Reliable Data analysis in IoT based Smart Agriculture

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Abstract

Due to their extensive use, agriculture now heavily relies on these technologies to provide food for human consumption. By giving farmers vital tools to forecast crop growth, the availability of moisture in the soil, soil quality, and other factors, the Internet of Things closes the gap. In order to regulate crop growth accurately, we outline a thorough agricultural monitoring system. For accurate data analysis in Internet of Things-based agriculture, the suggested study introduces the unique RelAgriSmart model. Additionally, this research looks into how delivering real-time data to farmers, such as weather forecasts, through sensor integration may improve their ability to make decisions. Raspberry Pi, Wi-Fi Module, Android App, Agricultural Sensors, and Internet of Things are all together.

.**Keywords:** Agriculture, Crop, IoT, Sensor, Data , Analysis

1. INTRODUCTION

It is evident that the Internet of Things is a paradigm that might completely alter permissive communication technologies, such as Wireless Sensor Networks (WSN) and Machine to Machine (M2M), by enabling intercommunication. The phrase "Internet of Things" often abbreviated as "Internet of Things." The words in question are "Internet" and "Things," with "Things" denoting any physical object that has the potential to create an online connection. The actions that an IoT device usually takes.

A. Sensors: Devices that collect information relevant to the task. These sensors might be integrated within the gadget or affixed to it in some other way.

B. Actuator: Various types of actuators enable action to be taken on real-world objects or machinery.

C. Communicate: These modules are in charge of communicating the data that has been gathered to other gadgets or a cloud server, such as an Amazon server, IBM server, Google server, ThingSpeak server, ThingsWorx server, a Things Board server, Xively server, or another.

D. Take Action: This section is in charge of using the data gathered to make decisions.

1.1 MOTIVATION

II. LITERATURE REVIEW

The agriculture industry supports the whole Indian economy by supplying both the raw materials needed by other businesses and the staple foods that make up the country's diet. Smart irrigation, greenhouse management, and many other aspects of agriculture depend heavily on the Internet of Things [9–17]. Farmers in developed countries, like India, are currently dealing with a serious challenge related to smart irrigation. Utilising state-of-the-art Internet of Things technologies, you can increase operational effectiveness, sustainability, and cost-effectiveness in agricultural production, which will go a long way towards addressing some of the industry's most critical issues. Farmers are getting information from Internet of Things devices on things like crop yields, insect control, and field rainfall. For farmers, the internet of things (IoT) offers a potential way to monitor advancements in productivity, crop yields, soil and crop health, and storage conditions. Internet of Things (IoT) sensors continuously monitor soil quality, including crop and soil health.

Massive technologies are currently playing a significant role in the agricultural industry thanks to an automated system and the application of multiple system designs for Smart agriculture, Precision farming, and Smart irrigation. The understanding of agriculture is being advanced on a large scale. Take a look at the following as a sample of the recent efforts. An Internet of Things-based smart watering system for indoor organic farming was introduced by Karunakanth et al. [3].Using Internet of Things (IoT) technology and a range of sensors (such as thermometers, humidity monitors, and ultrasonic sensors), the author [9–17] created a system for a home organic garden.

III. PROPOSED RelAgriSmart MODEL

The smart agricultural system proposed here includes several pieces of hardware, including a moisture sensor, a temperature and humidity sensor (DHT11), a raspberry pi with a Wi-Fi module, an android mobile, and the thingSpeak cloud. Using an analog-to-digital converter (MCP3008), these Internet of Things sensors communicate with a Raspberry Pi to send data to a remote server. Data is collected, analysed, and then sent to the consumer or farmer.

By developing an Android app using MIT's App Inventor, users may have access to information stored in the cloud or a database like thingSpeak. Until then, farmers have no way of knowing whether or not their efforts to improve things like crop yields, productivity, and water management are really paying off. Figure 1 is a process diagram for the RelAgriSmart monitoring system, and Figure 1 shows the general structure of the RelAgriSmart agricultural system.

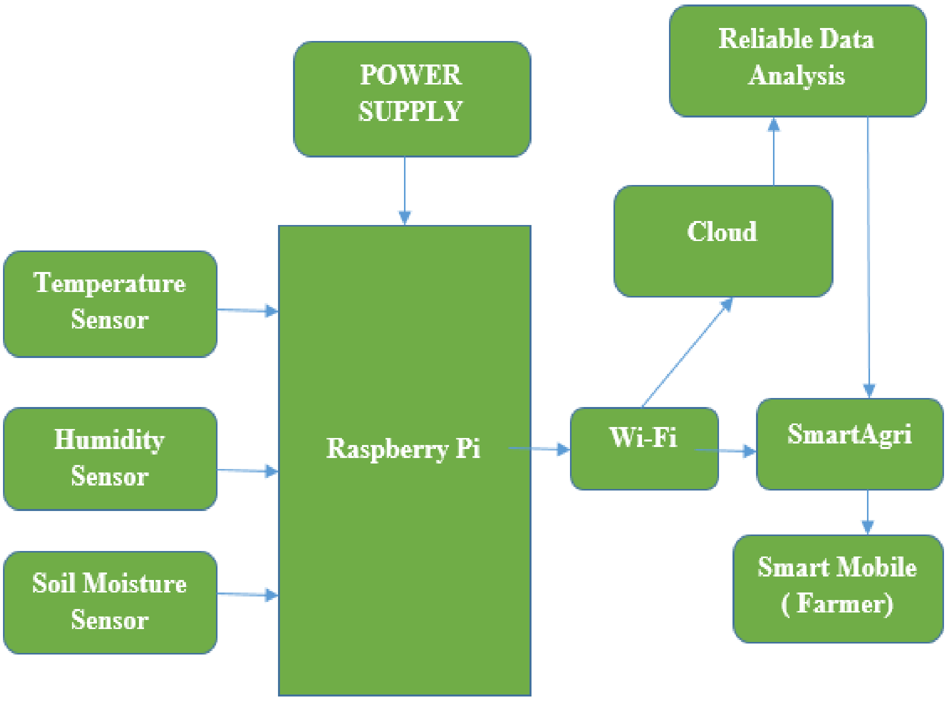

Figure 1. Proposed Model for RelAgriSmart

IV. PROPOSED FRAMEWORK

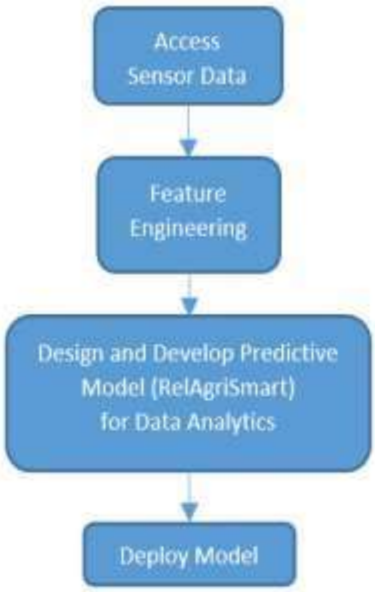

Figure 2. Proposed Framework for RelAgriSmart

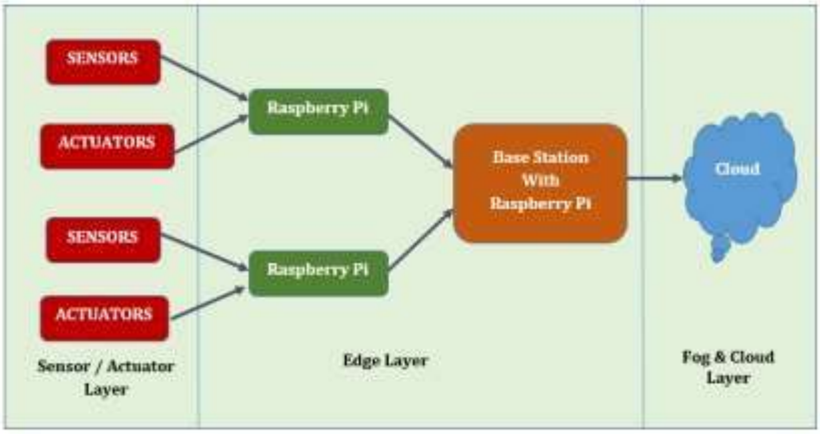

Figure 3. Layers in RelAgriSmart

4.1 Sensor Layer

In this research work, we examined growing climate-sensitive crops like crops and grapes in a farm. There were several types of sensors used to keep tabs on the conditions in the farm: a gas sensor, a dht11 sensor for temperature and humidity, a light sensor, a gas sensor, and a moisture sensor. Relaying parameters were also used in the selection and implementation of actuators to control machinery. Controlled relative humidity (RH), temperature (T), and light (Light), protection from rain, storms, and blistering sun, and pest and disease control are only some of the benefits of employing a greenhouse management system for crops. Layers in the Periphery

4.2 The Edge Layer

A low-power microcontroller Raspberry Pi optimized for the Internet of Things is linked to a network of sensors deployed in the field as nodes or edges. In our experiment, we used a Raspberry Pi and sensors to collect and process sensor data before sending it to the edge layer's home base. Collecting data in analogue or digital form necessitated the calibration and verification of sensors against an intended value. In order to guarantee crop survival by precise crop management, it was necessary to collect data for a wide range of climatic conditions, both favourable and unfavourable.

4.3 Fog Layer

The layer's major function was to handle decision making, regulate edge layer activity, and relay relevant data to the cloud layer, all for the benefit of farmers. Starting with data collected by edge-layer sensors, a machine learning algorithm developed the decision-making system through several iterations: IoT devices, especially sensors, collected data in real time or in small batches;• Data collection and aggregation in a target database; • Filtration of stored data: Algorithms could be used to clean and correct the data in this step; • Data classification relied on its intended purpose; • Computing: during this phase, calculations were performed on the classified dat.

4.4 Cloud Layer

Adafruit IO Cloud was used to display data from all of the edge nodes before it was processed and managed at the base station. Using a graphical user interface (UI) programme, farmers may monitor the development of their crops. Figure 3 depicts the various layers required for successful implementation of this proposed RelAgriSmart Model. As can be seen in Figure 2, in order to verify the feasibility of the proposed revolutionary greenhouse system, a prototype experimental model was developed utilizing an embedded system device consisting of numerous sensors and a microprocessor.

4.5 Proposed Methodology for Sensor - Data Analysis

1. *Obtain input data from Sensors.*
2. *Create feature and label data from raw dataset values from Sensor Datasets.*
3. *Apply feature engineering to each feature data.*
4. *Locate the missing and unknown values and replace them.*
5. *Compute the normalized value of all feature sets*
6. *Scale all feature data to a specific range.*
7. *Choose Machine learning Classifiers*
8. *Model Evaluate and select the best score and estimator for the chosen classifier.*
9. *Test and Train the Model*
10. *Use the K-fold cross-validation approach to validate the model performance.*
11. *If validation is successful, save/deploy the trained model; otherwise, repeat steps 2 to 10.*

V. DISCUSSION

This research work proposes a novel RelSmartAgri Model for the implementation Smart Agriculture with Data Analytics as depicted in the Figure 2, that it is crucial to adopt an IoT-based RelAgriSmart monitoring system by describing how it’s ideal introduction of tools and measures taken for greatly enhanced crop yield and the deployment of simple user interfaces. This research work presented a raspberry pi based novel RelAgriSmart Model connecting of several sensors to allow for flexibility in any agricultural scenario. It's a very clear display of data that can be cast and followed even in harsh environments. This novel technological approach to the farmers' problems may be quite helpful.

VI. CONCLUSION

This research work proposes a novel RelSmartAgri Model for the implementation Smart Agriculture with Data Analytics, that it is crucial to adopt an IoT-based agricultural field monitoring system by describing how its ideal introduction of tools and measures taken for greatly enhanced crop yield and the deployment of simple user interfaces. This front application may be changed in the future to make advantage of newly accessible technology, such as an MIT app that relays field data to farmers and enables them to adjust machines appropriately. This research work presented a raspberry pi based novel RelAgriSmart Model connecting of several sensors to allow for flexibility in any agricultural scenario. It's a very clear display of data that can be cast and followed even in harsh environments. This novel RelAgriSmart technological approach to the farmers' problems may be quite helpful.

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