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IoT based Smart Farming using Cloud Computing and Machine Learning

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Abstract: ***Internet of Things (IoT) is a most emerging and advanced technology that works on computing and communications. The survival of human beings in the world depends on the agricultural sector. The traditional agriculture methods are to be replaced with smart technologies. In order to minimize the cost, maintenance and monitoring the farms the technologies are used. The smart sensors sense the parameters like temperature, humidity, water level, soil nutrition's and PH levels are monitored. In this paper IoT methods are used for smart farming***

I. INTRODUCTION

New methods are essential in agriculture to supervise the crops in controlled environment like greenhouses and to replica of the environmental conditions of particular areas to obtain the products locally. The variations of the weather conditions impact on the crop yielding and can be managed with controlling the parameters like humidity, lighting and temperature. The main objective of modern agriculture is to increase the crop yield in the form of quality and production. One such advance in agriculture is hydroponics, which increases the soil spread and productivity [Resh 2012]. The requirement of fertilizer increases by eight to ten times, when compared to open field crops. Hence, it requires an optimal usage of water and fertilizers in these agricultural systems. The release of nitrates and potassium from the agricultural system into drainage causes environmental pollution [2].

The alternative method to hydroponic is to recirculation of the water, developed in Netherlands.

The major setback of re-circulation is increase of the salinity of water and reduces the productivity of crops. In the present years, the use of Smart IT and communication technologies has enabled the accurate monitoring and control. Current sensor technology estimates the parameters accurately and enables the actuators to control and manage the changes in climatic factors and enriches the fertility of the soil with added nutrients.

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The usage of modern computer intelligence technology plays an important role in future improvement in the productivity by minimizing the diseases and regular intervention of human.

Hence, the solution is use modern computer intelligence to automate the agriculture is the future, but it requires to build new framework to integrate the hardware and software for better management of crops.

In recent year the sensor technology has evolved a lot, which are required for automation and acts as a gateway. The traditional Control units are replaced by Cyber-Physical Systems (CPS), which has capabilities like computing, storing and communicate, control and interact with other processors. Cps consist of collect the data from the sensors, process it and activate the actuators to meet the requirements [3] . The cloud computing technology, the data is collected through the sensors and communication channels, are saved in data center. This data can be accessed by remotely by web services such as remote computer and smart mobiles phones.

II. LITERATURE SURVEY

There are various emerging technologies for agricultural applications like GPS, soil monitoring and soil parameters estimation based on the output of sensors. The concept of precision agriculture using IoT platform was first introduced by Miguel A,for cultivation of crop by saline water and farmer are always connected with the plant area by processing the data set obtained from the sensors[4].

The cloud enabled Clay-Mist Measurement Index was implemented by taking plant temperature and humidity directly connected to the plant was proved that the accuracy has been improved to 94% faster [5].

Later the agricultural application was integrated with wireless network in order to monitor the crop .Two different sensor are used at each node to measure the parameter of the crop like temperature ,humidity and compared with actual crop by taking the image. The above parameter plays a curial role for decision making about the growth of the plants. This method has higher stability of sensor and power consumption is low.

In modern days, powerful tool like vertical farming is used for measuring the environmental factors to enhance the crop yielding [6]. The extensive usage of the internet in past few decades has bought many advantages to the human life .The major advantage is collection and processing of large data in real-time through the internet. In this circumstance, the IoT systems are better suitable for agricultural sector. They can control the parameter of the field and act accordingly by collecting the inputs from the sensor.

Cloud Computing

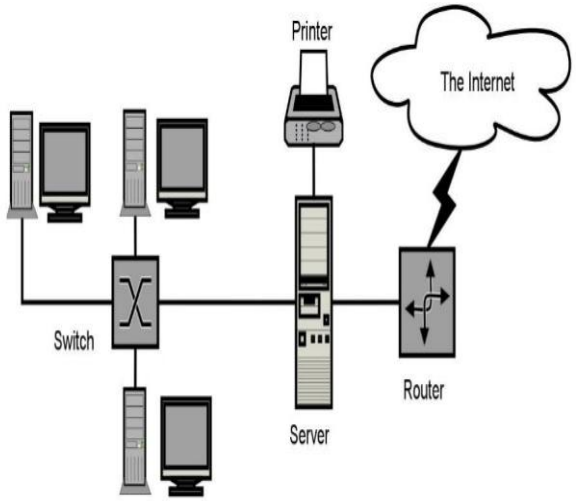

Fig.1 The basic architecture of the cloud computing

The basic working principle of the cloud computing is sharing of software and hardware related information to computers and all other equipment's when demanded through internet. [2]. Cloud computing defines an alternate method of addition, using and exchange of IT services which works on internet, which provides dynamic, expandable and real time resources by means of internet. It has the following features: Polling of resources, access of internet, fast elasticity, on-demand service and calculability. It provides the resource sharing in cheaper cost and offers the other services such as Software as a service(SaaS), Infrastructure as a Service(IaaS) and Platform as a Service(PaaS) in minimum cost. To the agricultural data , cloud computing can be used and for implementing the smart farming using the IOT .

There are many suppliers can pay for your data either transfers data through direct link or internet. The main problem with the direct link into the cloud makes the data uncontained, because the traffic was not online. Cloud computing is an efficient and simple technique for calculating the resources for accessing the data and programs from the central computer systems.

Internet of Things (IOT):

The basic architecture of the IoT is shown in figure 2, It consist of three different layers like, Data collection layer, Information exchange layer and Application layer. The data collection layer contains two-dimensional RFID tags and reader, code tags with readers, Sensors, cameras, GPS, sensor network and gateways, other related equipment's. The Information exchange layer works on IOT and communication skills like mobile communication, internet with a converged network formed by both, which contains information and management centres , cloud computing and expert systems. The integration of IOT with engineering knowledge , to achieve wider range of application by combining the intelligence technologies are carried out in the Application layer.

It contains different servers, the objective of these servers includes collection of data, transformation of data and analysis as per user requirements.

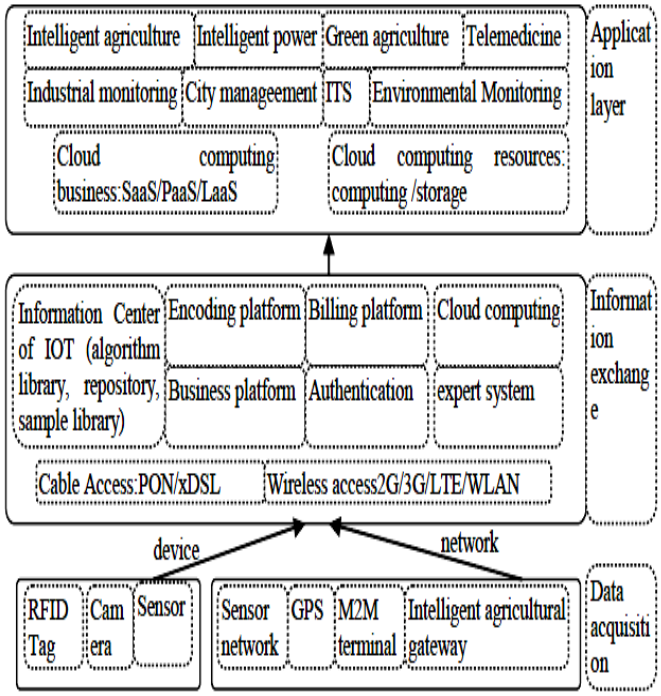

Fig .2 Architecture of the IOT for agriculture sector

The collections of the real time parameters like temperature, soil moisture and soil temperature are most critical for the agricultural production. The real-time data of the agricultural production can be acquired by use of IOT and GPRS, or by means of WEB, WAP and SMS.

The IOT aims at the target , construction of data in yield growing and carrying out systemic attention towards farm area ,yield pattern ,yield growing, the breakout, progress of agricultural damages ,yield output and so on. The monitoring system consist of wireless sensor network and distant monitoring data centre.

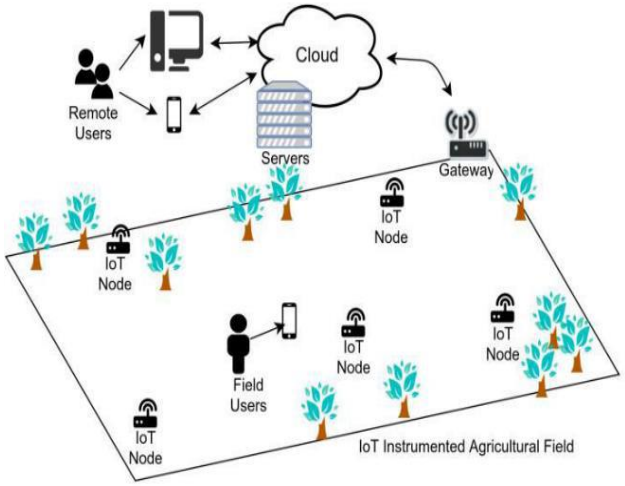

Fig.3 IOT based SMART farming

Zig Bee Sensor are placed at each node set to collect the information like air temperature ,moisture, soil temperature ,moisture and CO2 concentration and so on. The monitoring and control centre receive the data ,analyze the data . If there is any deviation in the data set beyond the set values, it makes alarming signal.

The mobile phones or remote computer can be used to read the real-time data set, monitor and control the environmental conditions of the agricultural farm [7-12].

In this paper present could computing application to IOT smart farming to predict the irrigation requirements of the field exploitation the parameters like soil temperature and wetness and climatic conditions together with the forecast information from the internet. The sensor placed at the nodes senses the soil wetness, soil temperature and UV light.

III. DESIGN

The parameter are defined as inputs to the software

1. Availability of fertilizers at the site, analysis of water required.
2. New nutrition solutions are defined as I
   A. Quantity of the mixture.
   B. Water sources and choice of the available fertilizers.
   C. Irrigation tank target
3. Calculating the mixture volume with water to dilute the excess nutrients.
4. Addition of missing nutrients.

In this paper hybrid machine learning has been used for prediction of the soil moisture and forthcoming day based on the past data. The sensor place at root of the plant gives the moisture to manage the crop production.

IV RESULTS AND DISCUSSIONS

First and second cycle of vegetable crop		
	First cycle	Second cycle
No.of plants	626	256
Plants per m^2	2.4	1.5
Total production	2056	2546
Fruit per plant	2.3	5.9

Table.1: Comparison of revenue generation of vegetable crops between first and second cycle

As seen from above observations, in the closed cycle the production and water saving has been improved in term of volume of water used for irrigation and the fruit per plant also increased by 89% from first and second cycle.

As seen from the results it can be concluded that the production levels has been improved sufficiently and at the same time the water usage is optimally maintained and the revenue generation is also increased.

V CONCLUSIONS

The IOT -based smart farming production system has been built to ensure the productive of the land remains constant on the long-standing wish of the future farmer. In order to protect the environment and address the societal problems and worrier for safe food. The agricultural production based on the IOT technique through software that works on GUI was designed. The quality of the agriculture products can be improved using the IOT technique because farmers can involve in the process cycle starting from the seeding to selling. The main advantage of IOT technology is the efficient quality of the product with minimum utilization of the resources. This make new era in the agricultural sector majorly like heavily populated country like India.

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