# Smart Agriculture Management of Intelligent Things Using NB-IoT

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**ABSTRACT**

Agriculture is very important since our early days and we can call India as Land of Agriculture. More than 60 to 70 % of Indian population are farmers. This field contributes over 20% of our Gross Domestic Product. So that we are making the agriculture to be smart rather than Hard using Internet of Things. The main objective of these smart devices using NB-IOT makes this field not to be in backlogs. Hence we want to make this field to be more active by using some Internet of things and Machine Learning approaches. Hence we are designing an Intelligent Agriculture Management System using Narrow Band IOT which helps farmers to improve their productivity with latest innovative reforms. Our NB-IOT method uses multiple sensors and considers various environmental factors without wasting resources by using a innovative techniques called precision agriculture. All the data what we have gathered and the results will be displayed as Graphs . The proposed IoT Narrow Band implements edge computing for the design of latency criteria for agriculture.

*Keywords*—*Internet of Things, Machine Learning, Agriculture, Intelligent Systems, Communication protocols*

## 1. INTRODUCTION

In recent days, the Agriculture System has been monitoring all knowledge with the rapid growth of the mobile Internet and the Internet of Things, such as smart devices. Different smart phone apps for seed control, prior field records, and finding findings are used in much of the agriculture system. Latest Agriculture equipment such as 3rdGeneration Rice transplantor [1], Gluco Shredder based on Infrared and Zigbee, Pit tracking systems such as smart Applications and a few other advanced appliances are available for use. Intelligence systems track past agricultural documents and eventually transfer the related information to the agricultural archive to safely preserve the records.The adoption of smart devices for agricultural systems will minimize practical expense, boost farming experience [2], and reduce farmers' labor force. These smart gadgets, though, are very demanding activities for a few days to accomplish their goals. The primary constraint role is the contact protocol. Both electronic devices do not support wired communications, so that intelligent devices are linked by short and long-range wireless communications. Therefore, designing the most advanced architecture of these devices is the main demanding challenge for the new.

Boudraet. al. The new agricultural tracking systems for farmers using wireless protocols and Bluetooth have been proposed. Catarinucciet. al. A three-tier network systemic architecture was implemented to track agricultural records[3], control and collect agricultural ecological records, consisting of three parts:

1) Radio Frequency Identification (RFID) that enhances the network of wireless sensors called a Hybrid Sensing Network

2) Intelligent Portal of the Internet of Things;

3) Record Control and Visualization client interface.

HSN monitors antenna systems with Generation 2 Radio Frequency Recognition tags that can broadcast their records to the higher layers using the Internet or LAN. Alharbeet. al. New ways of using Cellular Networks [4] and Radio Frequency Recognition systems have been developed to develop a knowledge processing system for agriculture. To automatically classify the areas, Zig Bee was used to advancing the Recorded Crop Records to the cloud centers.

Nasriet. al Using 5G networking methods, data has been transferred again from terminal to mobile phones, and also the data will eventually reach the cloud center immediately for yet more information.

Zhanweiet. al. To verify the data records and upload them to the cloud portal, the Authors suggested organizing some smart intelligent procedures for our crops. Wireless protocols have several drawbacks and many separate types of intelligent instruments can not be linked in hospitals under the existing infrastructure. Wi-Fi just as ZigBee are restricted reach remote conventions that have been limited by short correspondence space[5]. Contrasted with transient remote conventions with high-range remote conventions, high-volume remote conventions are energy-concentrated, and these sorts of conventions are not appropriate in keen horticulture for all around planned brilliant frameworks.

Narrowband IoT (NB-IoT) consumes less power, so practically from any place wireless protocol functions works. Costs are very low and less power consumption compared to all protocols, the major applications of narrowband IoT. In this way, it offers a new framework for integrating all mobile devices, needing far fewer details, long-range cycles, and smart meters than have been used in smart parking management.

Narrow Band-IoT is a common technology for linking all smart devices in well-maintained agricultural areas. In specific, this study proposes a concept that uses NB-IoT to link all mobile devices to smart agriculture networks. Narrow Band-IoT makes for a feasible architecture[6] for all devices.

## 2. LITERATURE SURVEY

Intelligent Agriculture Management System, for the most part, talks about versatile farming which alludes to the utilization of brilliant gadgets, gathers Real-time crop information from fields, and stores the information into network workers by means of the web. The put-away harvest records can be gotten to by various gatherings of ranchers. For instance, Farmers, seed Managers, and so on Today the greater part of the ranchers want to utilize canny horticulture information to analyze the yield infection and treat the harvest illnesses appropriately. The accessibility utilization of the Intelligent Agriculture Management System for crops builds the soundness of the field.

This atmosphere requires the integration of multiple smart well-being techniques to foresee the real-time risks. This Smart Agriculture Management System will become a significant consideration for prediction in the future[10].
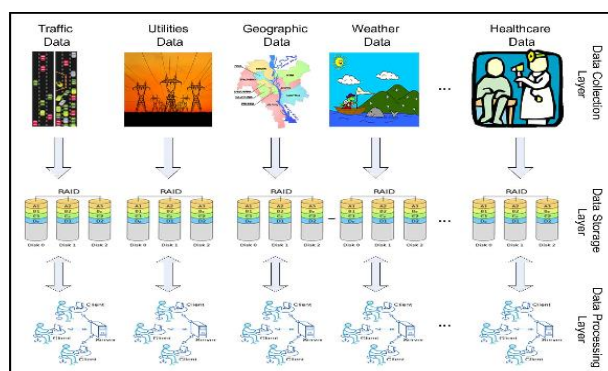
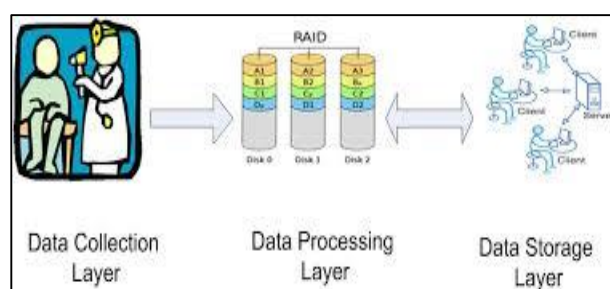**Fig. 1. Multi-layer IoT architecture**



**Fig. 2. M-Agriculture structural design**

This infrastructure, which is a part of the architecture of the Internet of Things, is supported by the Intelligent Agriculture Management System. It requires multiple levels, along with data collection, data storage, and data processing layers. Large data such as seed information, data on weather variability, data with traffic, survival can also be accessed from various data sources. [7] can be stored at the data storage stage. Smart data interpretation, data visualization, and report generation services are the responsibility of the data processing layer. The complete architecture of an IoT device is presented in Fig.1, while Fig. 2 Implements m-agriculture.

Growing the productivity of crop infrastructures including agricultural equipment is the most difficult priority for days. Apart from this one, some of the key challenges are providing quality of service to low-cost farmers and addressing the challenge of seed shortages[8]. Mechanical recognition, human control and smart machinery in agriculture, real-time monitoring of crops using physiological criteria, accurate identification of plants, rapid recognition of environmental threats are only a few instances of smart policies in smart agriculture.

Ultra-High-Frequency (UHF), Radio Frequency Identification (RFID), Wireless Sensor Network (WSN), and Intelligent Wearable Representatives [9] are the most important innovations in the application of the Intelligent Agriculture Management System. Energy-assisted smart devices, actually called tags, are made up of RFID.If an electromagnetic field is created by radar, BAP devices transmit the data. A low-power and low-cost system are RFID. To expand the capabilities available, UHF RFID tags are often very interesting. The key downside of RFID tags is that they are unable to work solely within the province of radar penetration. The scale is from 8m to 32m. Dinesh et.al[10] proposed IoT and cloud based Health care system for smart agriculture management.

Due to the exponential growth of agricultural spending and the human population, the Mobile IoT

Agriculture Management System is one of the most demanding targets for both government and citizens. The challenges faced by farmers and their expenditures are very serious problems, according to a study by the Food and Agriculture Organisation. Therefore, the challenge is to detect crop diseases at the right time and solve them at a low cost. In this study, several problems are raised. The key problem is that most IoT system nodes have insufficient disk capacity and networking capacities to keep them from linking to Internet Protocol-based networks.

The secondary problem is that all the systems do not have standard protocols. The mobile Agriculture Management System, the IoT environment has collected biometric information. In able to acquire proactive steps to save crop life in emergencies and crucial circumstances, the intelligent portable agricultural device suggests and informs farmers and their assistants in real-time concerning crop issue knowledge.

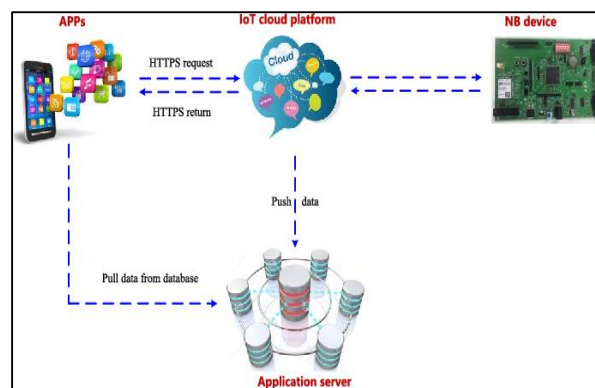**3. Design and Implementation:**



**Fig.3: System design**

Figure. 3. Describes the architecture of an IoT framework that involves an application server, cloud level, NB-IoT computers, and consumer software. The suggested approach offers Narrow Band-IoT communication only to purchase and update the NB-IoT SIM in the implementation panel for consumers.

The developed IoT framework, in general, consists of sensing and notification modules that are used in the proposed system. The collected data is again passed to the IoT Cloud environment and the IoT cloud transmits the sensing data to the server of the program. Such data will be used to construct each program. To connect clients and the application server, the user interface is used, and it gets data from the cloud portal.
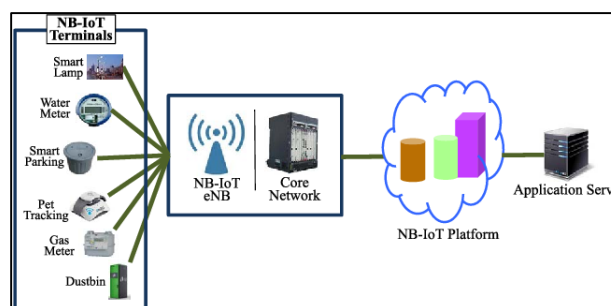


**Fig. 4: NB-IoT application architecture**

Four elements of the NB-IoT Technology Architecture:

(1) NB-IoT terminals—water or gas meters, smart lamps, dustbins, etc. Examples of NB-IoT terminals which are all connected to the a group of Narrow Band instruments.

(2) Data transmitting and broadcasting networks-Associated terminals will pass the stored records to one of the closest mobile base stations.

(3) NB-IoT cloud network- Data are passed to the Cloud Server from the cellular Base Station.

(4) Application Server: The records obtained will be moved From the NB-IoT cloud platform to a standalone program server. Take the Smart Meter as an example.

This method aims to explain the use of water, gas, etc.

This would be done within a fixed timeframe to complete the billing of customers. Some of the basic requirements of the device are:

(a) low-cost meters

(b) low power consumption;

(c) battery life;

(d) improved management  of the interior.

The framework proposed is worthy of  all these specifications that are discussed above. This system has distinct charging strategies depending on the data obtained at irregular times of a calendar day.

## 4. Narrow Band -IoT Architecture

The architecture of the Narrow Band -IoT focuses on low mobility, low cost, indifferent latency, use of multiple computers, and less power consumption. This protocol replaces the terminal quantity statement monitoring function commonly used with traditional mobile communications, when this lowers the power usage of the terminal system, but also eliminates the handoff functionality of data transmission. The suggested design of the protocol consists of a lot of equipment for entry and low power consumption.

In a consolidated center, vast numbers of devices are often affected by data transfer interference, which allows the system to use more resources In such a way that only the NB-IoT could not have power over delay in communication. It could be a very challenging job in some programs.

### 4.1. Architecture for Smart Agriculture System:

1) Sensing Layer: This layer is made up of a the wide number of terminal processes in use in the NB-IoT frames. The goal of these devices is to capture and process data. Also, including the security of terminal equipment, the use of resources and protection should indeed be taken into account.
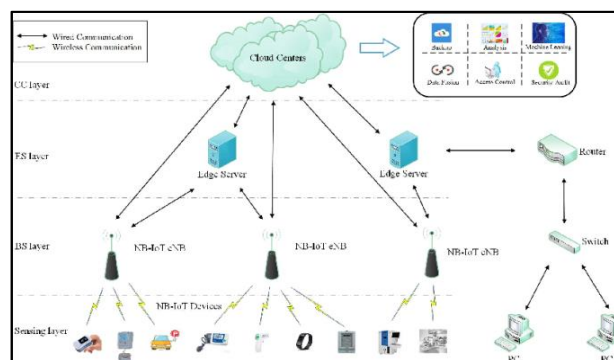
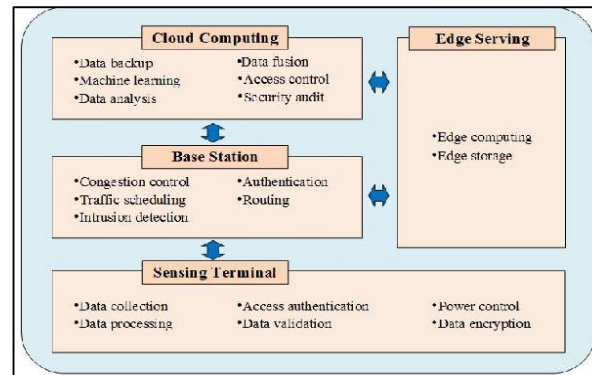**Fig. 5. Architecture for Terminals in Smart Agriculture Management System.**



**Fig. 6. Proposed Architecture Layer.**

*2) Base Station Layer:*

The Base Station Layer contains a significant number of NB-IoT Base Stations that can also be deployed on a network. In reality, routing, congestion management, network traffic scheduling and protection are also the features of this layer which ensure secure data transmission. Data from the sensing shall be obtained by the base station sheet, setting a fair transmitting route mostly on basis of the data specification.

The base station layer which schedule traffic where there is congestion to prevent congestion. Base Station Layer ensures data protection, as authentication and intrusion prevention must be known. The Base Station is very vulnerable to hacks. We, therefore, need a reliable form of Intrusion Identification (IDS) tends to capture and analyze network behavior, access logs, data inspection, and a variety of other key factors to validate those security policies.

*3) Edge Computing Layer:*

Conventional computation and big data storage can be taken out by the cloud infrastructure. Each NB-IoT Base Station can connect more than 50,000 computers, resulting in higher broadcast bandwidth and reduced network latency, with the most latency specifications for

available records within the Intelligent Agriculture Framework, a new approach called edge computing server is applied here to minimize latency and achieve real-time data processing.

*Benefits of Edge Computing Server in proposed architecture:*

1) The Edge computing system is somewhat close to the terminal, and this Records' Round Trip Time (RTT) is moderately somewhat lower, which essentially increases its throughput which reduces the RTT.

2) Improves the performance of the system. Records must be transmitted to the cloud network via smart devices without depending on edge server computing.

The data transfer to servers, computers, routers and other associated devices are mirrored. Using edge cloud computing, terminal records collected access data directly from servers without even being migrated to any other network computers, ensuring the reliability of the data.

3) The primary purpose of edge server computing is to reduce terminal things of energy consumption. This has a powerful computational capability to allow these edge computing servers to position the

computing tasks of the devices.

4) An outstanding infrastructure ecosystem is provided by Edge server computing. It is possible to run a huge number of programs at a time

### .4) Cloud Computing Layer:

The Edge computing system is somewhat close to the terminal, and this Records' Round Trip Time (RTT) is moderately somewhat lower, which essentially increases its throughput which reduces the RTT.

## 5. Results and Discussion

The proposed system includes sensor data imagined through charts. Additionally, the information collected is broken down using comparison diagrams of data fluctuation, light pointers, and custom measures including snappy and efficient arranging. Besides, the data obtained is signed into a CSV record because it is signed further into Real-time stockpiling Firebase Log. Figure 7 indicates the variation of dampness information obtained by the dampness sensor that is present in the soil. This is used anytime the dampness levels fall beyond the cap to turn the engine on.
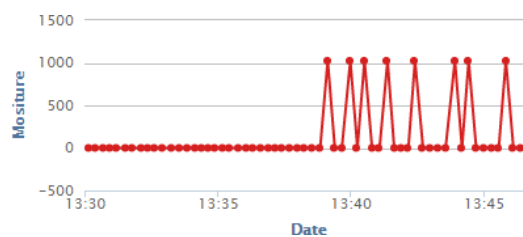


Fig. 7. Dampness information composed from NB-IOT

The temperature difference in the atmosphere from DHT-11 sensor is seen in Figure 8. The graph was plotted to use all the Thing Interact IoT Cloud mechanism being used by client at the front of the system.
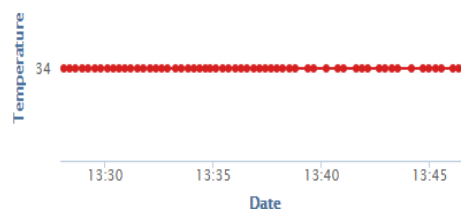


Fig. 8. Temperature information composed from NB-IOT

The extent of mugginess in the climate, obtained from the DHT-11 sensor, is shown in Figure 9. To leverage the Thing Speak IoT Cloud process, the qualities are plotted. It is shown in front of the application.
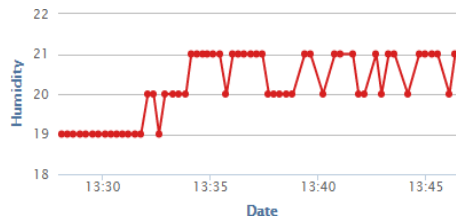
Fig. 9. Moisture information composed from NB-IOT

In the CSV log, the information calculated from the sensors are obtained and are then stored in the Firebase. This information is later used throughout the yield prediction module to foresee a fair harvest. In figure 10, showed.



Fig. 10. CSV data logging of DHT-11 sensor

The characteristics plotted for X data set estimations as seen in Figure 10. The X characteristics illustrate the data on the SVM classifier towards preparing the model. The red focuses capture the actual dataset, the train dataset characteristics are shown by blue focuses, and green focuses show the test dataset values.
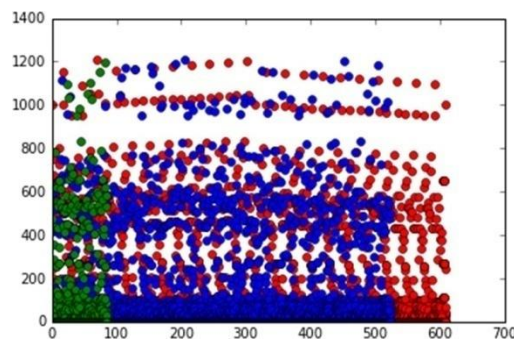


Fig. 10. Output Values for Crop Prediction using NB-IOT

## 5. Conclusion

Due to the lack of communication protocols, there must be a non-unified architecture that joins all smart agricultural devices. This work primarily presents the NB-IoT architecture for joining all smart devices in the Agriculture Management System. In formulating the state of latency in the crop data, the proposed NB-IoT implements edge computing. The primary aim the goal of edge computing is to

formulate the necessary latency specifications for diagnostic establishments in agriculture.

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