IoT Based Smart Agriculture Monitoring System

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Abstract: The population increase, climate change, and shortage of resources are posing hitherto unheard-of difficulties to the agriculture sector. The application of Internet of Things (IoT) technology to agriculture, or "smart agriculture," has become a game-changing response as a result. An IoT-based Smart Agriculture System intended to transform conventional farming methods is presented in-depth in this paper. In order to maximise crop output, preserve resources, and advance sustainable farming practises, the suggested system makes use of sensor technology, data analytics, and real-time monitoring. Numerous sensors for monitoring temperature, nutrient levels, and soil moisture are among the main elements of the Internet of Things-based Smart Agriculture System. These sensors' wireless transmission of data to a centralised cloud-based platform, where sophisticated data analytics algorithms process the data, is done. This platform is accessible to users via

Keywords: Internet of Things (IoT), Sensor Technology, Data Analytics, Sustainability, Crop Monitoring, Agricultural Productivity.

I. INTRODUCTION

IoT systems provide solutions that will allow users to manage irrigation, ensuring crops receive the right amount of water basic needs. By monitoring such as humidity and temperature, the system will provide accurate and timely information to optimize the allocation of resources andsupport crop growth.

II. EXISTING SYSTEM

Internet of Things-based smart agriculture has proven to be beneficial for users. In fact, users face problems with harvesting even after harvesting.To answer all the questions, it is important to create an integrated approach that addresses all factors affecting profitability at all levels: light intensity, temperature, humidity etc. The starting point of weather conditions can be determined by the environment in a region.The system can also detect animal infestation, which isthe main cause of crop loss. The system creates a water system based on real-time data from the fields and data from cloud storage.The system can tell users whether they need water or not. A constant Internet connection is required. This can be overcome by continuing to send advice to users via SMS directly to their phones using GSM modules instead of mobile applications.

III. OBJECTIVE

This introduction provides an overview of the project, Based on the analysis of differences and comparisons of

including the name of the project, a brief description of the existing systems, specific objectives should be addressed

solution, and the motivation behind the particular solution.

during the development of IoT-based real-time crop
The project aims to create an IoT system that can monitor monitoring and processing. These are advantages:
real-time changes in humidity, temperature and other environmental factors to improve crop growth and reduce
1)Integration of other environments:Integrate sensors and agricultural water. The system will also ensure resource data collection mechanisms to monitor other environment
efficiency and support permaculture practices.[1] such as soil moisture and light intensity.Design and
The motivation behind solving this particular problem stems distribute sensors that measure humidity and light intensity from the increasing global demand for food production and in the crop's environment. the need to solve agricultural water scarcity and environmental health problems. Using IoT technology, we 2)Advanced Data Analysis and Predictive Modeling: Use can leverage the power of real-time data and machine advanced data analysis techniques and predictive modeling utilization to optimize crop production and reduce resource algorithms to derive insights from collected data. Using waste.[2] machine learning algorithms to analyze historical and eal-time data allows the system to predict best results and create irrigation plans based on crops and the environment.

Improve crop compatibility and soil conditions: Improve compatibility with different crop types and soil conditions to meet the needs of different farms.: Conduct research and experiments to identify and correct poor methods and techniques to accommodate different crop and soil combinations.

User-friendly interface and easy access: To create a Research and innovation: IoT-based smart agriculture opens up opportunities for research and innovation, leading to the development of new technologies, sensors and farming practices.

The scope of smart agriculture using IoT technology is huge and its potential benefits are numerous, including increased productivity, sustainability and economic efficiency in the agricultural sector. It offers the promise of solving some of the critical challenges facing global food production.[4][5]
user-friendly interface for users to easily access and manage

V. REQUIREMENT ANALYSIS

information informing the system.Create a website and intuitive dashboard that allows users to monitor sensor data, set water schedules, and receive alerts and recommendationsin real time.

IV. SCOPE

The scope of an IoT-based smart agriculture system is vastand has significant potential to transform the agricultural industry. Here are some key aspects of its scope:

- Improved crop monitoring: Smart farming systems can continuously monitor crops using sensors to measure parameters such as soil moisture, temperature, humidity and light conditions. This data helps users make informed decisions about irrigation, fertilization and pest control.
- Precision Farming: IoT systems enable precision farming by providing real-time data on crop conditions. Users can optimize the use of resources,reduce waste and increase yields. This can lead to more sustainable farming practices.
- Environmental monitoring: Smart agriculture can also be used to monitor environmental conditions. This includes weather forecasting, air quality and soil quality assessment.
- Data analysis and decision support: IoT systems generate huge amounts of data. By leveraging data analytics and artificial intelligence, users can make data-driven decisions for crop management, resourceallocation and risk assessment.
- Remote monitoring and control: users can remotely monitor and control various aspects of their farms, allowing for early intervention when problems arise.
- Water resource management: In water-scarce regions, IoT-based systems can help in efficient water management through automated irrigation systems, water level monitoring and leak detection.
- Sustainability and environmental impact: Smart farming systems can help reduce agriculture's environmental impact by optimizing resource use,reducing chemical inputs and minimizing waste.
- Scalability: The scope of IoT-based smart agricultureis scalable, meaning it can be applied to small family farms as well as large agribusinesses.

Functional Requirement:

- Sensor Integration: The system should support theintegration of various IoT sensors to monitor environmental conditions such as soil moisture, temperature, humidity, light intensity, and atmospheric condition.
- Data Collection and Analysis: The system should collect sensor data in real-time and perform data analytics to derive insights and patterns related to crop growth, health, and environmental conditions.
- Crop and Livestock Monitoring: The system shouldenable monitoring and tracking of crop health, growth stages, disease outbreaks, and livestock behavior, facilitating early detection and timely intervention.
- Decision Support: The system should provide decision support to farmers, offering recommendations for irrigation schedules, fertilization, pest control, and other farming practices based on analyzed data and algorithms.
- Remote Access and Control: The system should allow farmers to remotely access and control the agricultural processes, monitor real-time data, receive alerts, and adjust settings through web ormobile interfaces.

Non-Functional Requirements:

- Scalability: The system must be scalable, accommodating a large number of sensors, farms, and users. It should handle increasing data volumesand growing farming operations effectively.
- Reliability: The system should offer reliability, ensuring continuous operation to minimize downtime. Critical farming operations must not bedisrupted, ensuring uninterrupted functionality.
- Security: Robust security measures must be implemented to protect data privacy, prevent unauthorized access, and guard against cyber threats.This is vital to maintain the integrity of the system and secure farm operations.
- Energy Efficiency: The system should optimize energy consumption, ensuring efficient operation ofIoT devices, sensors, and communication systems. Maximizing battery life is essential for prolonged and sustainable system functionality.
- User Experience: The system must provide a user-friendly interface with intuitive navigation, clear data

visualization, and easy-to-understand
alerts and notifications. This ensures a positive userexperience for farmers and stakeholders, enhancingsystem usability.

VI. DIAGRAMS

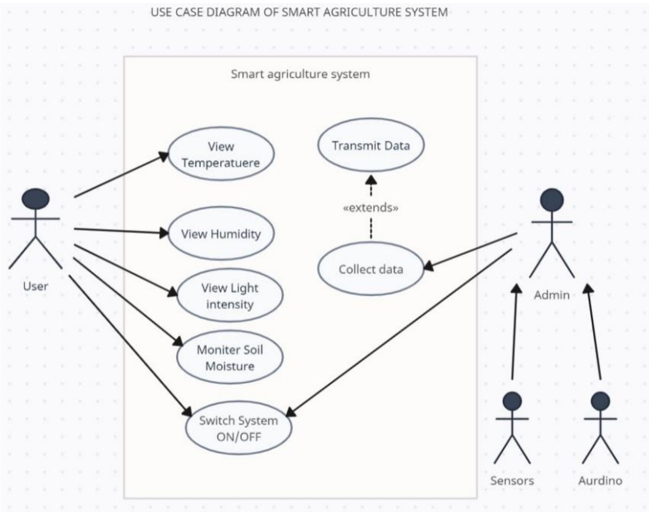

Fig. 1 Use Case diagram of Smart Agriculture. In fig 1 explain about the flow of implementation throughout the project users can view temperature,humidity,light intensity and soil
moisture.User also switches the system to turn on and off the system.Admin will collect the data and transmit data to the user .Admin will be able to access sensors and arduino. Admin can also access the switch system to turn on and off.This diagram can show the flow of the overall project .

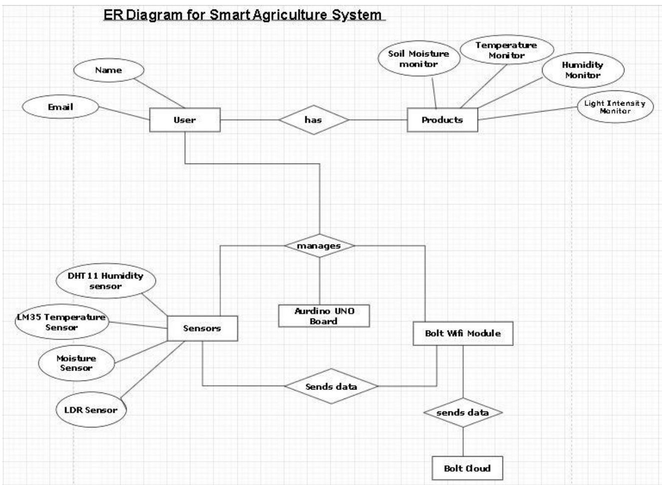

Fig. 2 ER Diagram for Smart Agriculture

In this fig 2 there are five major factors:User,Product,Sensors,Arduino Uno Board and Blotwife module.User will access website through email and Name has relation with Products where there IOT based products are there soil monitor ,Temperature monitor

,Humidity monitor and Light Intensity monitor. User manages Sensors , Arduino uno board and Bolt wife Module.There are four type of sensor used in this project which are DH11 Humidity sensor , LM 35 Temperature sensor,Humidity sensor and LDR sensor.These sensors senddata to bolt wifi module then wifi module sends data to blotcloud .

VII PROJECT DESCRIPTION

The Smart Agriculture IoT-Based Project is a cutting-edge initiative aimed at transforming traditional farming methods through the integration of Internet of Things (IoT) technology. This project involves the deployment of sensors to monitor soil moisture, temperature, humidity, and crop health in real time. The collected data is processed using advanced algorithms, enabling farmers to make data-driven decisions. Automated irrigation systems and precise resource management are implemented, ensuring optimal conditions for crop growth. The project promotes sustainable farming practices, reduces resource wastage, andenhances overall productivity. Through a user-friendly interface, farmers can remotely monitor their fields, receive timely alerts, and control farm operations, ushering in a newera of efficient and eco-friendly agriculture.[5]

VIII. SOLUTION PURPOSED

- Hardware setup:

Get the BOLT module kit including microcontrollers, sensors, and connectivity options. Connect the BOLT module to the development board or microcontroller.[1]

- Sensor Integration:

The sensors used in this project include soil moisture sensors, temperature sensors, humiditysensors and light sensors.[2]

Connect and connect the sensor to the BOLT moduleusing the appropriate interface or protocol.

- Data collection and processing:

Develop a BOLT module to collect data fromconnected sensors.[6]

Perform data processing on microcontrollers toanalyze and interpret collected data.

- Connection and communication:

Wi-Fi or GSM/GPRS etc. for the system dependingon the availability of network services in the area. Create connection options such as.[6]

Develop BOLT module to send completed data to central server or cloud platform for further storageand analysis.

Ensure secure communication between the BOLT module and the server/cloud platform, taking into account encryption and authentication mechanisms.

- User Interface and Management:

We will create a user interface for monitoring and managing smart agriculture.It will provide users with instant information about the environment, crophealth and everything that needs to be done.

- Continuous Monitoring and Monitoring:

Enable monitoring of the health and operation of thesmart farm, including BOLT modules and connectedsensors.

We will regularly check and evaluate the indicatorsto ensure accurate data.

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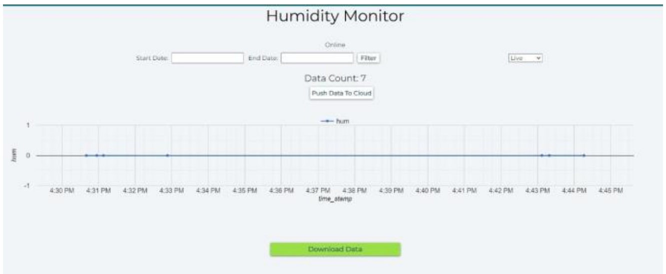
IX. EXPECTED OUTCOME

The development of an IoT-based system for real-time monitoring of soil moisture, temperature, and other environmental factors to optimize crop growth.There are four sensors :

1. DHT11 Humidity Sensor: Measures and provides real-time humidity levels in the environment, crucial for monitoring and maintaining optimal growing conditions.



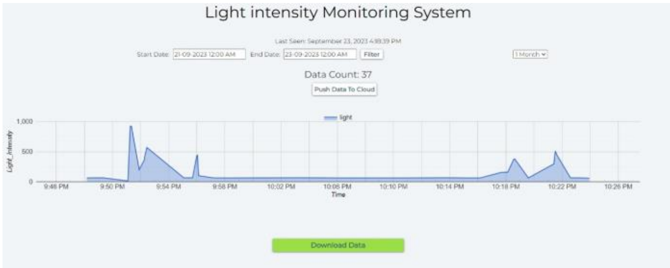


Fig 3. Humidity Monitor

DHT11 is a simple and inexpensive humidity and temperature sensor that can be used in many applications, including real-time monitoring of the environment. You usually need a microcontroller like Arduino or Raspberry Pi to use the DHT11 humidity sensor and monitor the data.

2. LM35 Sensor: A temperature sensor that accurately measures ambient temperature, helping ensure the crop's temperature requirements are met.

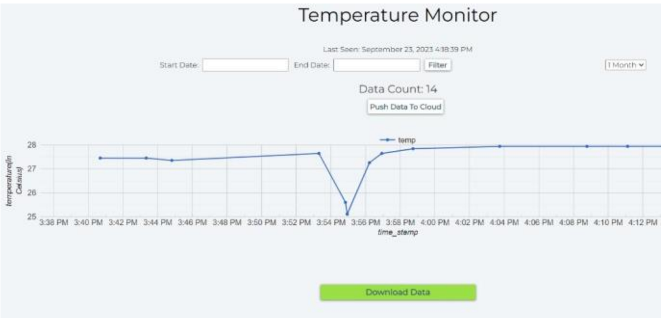


Fig 4.Temperature Monitor

In fig 4 The LM35 is a popular analog temperature sensor that provides a linear output voltage proportional to the temperature in Celsius.[6][4]

4. Moisture Sensor: Monitors soil moisture levels, assisting in irrigation management and preventing over or under-watering.

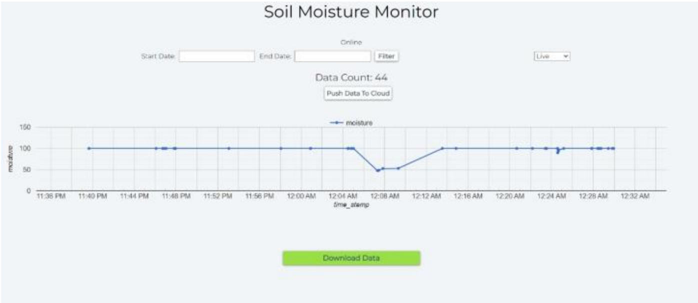


Fig 5. Soil Moisture Monitor

Creating a soil moisture monitor involves using a soil moisture sensor to measure the moisture content of the soil and a microcontroller to collect and process the data.

5. LDR Sensor: Detects light intensity, aiding in optimizing crop growth by adjusting artificial lighting when natural light is insufficient.

Fig 6. Light Intensity Monitoring System

Used light examines light measuring machines used in a particular environment and can be used for many applications such as cultivation, home lighting control or security. To set up a light source, you need a light source (like a photodetector or photodiode) and a microcontroller (like an Arduino or Raspberry Pi).[6]

There are two main feature used in sensors to retrieve data are:

1) BOLT ESP8266 Wi-Fi Module: Enables wireless communication between sensors and the cloud, allowing remote monitoring and control of agricultural parameters[5]

2) Arduino UNO Board: Serves as the project's microcontroller, responsible for processing sensor data and controlling connected devices for automated farming tasks.[6]

X. CONCLUSION

IoT technology plays a crucial role in advancing smart farming practices. By utilizing IoT, the system can accurately predict soil moisture levels and humidity, enabling efficient monitoring and control of irrigation systems. IoT applications span various farming domains, enhancing time efficiency, water conservation, crop monitoring, soil management, and the precise application of insecticides and pesticides. This system not only reduces human labor but also simplifies farming techniques, leading to the evolution of smart farming. Beyond its inherent benefits, smart farming facilitates market expansion for farmers, offering a streamlined approach with minimal effort and a single touch.

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