies. Internet, search engines, online services, communication-enabling protocols, and security mechanisms. Wireless Sensor Network (WSN) It is composed of a number of interconnected sensors and nodes that may monitor different types of data.

6 Proposed system

To solve farmers' problems such as lack of modernization and mechanization. Invest in agricultural productivity and improve production, help them. respond to climate change and soil erosion. An app and a device are introduced to know various data remotely on their land where they can schedule certain events for a month or a day. It also provides recommendations to users based on the crops they have grown. Farmers can monitor and control their land, and make suggestions for the next crop and improve yields. It's a subscription model in which users pay for their Internet services for support. Reach customers through referrals, resellers and third-party apps. Our products are extensible with our devices (additional modules) as well as with third party devices. Ability to provide different functions in an application like generating reports etc.

6.1 Building- Iot based intelligent farming

With the help of autonomous watering systems, sensors (for light, humidity, temperature, soil moisture, etc.), farmers may reduce waste and boost productivity. Farmers may also remotely check field conditions thanks to these sensors. When compared to the traditional method, advanced agriculture based on the Internet of Things is highly effective. It may, however, also be a new instrument for advancing other emerging or well-liked agricultural practices, such as organic farming, family farming (complicated or confined spaces, livestock and/or specific crops, maintaining certain kinds or attributes, etc.), and promoting extremely transparent agriculture.

6.2 Precision livestock farming

Cattle farming can also be optimized with IoT technologies. Internet of Things devices allows each animal to be tracked and tracked individually, in terms of health and location. To optimize beef production, farmers can tailor the nutrition of individual animals, as well as monitor animal welfare and identify potential outbreaks. This would be helpful by allowing sick animals to be separated from the herd before the problem spreads, to treat the animal before its condition worsens. This helps farmers reduce costs for veterinarians and routine checkups. It may, however, also be a new instrument for advancing other emerging or well-liked agricultural practices, such as organic farming, family farming (complicated or confined spaces, livestock and/or specific crops, maintaining certain kinds or attributes, etc.), and promoting extremely transparent agriculture.

6.3 Functions

Smart Agriculture solutions provide an integrated IOT platform in agriculture that allows farmers to use sensors, smart gateways, and monitoring systems to collect information and control various parameters on the site. their camps and analyze the data in a timely manner. Smart farming includes the application of sensors and automated irrigation practices that can

help monitor soil, soil temperature, and humidity. To provide an efficient decision support system using a wireless sensor network that manages various farm operations and provides farmers with useful information related to the agricultural sector. It is based on four areas, namely monitoring, control, prediction, and logic.

6.4 Management and processing

On a local agricultural scale as well as in large-scale soil-atmospheric interaction models, soil moisture is the most significant part of the atmospheric water cycle. Crops and vegetation have traditionally been more reliant on the presence of moisture at the roots than on the frequency of precipitation. Information regarding the local soil moisture is necessary for the budgeting of water for irrigation planning as well as the actual planning for irrigation measures. Understanding the soil moisture content aids in predicting the likelihood of flash floods or the emergence of fog. While soil water potential is a statement of the energy state of soil water, soil water content may be regarded of as an indication of the mass or volume of soil water. It is unusual for content and potential to be correlated, and this connection is influenced by regional soil properties including soil density and soil texture. Simple methods for measuring soil water All items that can be controlled via the Internet are considered IoT devices. To fulfil fluctuating demand, Internet of Things applications in agriculture are shifting toward conventional farms. loss of productivity. Some prerequisites are essential for the IOT-based intelligent agricultural system. Some of these needs are listed below. Farmland first had sensors put for monitoring. The user may configure the range for each sensor via the web interface. For example, some crops need a certain temperature, thus each sensor is then set to a current number or range. The lamp's resistance value is set to 255. If the range decreases, the light will turn on automatically.

Similarly, the two blades of the humidity sensor are embedded in the ground to check the moisture level. If the field is wet, no water is supplied, if the field is dry, the water pump connects to the sensor to supply water to the field. In addition, an additional sensor is retained to measure the water level in the area of interest, if the area is sufficiently watered, the engine can be turned off using a web application via mobile phone or laptop. To save crops from Rot in the warehouse, a temperature sensor is used, which is set to a specific range, if that range is exceeded, the fan will automatically turn on, providing a cooling effect. Likewise, if smoke is detected, the smoke sensor will alert the user and the fan will automatically turn on. All these sensors are monitored using a web application developed in Python. User will get a URL where he can login with username and password and can view temperature and control sensors. This feature allows users to get better performance and results. IoT platform agnostic types or applications

- Connectivity: cellular, LoRa
- Location: GPS, satellite
- Robots: automated tractors, processing plants

6.5 Data as a Service

The data will be fed from the database to the dashboard of the automation system customer that is actually grown in the crop field. Information about all devices, systems, and processes is considered data, and data is provided to customers to run automation processes efficiently.

6.6 Management as A Service

Basic and advanced control system for connected devices in the field for the process of automation system with control buttons and sliders for automation. Customers can control processes and equipment at their discretion. In order to collect data for analysis, In remote sensing, sensors are used, such as weather stations installed on farms. They watch for changes in plants' shape, size, light, moisture, and temperature. To determine weather patterns in fields and nurture the proper crops, sensors collect data on humidity, temperature, precipitation, humidity, and dew detection. The amount of water required for irrigation and the most profitable type of farming is controlled in part by the soil's acidity or drainage capability. Analysis of the soil quality also aids in determining the farm's dry area and nutritional value.

7 CODE FOR SMART FARMING MONITORING

```
import wiotp.sdk.device
import time
import os
import datetime
import random
myConfig = {"iden ty":{
"orgId":"04gt4e ",
"typeId": "NodeMCU",
deviceId": "12345"
},
"auth":{
"token": "123456789" }
}
client = wiotp.sdk.device.DeviceClient(config=myConfig,
logHandlers=None)
client.connect ()
def myCommandCallback (cmd) :print ("Message received from IBM IoT Pla orm:
%s" %
cmd.data['command'])
m=cmd.data['command']
if(m=="motoron"):
print ("Motor is switched on")
elif(m=="motoroff"):
```

Fig.2. Code for Finding Environmental Parameters

Fig. 2 and Fig. 3 represents the Code for Finding Environmental Parameters such as Temperature, Humidity and Moisture of the registered fields at different timings in different cities.

```
logHandlers=None)
client.connect()
def myCommandCallback(cmd):print("Message received from IBM IoT Pla orm:
%s"%
cmd.data['command'])
m=cmd.data['command']
if(m=="motoron"):
print("Motor is switched on")
elif(m=="motoroff"):
("Motor is switched OFF")
print("")
while True:
soil=random.randint(10,100)
temp=random.randint(-20, 125)
hum=random.randint(0, 100)
my Data={'soil_moisture': soil, 'temperature':temp,
'humidity ':hum}
Client.publish Event (even tId="status", msg
Format="j son",data=my Data, q o s=0 , on Publish=None)
print("Published data Successfully: %s", my Data)
time.sleep(2)
client. Command Call back = my Command Call back
client.disconnect()
```

Fig.3. Code for finding environmental parameters.

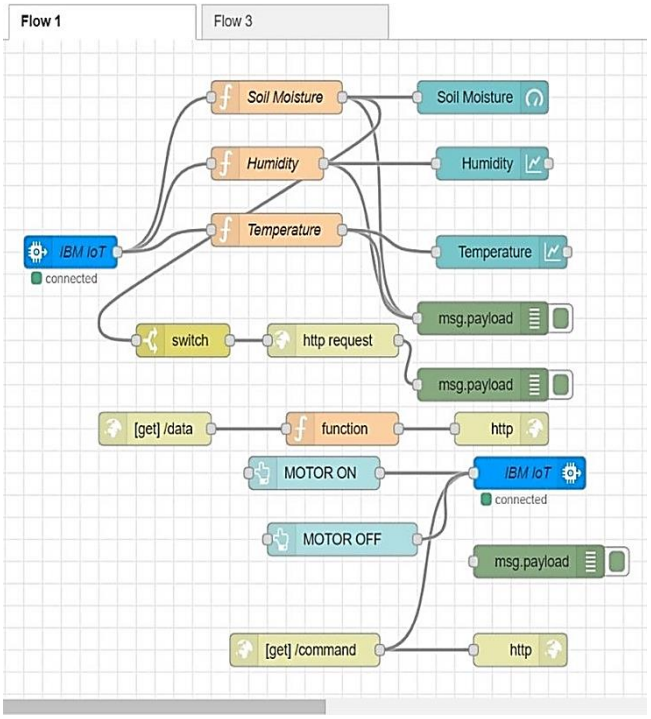

Fig.4. Connections made in preferred website of Node Red

Fig.4 represents the connections made in the Node red Platform which is an open-source visual programming tool called Node-RED is used to connect physical components, APIs, and web services. Users may design flows using the web-based flow editor by dragging and dropping nodes onto a canvas and connecting them.Node.js, a well-liked JavaScript runtime environment for developing server-side applications, forms the foundation of Node-RED. Node-RED is intended to be simple to use and quick to deploy, which makes it perfect for Internet of Things applications. Nodes from Node-RED may be used to communicate with a variety of hardware components, including sensors and actuators, and software applications, like Twitter and Slack.

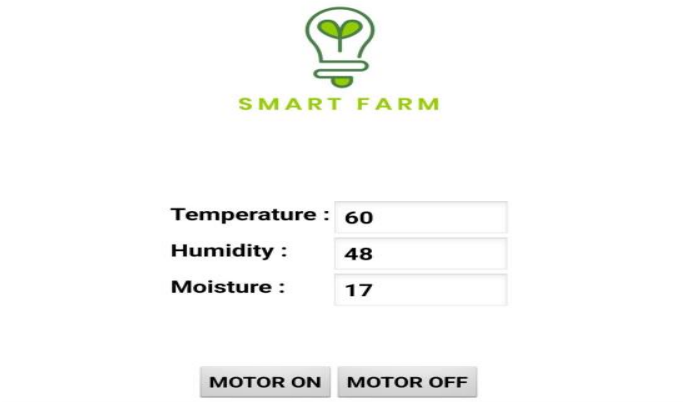

Fig.5. Output Image

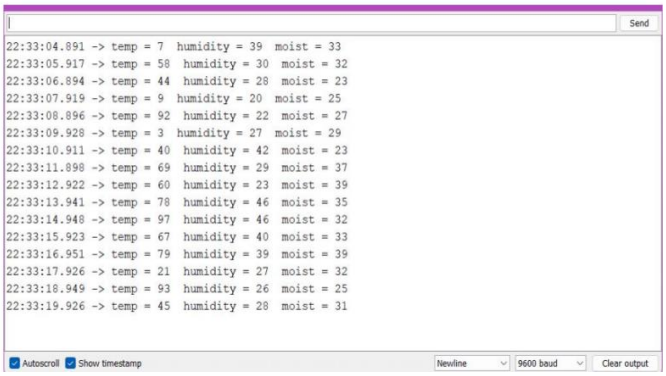

Fig.6. Represent the Output for The Code

Fig.5 and Fig.6 describes the output shown in the app and output taken from the code respectively of the registered fields.

8 ADVANTAGES

A remote control system can help operate the valves in the irrigation system on a schedule. Irrigation of remote farm properties can be particularly cumbersome and laborious. It is confusing when the valves are actuated and whether the ideal amount of water has been delivered. For situations where a quick response is required, manual valve activation is not always possible. Thus, remote monitoring and control of irrigation systems, generators or wind turbines, or any other motorized equipment becomes the next logical step.There are various solutions for monitoring engine statistics and starting or stopping the engine. When the customer chooses to start or stop the engine, the program transmits a signal to the unit within seconds via the mobile phone system. Submersible gravity sensors or ultrasonic sensors can monitor the levels of tanks, lakes, wells, and different types of liquid storage such as fuel and compost. The volume of the product figures depends on the shape of the reservoir or lake after a certain time. It transmits alarms based on different conditions

9 DISADVANTAGES

Smart farming needs the internet all the time. The rural part of most developing countries does not meet this requirement. Also, the internet connection is slower. Smart farming-based equipment requires farmers to understand and learn how to use technology. This is a big challenge for the large-scale adoption of smart agriculture in all countries.

10 CONCLUSION

Farmers can greatly benefit from an IoT-based smart farming system. Agriculture is affected by a lack of irrigation water. Climatic factors such as humidity, temperature, and humidity can be adjusted for local environmental variables. The technology also detects animal encroachment, a major cause of crop failure. This technology facilitates irrigation planning based on field data and climate source records. This helps the farmer decide whether to irrigate or not. A permanent Internet connection is required for continuous monitoring of sensor data. This can also be overcome by using another GSM device for the mobile application. Thanks to GSM, text messages can be sent to farmers' phones.A smart farm monitoring system can be used as a farm's destiny item. It will be a relief for farmers as it will ease the burden of manual efforts. A soil moisture filter has been built and the mission offers the possibility of examining the dominant structures, from the perspective of their characteristics and disadvantages. The specified utility can be used to turn on/off sprinklers based on soil moisture, thereby automating irrigation engineering, one of the most time-consuming activities in agriculture. Farming is one of the most demanding hobbies. The device uses statistics from the soil moisture sensor to irrigate the soil.

11 FUTURE SCOPE

In the current project, we have implemented a project that can protect and maintain culture. In this project, the farmer monitors and controls the field remotely. In the future, we may add or update some more things to this project. We can create several more models of the same project so that the farmer has the overall information. We can update this project with the solar mechanism. So, the power supply of the electric poles can be replaced by solar panels. It reduces the cost of power lines. It will be a one-time investment. We can add solar fence technology to this project. We can use GSM technology for this project so farmers can receive information directly at home by SMS. This helps farmers get information if there is a problem with the internet. We can add camera functionality so farmers can monitor their fields in real time. This helps prevent theft.

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