

Applying IOT for Smart Cultivation: Revolution in Farming

K Rammohan Goud¹, Venu Babu Gali²

Assistant Professor

Department of Computer Science and Engineering

St. Martin's Engineering College-Secunderabad 500100

Corresponding Authors' Email id: rammohan.koukuntla@gmail.com¹, gvbabu1988@gmail.com²

Abstract

Oppose the perception people may have regarding the agricultural process, the reality is that today's agriculture industry is data-centered, precise, and smarter than ever. The rapid emergence of the Internet-of-Things (IoT) based technologies redesigned almost every industry including —smart cultivation (agriculture) which moved the industry from statistical to quantitative approaches. Such revolutionary changes are shaking the existing agriculture methods and creating new opportunities along a range of challenges. This article highlights the potential of wireless sensors and IoT in agriculture, as well as the challenges expected to be faced when integrating this technology with the traditional farming practices. What sensors are available for specific agriculture application, like crop and water management, pest controlling and its working, precision agriculture, and food production and its safety detection are listed. Finally, based on this thorough review, we identify current and future trends of IoT in agriculture and highlight potential research challenges.

Keywords: Food quality and quantity, IoTs, APSCM) M2M, RFID, EPC, ZigBee

INTRODUCTION

Agriculture is the backbone of the economic growth of India. Around 61.5% of India's population is directly involved in agriculture work. In India, we talk about previous methods of cultivating through

old tools like Plow. In ancient cultivating, farmers used bio fertilizers. Earlier they didn't have many options related to seeds and they had depended only on Monsoons and they only estimated weather forecast through the sun. On the other side, modern

technology in agriculture includes proper management of water supplies, new innovative automated tools like pickaxe, knapsack, and different sprayers, harrows, harvesters, etc. With the adaptation of internet source, the agriculture processes became easier to farmers. Through sensors, they get absolute information about their

crops and their cultivation. IOT helps farmers in adverse climatic conditions as it is impossible for farmers to predict the right weather forecast. IOT is set to be a revolution for agro-based startups. Smart Applications deliver information about the composition of the soil, crop health, and water requirements automatically on time.

Table 1: Application Area of Smart Agriculture

Application Name	Description
Crop Water Management	Mostly the farmer pumps the water either much or less to cultivate his field Therefore result in problem of wastage of water or inadequate to the crops. It sends a notification message to farmers when the level of moisture either increases or decreases.
Precision Agriculture	High reliability is required about weather information which decreases the problems of crop damage. Agriculture in IOT makes exact delivery of real time information on the weather changing, soil quality, labor cost and many more to farmers.
Integrated Pest Management or Control (IPM/C)	Farmer's hard work is damage by insects and pests therefore results in big loss to farmers. To prevent this problem IOT in agriculture has a system that detects their movement of predators using PIR sensors.
Food Production & Automation	Agriculture in IOT system precise and maintains different parameters such as storehouse temperature, shipping route system, joins cloud based systems. It protects the quantity of different foods and grains from unnecessary wastages in government warehouses.
Green House Automation	Greenhouse Automation Systems works on all sides the clock to increase the climate in greenhouse, increasing of crop yields, also helps to reducing the energy of costs and its labor costs.
Other Projects Implemented Till Date	A series of activities that can be natural or physically allocate to a user and collection of users that will support to did a specific task.

RELATED WORKS

Smart farming can be applied using different methods. Each method uses various tasks, platforms, architecture and way of transmission modules having its benefits and application areas can be used for providing the facilities to farmers. Many sensors are deployed in the cultivated land to collect the exact data and send it to the system or server. After, the processing of data and its result generation, the final resulting message is sent to the farmers.

The Applications of Connection-Less Sensors Network in IOT as well as Smart Grid

The authors facilitate the flexibility of Wi-Fi-based mostly connection-less sensor networks in IOT and sensible grid to boost the information measure the standard of

Wi-Fi-based mostly Wireless Sensor Networks has higher bandwidth or rate and non-line-transmission ability or large-scale knowledge assortment and that they are extremely cost-efficient¹.

Smart Grid plays a necessary role in sensible power generation, intelligent transmission, station and usage of intelligent power. The authors target to collect the period info regarding the sensors and additionally providing suggestions to the farmer like temperature, humidity, wind, the base of operations, rainfall, soil wetness, soil compaction, soil physical phenomenon, pH value and soil nitrogen. The advantage of the Wi-Fi-based Wireless Sensor Network is it will be employed in techniques that need video observance knowledge.

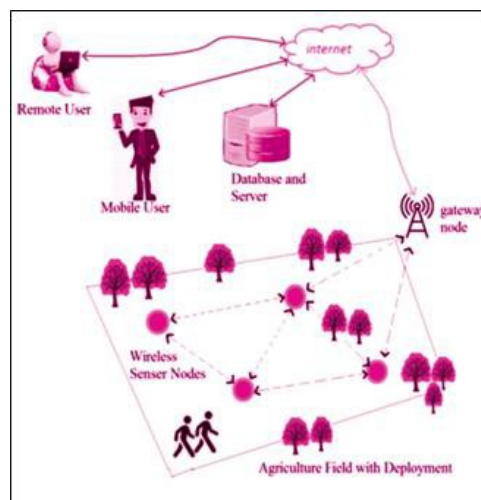


Fig.1: Smart Agriculture

The Study and use of IOT Technology in Agriculture

The authors aim at expanding the software package to observe the fields. The unfavorable temperature, wetness, and soil indicate gathered from the sensors that are performed by a wireless network through the M2M (Machine to Machine) platform. The planning of the software package includes a computer program module system communication module, knowledge assortment module and processing module².

With the assistance of the temperature detector, it turns the temperature signal to the digital signal that anyone can track by the MCU (Micro Control Unit). Wetness detector fetches all signals from location, however, MCU can't scan and fetch analog signals, and so, AD converters were used to convert analog signals to the digital signals. This refined knowledge is displayed at digital display screens. The benefits of this method were extremely performed and it's conjointly a user-friendly.

PROPOSAL WORK

Smart Agriculture Based on Cloud Computing and the Internet of Things

Authors are utilizing the Internet of Things simply like Cloud computing, image &

SOA technology that detects plant manufactory for contemporary agriculture activities and to extend the capability of crops. Cloud computing merely depends on the internet that helps the computer and every different resource to approach the connected hardware also as code. The cloud involves four layers these are: physical layer, resource pool layer, management & middleware layer and SOA construction layer. The advantage of cloud computing is user they are doing not need skilled information concerning the cloud. IOT helps the remote to get the resources. It's having 3 layers are as follows sensing layer, the delivery layer, and the control layer³.

Hardware resources are consolidated by visualizing technology to attain important distribution of resources & load equalization. It involves the management of cloud computing and its customization application and process that variety of services, organizing and coordinative services furl knowledge center. It includes pursuit and dominant plant manufactory security. It takes the record of standing and security information associated with the provision method.

Merits of this method are crop management, analysis of productivity

effects and significance of management measures.

The Relevance of the Internet of Things in Animal Stocks Chain Management in India's Perspective

Authors have discussed the importance of the Internet of Things in trendy technologies, particularly in animal product applications. It makes positive that people's receiving food quality is controlled the diseases that happen in foods. It endeavors the aim to produce agricultural products through supply Chain Management (APSCM). APSCM may be a network that's supported supply, information processes and capital flow. It relies upon 2 technologies specifically EPC and RFID. Every product is marked with the EPC code that is reserved in electronic tags and that is useful in recognizing the products in actual time situation. Here, EPC is often used for following all product activities and to uplift the integrity of APSCM. RFID was helpful to spot these tags and to discover the particular merchandise. Then, it transfers the knowledge to the middleware for the forward process. The RFID and network information are often accustomed to integrate all work of production.

The significance of this paper is to uplift the communication technologies in this approach that it will connect the additional things into objects anyplace, anytime and through any media⁴.

Managing the Upcoming Ubiquitous Computing

The author's objective is to forestall the network that is being flooded by the unchanged traffic. It is created from 3 domains that are system monitoring and management, ubiquitous computing and cognitive radio. System monitoring and management essentially is a tool that lives monitor and manages the troublesome system to induce higher quality.

After distinguishing the inner mechanism of a system, the tool corrects worldwide behavior. This technique is essentially managed and monitored through the common cycle that lives and observes all data, analyzes the data and information to arrange a brand new set of knowledge, and then make a judgment. This paper offers information concerning ubiquitous computing through the use of WSN, which may contain objects providing and giving intelligence to the atmosphere, and RFID that pinpoints the essential objects in WSN that offers brand new findings to completely different regions through

environmental watching, to the smart museum. The main function of the cognitive software package outlined radio (SDR) is additionally mentioned. Here, the radio signals are tracked and processed by the software package running on the processor.

Expert System for Seedling Weeds Identification in Cereals

The author obtains knowledge supported system utilized in the decision-making process. It acknowledges the matter and transmits it to the ultimate user or farmer to require the acceptable action. It collects the knowledge from unrelated weed seeds and makes a data sheet with the assistance of characters that behave towards as primary keys for managing records.

This information is reserved within the knowledge base. It additionally includes many phrases that are associated with downside choice, data acquisition, data illustration, program testing, and analysis. It makes use of the IF THEN ELSE command. The transactional information is held on into the database that is then transmitted into facts and rules. And this technique additionally contains a program supported GUI (Graphical User Interface). The major task of this technique is an aggregation of the weed seed data for the

process, search question, weed fingernail that maybe won't acknowledge the seed options. This technique additionally helps in organizing and synthesizes knowledge and information of various varieties.

Expert System Model for Identification Pests and Diseases of Forest Tree

The authors had evolved a specialist system that may be used for identification, recognition and forest management. Essentially it includes 2 techniques that are illation techniques and some other different certainty and uncertainty techniques. A knowledge base is often developed. The graphical user interface (GUI) is planned for user interactions. An expert system includes 2 necessary parts, as well as the knowledge base that needs the domain-specific knowledge and also the inference engine is combined of algorithms that additional manipulating the data then pictured within the knowledge base. It even is fashioned of consultation & development sides. The consultation facet is providing consultation interface to the end-user for providing consultation with an expert system, inference engine, certainty and uncertainty methodology, and temporary results. On the opposite hand, development facet has solely 2 users that they interact with the expert system

particularly expert system and also the data engineer⁷.

The knowledge base of an expert System is helped in the identification of various forest and tree plantations that describe a relational database service and it includes all information of trees, their symptoms, diseases, pests, control activities, and everyone rules. The inference engine supported 2 approaches, i.e. forward chaining and backward chaining. Within the finish, the system user interface relies on 2 interfaces as particularly consultation interface and development interface. The consultation interface is opting by the end-user to induce answers to the issues. The event interface is veteran by an expert conjointly the knowledge engineer for the developing activities that also includes adding rules, knowledge base and knowledge refinement.

The benefit of this technique is to pinpoint the pests and diseases that affect the crops.

Combining RFID and Smart Objects into a Unified Internet of Things Architecture

The authors mix the ideas of RFID and therefore, the smart objects with internet and Things to cover up the entire service lifecycle of the application provided. The target of this paper is to beat the current

problems relating to architectural models by analyzing the superimposed lightweight and open middleware. RFID provides data relating to the labeled object by browsing a web address for that object. IOT is a mixture of smart objects. The smart object provides information concerning themselves and their surroundings. Smart objects might carry chunks of application logic to produce logic and permits interaction among the humans and alternative close to objects.

Smart objects can track the whole existence of an associated object from the time before it had been created. Smart objects have twin nature⁸.

On the one hand, it participates in a worldwide infrastructure of networked things. On the opposite hand, it is represented by its social illustration. The implementation problems relating to this paper are middleware resolution. This author describes the service lifecycle involving the subsequent steps like Service composition surroundings together with wizards and linguistics language backend, The transformation provides tailored service and dynamic preparation of those services into IOT building blocks. The RFID is restricted by RFID tags and

readers.

The demerits of smart objects apply solely to those objects that are supporting the complicated functionalities which may limit the scope of IOT. The author in the future might offer infrastructure in terms of quantify ability, ability and performance maximization.

Research on Key Technology and Applications for the Internet of Things

The author mentioned the importance of IOT and RFID in this paper. IOT can do interconnection of all things anyplace, anytime with correct management and reliable transmission. Varied layers are:

1. Access Layer: To transfer information from the sensing layer to the network layer
2. Network Layer: To integrate the knowledge resources of the network
3. Middleware Layer: To manage the management real- time data
4. Application Layer: To integrate the function of the bottom system.

In this paper, RFID technology is employed for machine recognition of enemy aircraft. It can even be used for production management, t transportation, high confidentiality and high irresponsibleness of RFID devices. Antenna technology is the key feature of RFID⁹.

Electronic Product Code (EPC) is employed to construct real- time network sharing information. EPC consists of EPC encoding, PML, ONS Server, readers, EPC tags and internet. ZigBee includes 3 main areas: Hardware platforms, Network communication protocol, and knowledge processing technology. This system is mainly utilized in industrial controls, home automation, digital agriculture, and medical observance.

A web-based Tomato Crop Expert Information System Based on Artificial Intelligence and Machine Learning Algorithms

The author develops an associate expert system that supports AI and machine learning to trace the tomato crops. By victimization of this tomato crop conductive system the user gets the static info concerning un-alike diseases, their symptoms, chemical controls and preventions of tomato crops. Currently, the user will interact with this expert system on-line and simply answer the queries asked by the expert system. Looking at the responses of the system display and its management measures, this technique is meant to use the ID3 algorithm and a few of the optimization algorithm for providing the higher results. It is essentially an online-based expert System and also the

program is split into 2 components specifically information system and conductive System¹⁰.

It is supported the symptoms gathered as data this algorithm validates the knowledge and displays the results to the user through victimization rule primarily based system or optimization formula. ID3 algorithm generates a decision tree through the collected information.

This system is useful in providing horticulture-related advice and facilitates by providing recommendations with no need for an expert.

Challenges in IOT in Agriculture in India

- Little knowledge concerning the native weather.
- Lack of sales of distribution info sources.
- Imperfect ICT (Information and Communication Technology) infrastructure and ICT illiteracy.
- Insufficient knowledge among farmers concerning the advantages of smart farming.
- Machinery for work is expensive.
- Additional manual work.
- Keep a mark of record manually.

- Lack of correct analysis of market research skills as well as research Centre.
- Changes thanks to the weather conditions.
- Having no interest in the agriculture profession by young and educated professionals.

Limitations

- Agriculture being a phenomenon depends totally on nature, and man predicts or controls nature, let, its rain, drought, daylight convenience and pests control, etc. therefore, ever implementation IOT system agriculture.
- The smart agriculture desires convenience on the internet incessantly. Rural a part of the developing countries failed to fulfill these needs.

CONCLUSION

Internet of Things is a new revolution of the internet it is a key analysis topic for a researcher in embedded, computer science, information technology a read thanks to its very diverse area of application heterogeneous mixture of varied communications and embedded technology in its architecture.

The global population is about to touch 9.6 billion by 2050. So, to feed this abundant population, the farming trade should embrace IOT. Against the challenges like extreme climate and rising temperature change, and environmental impact ensuing from intensive farming practices, the demand for a lot of food has got to be met. Hence, nowadays we taught, however, agriculture fields area unit benefitted from IOT systems. We have covered the various IOT Applications in Agriculture and how they've created use of. We'll learn a lot of regarding IOT very well within the future tutorials. What is more, keep tuned to be told a lot of fascinating things that you simply will do with these technologies.

We will predict the soil wet level and motion of predators.

- The irrigation system may be monitored.
- Damage caused by predators is reduced.
- Increased productivity.
- Water conservation.
- Profit to farmers.

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