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# Enhancing Smart Agricultural Management by Using Big Data Analysis and IoT

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**Abstract:**

The objective of the present investigation is to improve agricultural practises by incorporating cutting-edge sensor technologies and data analytics. A thorough system is created that combines a temperature sensor, a humidity sensor, a leaf sensor, a GPS module, and an image sensor to systematically capture crucial data on a particular crop inside an agricultural domain. These various data sets are smoothly delivered to the launch pad of the CC3200 and are afterwards archived in a cloud infrastructure. The collected data is effectively shared with users, in this case farmers, by an Android application that accesses and displays the data from a cloud repository. The application of strong decision-making and predictive algorithms enhances the efficacy of this integrated system further. To handle and analyse the data saved in the cloud, these algorithms make use of artificial neural networks (ANN), fuzzy logic, and neuro-fuzzy systems. The Android application may provide informative recommendations and forecasts thanks to the cooperative use of different computational techniques. The proposed solution greatly aids farmers in making well-informed decisions by utilising this combination of data-driven methodologies.

***Keywords:****sensor, CC3200 launch pad, ANN, fuzzy logic and neuro fuzzy system.*

## INTRODUCTION

Modern agriculture is experiencing a fundamental change as a result of the fusion of cutting-edge technologies and data-driven approaches. In light of this, the goal of our research project is to revolutionise crop management practises by utilising the potential of a wide range of sensors and cutting-edge computational approaches. We aim to gather a wide range of information about a particular crop inside an agricultural area by combining a temperature sensor, a humidity sensor, a leaf sensor, a GPS module, and an image sensor.

The foundation of our project is this multidimensional data collecting approach, which enables a thorough comprehension of the important variables that affect crop development, health, and production. As a result of the integration of these sensors, data is collected and sent to a CC3200 launch pad, which serves as a crucial gateway for directing the data into cloud-based repositories. This extensive collection of agricultural data takes shape in the cloud, giving a flexible and scalable resource ready for use and analysis.

Our study's focus goes beyond just gathering and storing data. An Android application that is positioned to act as a conduit between the end

users, or farmers, and the cloud-stored data, is the basis of our innovation. This user-friendly interface makes it easy to retrieve and present the collected data, giving farmers immediate knowledge of the details and conditions affecting their crops.But our suggested system's ultimate power rests in its capacity for prediction and decision-making. Our Android framework uses a sophisticated ensemble of artificial neural networks (ANN), fuzzy logic, and neuro-fuzzy systems to take use of the vast amount of cloud-archived data. These analytical tools serve as the building blocks for data processing and interpretation, allowing the application to give farmers accurate forecasts and practical advice.

Essentially, the goal of our research is to close the gap between cutting-edge technology and realistic agriculture, leading to a solution that has the potential to greatly assist farmers. Our suggested solution represents a game-changing step towards streamlining agricultural practises and raising productivity by providing a comprehensive understanding of crop dynamics and arming farmers with data-driven insights.

**METHODOLOGY**

The research project's methodology includes an organised strategy to collecting, handling, analysing, and using agricultural data for farmers' advantage. The base of data collecting is the integration of a temperature sensor, a humidity sensor, a leaf sensor, a GPS module, and an image sensor. This data will then be sent to the CC3200 launch pad and stored in a cloud infrastructure, opening the door for client-side decision-making and predictive analysis via an Android application. The process can be divided into the essential steps listed below:

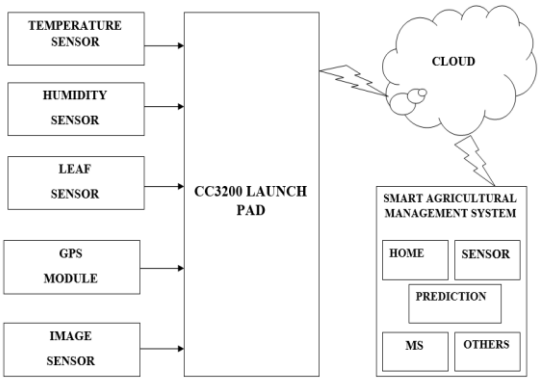


**Figure (1) Block diagram**

**Sensor Integration and Data Collection:**

installing the image sensor, GPS module, leaf sensor, humidity sensor, and temperature sensors in the agricultural area where the targeted crop is being monitored.

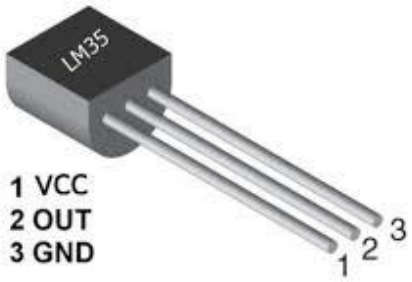


**Figure (2) Temperature sensor**

**Figure (3) Humidity Sensor**

**Figure (4) Leaf Sensor**


**Figure (5) Image sensor**

systematically gathering data from various sensors to record environmental and crop-related information in real time.

**Data Transmission and Cloud Storage:**

establishing a reliable communication protocol to enable data transmission between the sensors and the CC3200 launch pad.

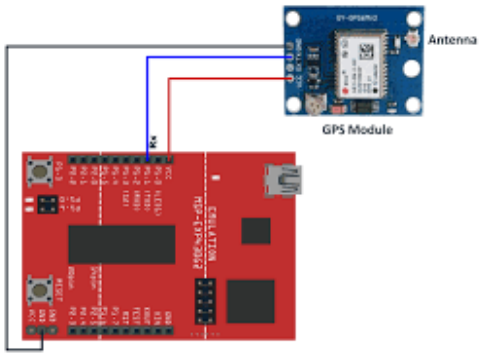


**Figure (5) GPS module**

before transferring it to the cloud for storage, aggregating and formatting the acquired data. securing the archiving of incoming data using cloud-based storage options to ensure accessibility and scalability.

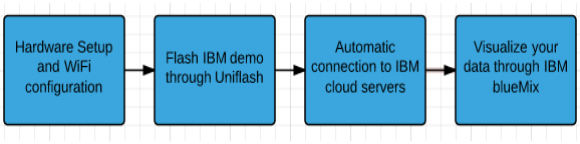


**Figure (6) IBM cloud**

**Android Application Development**

designing and creating an Android application that will act as the farmers' interface. Including cloud connectivity features in the application will make it easier to access data stored in the cloud.

**Data Processing and Analysis**

the cloud-stored data will be analysed using Artificial Neural Networks (ANN), fuzzy logic, and neuro-fuzzy systems. putting data preparation techniques to use to increase the analytical models' correctness and dependability.

**Decision-Making and Prediction**

based on the findings of the data analysis, developing prediction models and decision-making algorithms. Creating an analytic foundation for the Android app to offer the farmers predictions and actionable information.

**User Interface and Visualization**

creating a simple, user-friendly user interface for the Android application. presenting the results of the analysis, the forecasts, and the advice in a way that is visually instructive and simple for farmers to understand.

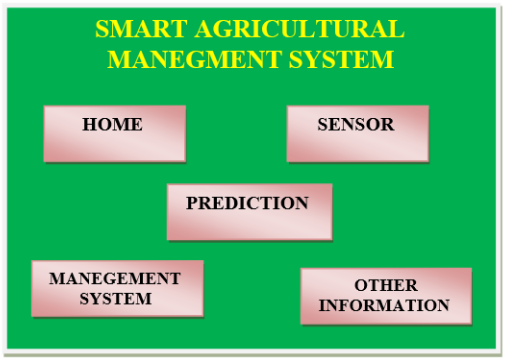


**Figure (7) Android Application**

**Testing and Validation**

thorough testing to make sure the integrated system is accurate and reliable. collaborating with farmers to test the system's performance in actual agricultural situations.

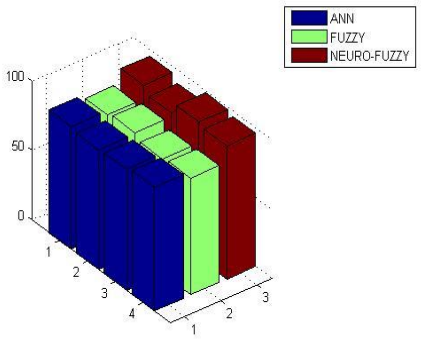


**Figure (8) Performance analysis**

Three methods—ANN, fuzzy logic, and neurofuzzy system—are combined to create the suggested system. The accuracy value serves as the foundation for the suggested system's evolution. Figure (11) displays the compression graph for the suggested system. In this graph, the ANN approach's accuracy outperforms the fuzzy logic technique. In terms of output, the neuro fuzzy system performs better than ANN and fuzzy logic. assessing how the suggested approach will affect farmers' decision-making, crop productivity, resource use, and overall agricultural practises.

Our research project intends to realise a comprehensive system that provides farmers with data-driven insights and predictive skills, ultimately resulting in improved crop management, increased production, and sustainable agricultural practises by strictly adhering to this methodology.

Importantly, our suggested system's primary strength is found in its capacity for prediction and decision-making. We have developed a framework that can handle and analyse cloud-based data to give farmers knowledgeable advice and forecasts by using the capabilities of artificial neural networks (ANN), fuzzy logic, and neuro-fuzzy systems. This symbiotic relationship between data analysis and practical application has the power to transform current agricultural methods by optimising resource use, reducing hazards, and eventually improving crop output and quality.

The results of our study have significant significance for the agricultural sector going forward. Innovative technology combined with data-driven approaches and user-centered design offers the ability to close the gap between technological advances and practical agricultural difficulties. We foresee a future where sustainable practises are encouraged, productivity is maximised, and general well-being of both the agricultural sector and the larger society is elevated by providing a tool that equips farmers with insights drawn from a comprehensive understanding of their crops.

**CONCLUSION:**

In conclusion, our research effort is a significant advancement in the field of modern agriculture, utilising cutting-edge sensor technologies and cutting-edge data processing methodologies to provide farmers with useful information and forecasts. A specific crop's critical data may now be systematically gathered thanks to the combination of a temperature sensor, humidity sensor, leaf sensor, GPS module, and picture sensor inside an agricultural context.

This data's flawless transfer to the CC3200 launch pad and subsequent cloud storage have created the foundation for a dynamic and accessible repository. From the perspective of the farmer, an intuitive Android application acts as a conduit for accessing and visualising this plethora of data, providing real-time updates and a thorough overview of crop conditions.

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