Applying Cloud Computing And Wireless Sensor Technology For Making Smart Agriculture

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Abstract— **Smart Agriculture is a development that emphasizes the use of information and communication technology in the farming. Most of the population in India depending on agriculture. This situation is one of the reason, that hindering the development of country. So new technologies such as the IoT and Cloud Computing are expected to leverage this development and introduce more automated systems in farming. By observing soil, crop and climate in a field and given a decision support system that is able to learn, it is possible to provide treatments, such as irrigation, fertilizer and pesticide application. First this project includes remote controlled process to perform tasks like spraying, weeding, bird and animal scaring, moisture sensing, etc. Secondly it includes smart warehouse management which includes temperature and humidity maintenance and theft detection in the warehouse. Thirdly, intelligent decision making based on accurate real time field data for smart irrigation with smart control. IoT used to connect the devices, collect and distribute the information. Cloud adoption is expected to increase significantly in near future due to improved cloud hosting facilities and faster internet speeds. Together they will give required information along with the consideration of reduction in cost which will be beneficial to farmers.**

Keywords: Smart Agriculture, automated systems, cloud computing, IOT, Li Fi.

I. INTRODUCTION

Agriculture gave birth to civilization in India. India is an agrarian country and its economy largely based upon crop productivity. Thus agriculture is the backbone of all business in India. Now India stands in second rank in worldwide in farm production, Agriculture. Most of the population depends on agriculture and farming. The cultivation of plants includes analyzing the environmental factors, soil moisture, temperature and manage the water supply for proper cultivation of plants.

It is predicted that 87% world's using fresh water for irrigation and 33% of world's population produced food uses irrigation at every year. Hence, per capita fresh water is declining. On the other hand, world global warming increases.

II. CHALLENGES IN INDIAN AGRICULTURE

Recently, we share a critical problem in agriculture that the average age of farmers are rapidly increasing and youngsters are not willing to take agricultural work. The quality and quantity of this natural wealth has ruined over the years due to various economic problems related with increased cost of inputs, decreased farm incomes, ever decreasing land, labor, energy resources and also ecological problems such as soil, water pollution and soil erosion, putting the capability of future agricultural operations at risk. Apparently, this will cause a big issue in the near future. Therefore, it is important to consider how the aged experts know-hows are succeeded to young generation so that the agriculture can make profit even for unskilled persons. With the global population expected to reach 8 billion people in 2025 and 9.6 billion people by 2050, the nations of this world will have to double its current food production despite several barriers such as limited availability of land, climatic changes, fresh water requirement, declining labor force, energy crunch etc. in fulfilling the demand.

Agricultural progress is important not just to feed the increasing population but also to provide raw materials to industries. Hence it must be understood that industrial and agricultural developments are not alternatives, but complementary to each other in the path to achieve food security. The variety of challenges faced by today's agricultural area can be overcome by accepting sustainable or precision farming techniques with the help of technology.

Although IOT is beneficial for the Indian agriculture sector, this technology has various challenges [9] as far as India is concerned. Internet availability and connectivity in India is one of the biggest challenges. Consumer IOT adoption: this would remain another major challenge. India is in a unique position to come up with innovative products. If it is true,

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India can truly realize the dream of "Make in India" for the world.

III. PROPOSED SYSTEM

As shown in the below figure, the proposed model uses IOT to collect required information of different objects located in different parts which is not feasible without the usage of sensor network. Here, use of cloud computing storage server is proposed to reduce the cost of data service, and thereby overcoming another drawback of high cost of data service.

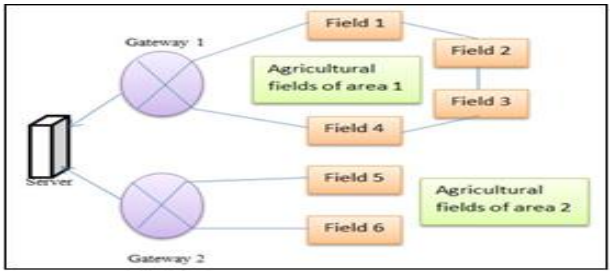

Fig.1**. Cloud computing and IOT based agricultural proposed general model**

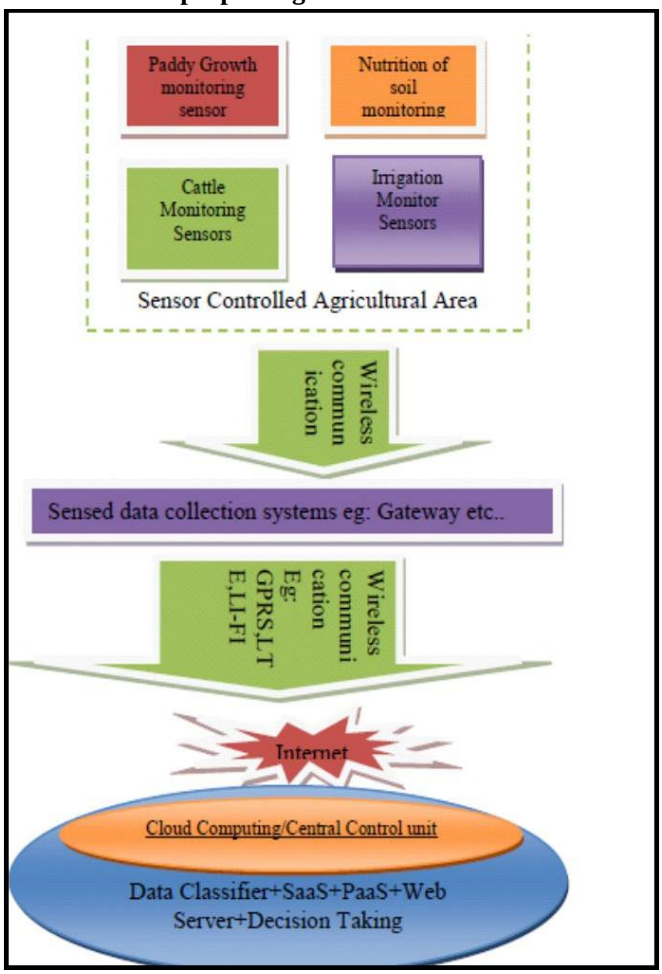

Fig.2. **Cloud computing and IOT based agricultural proposed general model**

The above diagram shows Hundreds of energy, low cost and computational power wireless sensor nodes are mostly used as agricultural monitoring system.

IV. AGRICULTURAL MONITORING SYSTEM BASED ON SENSORS

A. *Precision Agriculture*

Precision agriculture [2] is playing a vital role mainly in developing countries. In PA, based on as humidity, temperature, rainfall, soil moisture we can analyze utilizing of water, fertilizer, pesticides, seeds etc. in fields. Hence, it is used to increase the profit, maintain quality products and reduce waste. Wireless cameras, sensor networks monitor crop conditions or growth for a longer period of time without fail and they also made a decision remotely and generate or evaluate the potential of new crops.

Field Assessment

Agriculture farmers are follows traditional methods for the irrigation, applying required fertilizers and pesticides. Hence we propose wireless camera and sensor network based area field management and monitoring system for this purpose. Hence, the collected information from cameras and sensors are in two different sources are available for assessment, comparison and analysis. Camera nodes send the height, coverage and greenness information of the agriculture area field grass through wireless sensor and camera networks to the base server. Then the BS allocates time for these wireless camera nodes to send images.

V. SENSOR BASED AGRICULTURE SYSTEMS IN DEVELOPPING COUNTRIES

This sensor based agriculture monitoring system should include decision support system to maximize production, optimize resource utilization and can decrease environmental hazards.

A. *Design Challenges in Developing Countries*

Countries As sensor based agriculture monitoring networks are application specific, designing a sensor network for each application leads to the problem with limited resources and cost. Designing sensor-based agriculture monitoring Communication [8] framework to use in multiple applications can optimize these problems. On the other hand, sensor-based agriculture systems used in the precision agriculture of developed countries are not suitable in developing countries because almost throughout world 87% farmers are depending on labor. Thus, the existing sensor-based M2M agriculture monitoring systems[8] are required to be modified in this context.

i. Cost - is the most important factor in the case of developing countries. Cost can be reduced by using sensor based agriculture monitoring communication networks in which it is not currently being used in agricultural monitoring systems.

Reliability – in all most developing countries, sensor and camera nodes are climates extreme and scarce. Hence, important point those sensor nodes must be covered to

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protect from outdoor conditions including heat and moisture. One important challenge is availability and reliability of telecommunications and wireless infrastructure in rural areas of developing countries are very difficult.

Resource- throughout world most of poor farmers are relying on rain fed farming for production of food. Hence, a sensor based agriculture monitoring irrigation systems with a decision support system is required to maximize food production of irrigation while minimize the intake of good water.

Technical Frameworks of Sensor-based Monitoring Systems

i. Topology- one of the important primary requirement of this sensor based agriculture monitoring network fields in developing countries, one preferable method is zone-based topology can be used, which requires less number of sensor-based MTC devices. However, the zone-based topology suffers from network coverage problem and reliability (i.e., how the system works when a node in a zone fails). In [4], Kabashi and Elmirghani propose a dynamic zone-based topology for the VESEL project. Initially, nodes are distributed to the zones based on the optimized condition that each node remains within the range of the nodes of at least two zones. Hence, this overcomes the problem of node isolation. Then, each node identifies their neighboring nodes by broadcasting node/zone ID that is assigned by the gateway/coordinator nodes. Each zone node elects nodes in the neighboring zones to which they can connect with a minimum transceiver power. This generates several connected graphs, and the graph that requires minimum transmission power is selected for routing.

Task Scheduling- Task scheduling considers or includes the parameters for sensing data, environmental factors (that affect sensing and network operations) and energy of the resources. This mechanism effectively schedules three system parameters: frequency of transmission, sampling rate and bit resolution. Initially, all values of these parameters are optimized for scheduled and then, adaptively rescheduled by a trigger from another neighbor environmental. For example, rainfall or humidity sensors are triggered with soil moisture sensors. Task scheduling is done at application layer by coordinator nodes and external server.

VI. PROPSED SENSOR BASED AGRICULTURAL MONITORING SYSTEM

Based on the design challenges and existing technical framework of the agriculture monitoring systems we identify and present differences in sensor-based agriculture monitoring systems of developed and developing countries. Considering all these challenges and technical frameworks, we propose a novel agriculture monitoring systems (with improved Li-Fi technology, topology and routing protocol) for farmers in developing countries. In this proposed technology is proved with the below mentioned results. Usually low level network system was fixed in with IoT devices. Like sensors, relevant object and cameras are covered with communication network i.e Li-Fi technology which is clearly mentioned in above phases.

A. *Block diagram of proposed system architecture*

In the below diagram, at first relevant fields data are collected from relative sensors and that data/information sends to data collection server. This communication done with new Li-Fi technology. Actually lot of technologies is present with previous methods. But lack of communication leakage we are forwarded to this present technology for better performance.

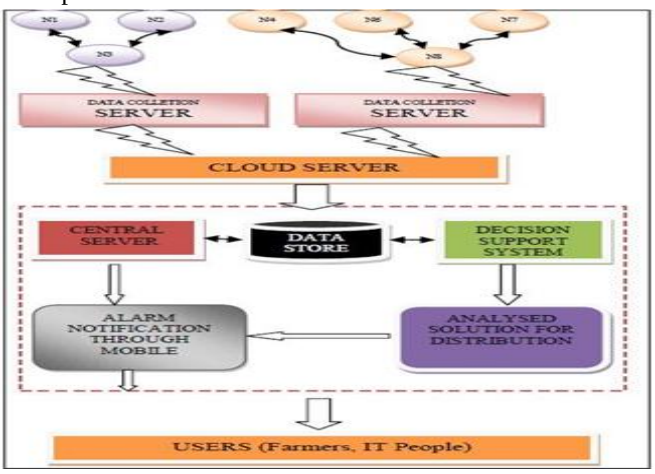

Fig.3. **System architecture**

After receiving data from sensors that information must transfer to cloud server with the help of GPRS and WIMAX technologies. Then cloud server take a responsible to analysis the data based on requirement. Based on collected data sever will take a decision and that decision need to distribute over the subscribed users.

B. Flowchart for process management

The proposed system starts and first executed by user validation weather that user is authorized or not. If user valid that all connected sensors are activated than that collected information send to cloud server. That will take an action regarding that query. Actually that data is two types compared and assessed. At last if the problem solved that the process terminated otherwise recycle that execution process.

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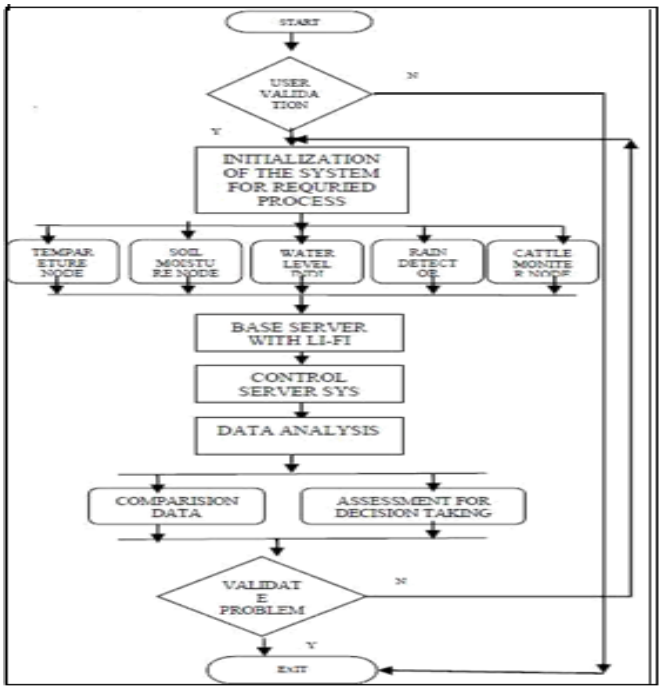

Fig.4. : **Flow chart of proposed method**

1) Temperature sensor:-

It refer a device, usually an RTD (resistance temperature detector) that received the data about temperature from a particular source sensors and make a conversion of the data into human understandable form for an observer or a device. One of the most commonly used temperature sensor is a thermometer, in which temperature can measure of solids, liquids and gases. Different types of temperature sensors are as follows:

- Thermocouples
- Resistor temperature detectors
- Thermistors

Now we explained briefly about each and every sensor in detailed manner.

Thermocouples: It is abbreviated as TC. TC is used for long distance because it is extremely rugged, low-cost.

Fig.5. Thermocouple sensor

A thermocouple can be used as a voltage device. The principle used for working of these metals is thermoelectric effect. When two dissimilar metals produce a voltage, a thermal difference exists between the two metals. Thermocouple voltage rises when the temperature rises.

Resistor temperature detectors: In this, the resistance is proportional to the temperature.

Fig.6. RTD sensor

RTD can be used for measuring a wide range of temperature. It can be used to measure a temperature between 270oC to +850oC.

Thermistors: When the temperature changes like RTD sensor it changes its resistance.

Fig.7**. Thermistor temperature sensor**

Thermistor offers high sensitivity compared to resistor temperature detectors. In the thermistors temperature increases when the resistance decreases.

2) Soil moisture sensor:-

Fig.8. **Soil moisture sensor**

For measuring soil moisture Tensiometric and volumetric are the two primary sensor types. Tensiometric sensors measure soil moisture tension. The actual volume of water in the soil is measured by volumetric sensor. Soil moisture sensors can prevent sprinklers from coming on if there's enough moisture in the soil.

3) Water level sensor:-

Fig 9: **Water level sensor**

The sensor used for measurement of fluid levels is called a level sensor.

VII. PRACTICAL RESULTS

End users can analyze output result in things peak application. That the below figure shows practical representation. This involved a lot of IoT devices.

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VIII. CONCLUSION

Better improvement of production in crop is a major challenge in well developing countries like India should take novel smart technologies under agriculture stream that leads to green population country. So in order to reach we proposed a new agriculture technology based on IoT association with cloud computing. Here Li-Fi technology was introduced for fixed area structure topology for better performance. Usually GPRS technology was used for better results within low cost. This system made with ability for further improvement by incorporating new self-learning techniques in which easy deployment in to cloud to understand behavior of sensor collected data and can take individual or autonomous decisions.

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