International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 03 | Mar-2018 www.irjet.net p-ISSN: 2395-0072

Smart Agriculture using Clustering and IOT

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Abstract - *This is the era of digitalization. So, digitalization also is required in agriculture. Cloud-based IoT(Internet of Things) services are getting popular. In this paper we are implementing IoT based services for the agricultural industry. The main aim of this paper is to collect data from multiple locations in a farm. This data will be available to the farmers via the cloud service. This data can be accessed through a mobile application. Not only providing data graphically, the mobile app will also provide numerous services beneficial for the farmers. This paper focuses on remote monitoring system for agricultural industry combined with some farmer friendly applications. The main aim is to collect the readings from multiple nodes and help the farmers handle various operations wirelessly providing a smart agricultural field for smart farmers.*

Key Words*: *Smart Agriculture, IOT, Clustering, Cloud based agriculture, Node

1.INTRODUCTION

Agriculture is the foundation of the Indian economy, the development of agricultural industry is good for the entire nation and this can help to improve economy steadily. Using IoT(Internet of Things) in the field of agriculture can boost the yield. The Indian farmers use traditional methods for farming. The use of IOT in farming will help increase the yield as well as beneficial for the farmers.

IOT:

IoT is a network of Internet enabled objects, web services interact with these objects. It is a technology where objects around us will be able to connect to each other in the system. The IoT will create a world where all the objects are connected to the Internet and communicate with each other with minimum human intervention to optimize use of resources to increase the quality of services offered to people and minimize the operational costs of the services.

In this paper IOT will be taken as a measure to help in the increase of yield of the crops. Here, the development of intelligence based systems for the farming sector has to concentrate. The system monitors and alerts based on IOT with real time monitoring environmental parameters, which, is aimed at monitoring and managing the growth of crops in the farm. It includes mobile inspection device, data receiving devices, data acquisition units, data storage servers. So, the system can automatically collect environmental parameters such as air temperature, air humidity and soil moisture, etc from the environment. It automatically judges the parameters and presents a graphical reading for the users to understand the requirement of the parameters. This will also enable the farmers to control the different devices using the mobile application.

2. LITERATURE SURVEY

Agriculture is the major source of income for the largest population in many countries and is major contributor to the country's economy. However technological involvement and its usability still have to be grown and cultivated for agro sector in India. Some initiatives have also been taken by the respective Governments by providing online and mobile messaging services to farmer related to agricultural queries, agro vendor information to farmers, it provides static data related to soil quality at each region. The system has not been implemented which can utilizes real time data of soil quality based on its current properties. Soil properties determine the quality of soil. Also health of soil can be maintained by applying only required amount of fertilizers with the help of real time monitoring. Soil moisture analysis helps to supply the water whenever necessary avoiding wastage of water. Also environmental conditions such as temperature and moisture also affect the crop production and crop diseases. In this respect we need a dynamic model which collects such real time data.To increase the production and ease the distribution of agricultural products all agriculture entities need to be connected to have decision making system from farmers to marketing agencies and from vendors to farmers. Such system will also be responsible for controlling other parameters like agro product rates.

3. CHALLENGES IN AGRICULTURE INDUSTRY

- Deficient production information.
- Less knowledge about the weather forcast.
- Not enough sales distribution information.
- Poor ICT(Information and Communication Technology) infrastructure and ICT illiteracy.
- Lack of awareness among farmers about the benefits of ICT in agriculture.
- Marketing research skills and research centre.
- Drastic changes in the climatic conditions
- Lack of interest in agriculture profession among young and educated professionals.
- High cost machineries for work.
- More manual work.
- Keeping a track of record manually.

4. PROPOSED SYSTEM

The proposed system is applying the concept of IOT in the agriculture field by using smart sensors to make agriculture field a smarter one. The basic aim of the project is to collect data from multiple nodes and to process this data. The farmers will be able to control the operations remotely through a mobile application as well as access the readings through a cloud.

The purpose of the system is to develop centralize monitoring and control for the agriculture land. This can be managed and functioned from any location wirelessly using a mobile device. The application user can control basic operations of collection of environmental, soil, fertilization, and irrigation data; automatically correlate such data and filter -out invalid data from the perspective of assessing crop performance; and compute crop forecasts and personalized crop recommendations for any particular farm using the application.

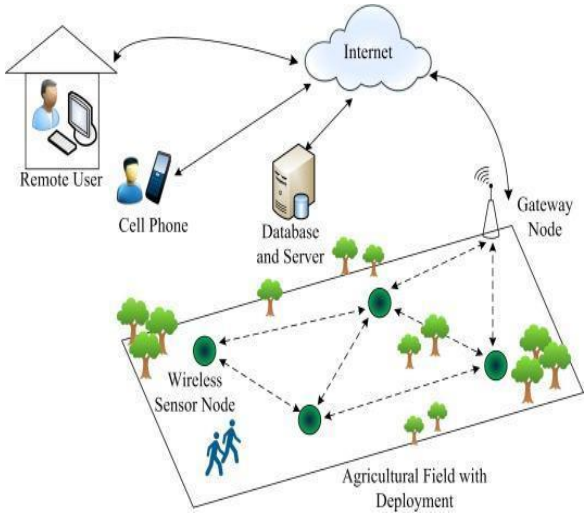

Fig. 1: Architecture Diagram of the Proposed System

System can integrate virtually any IoT device, including commercially available sensors, cameras, weather stations, etc. and can form a cluster of these devices which would make it flexible for a single user to cover a large area and store their data in the cloud for performance analysis and recommendations. End user can get all these details of the field on Smartphone by an application Smart Agro Services and can control the operations.

The sensor network is designed to get information about the climatic conditions of the farm such as Soil Moisture, Temperature, Light, and Humidity. With the help of this, system will decide the operations on the field.

A single farm can have multiple crops divided into fields. So each crop will have different parameters to be controlled. This, we need to have a cluster that will collect data separately. For this nodes are installed on various parts on the field depending upon the parameters. Each Node comprises of a microprocessor Raspberry Pi and a sensor connected to it. Sensors may be temperature and humidity sensor or soil moisture sensors. The soil moisture sensor being an analog sensor requires an ADC (Analog to Digital Converter). The data from sensor is in the analog form and need to be converted to digital form. Hence the raw data is supplied to ADC which in turns to digital. The digital data is in the form of voltage value and depending on voltage value the percentage of moisture in the soil is taken. The sensors are connected to Raspberry Pi. Raspberry Pi collects the data from the sensors of that node. There are multiple nodes that are placed around the field. Using the clustering technology the farmer can make accurate decisions like in which part of the field soil moisture has reduced and where to divert the irrigation system.As well as when to switch on and off the motor pumps and other devices for the parameters to be maintained.

Data from all these nodes is collected and transferred to a cloud. Here, we are using the cloud service as a storage database. The Data sent to the cloud is stored in the cloud database. Farmers can log in their respective accounts to view their history and the current data of each node.

The data from the cloud is given to the mobile application. With the help of the mobile application the farmers get ease to control various devices and record the readings from the sensors.

5. Smart Agro Mobile Application

The farmers are the end users of this application. This application will provide full wireless connectivity to the farmers for their farm.

The processed data from the cloud will be accessed by the farmers using this mobile application. The farmers will get a graphical representation of data as well for better understanding of the parameters.

With the help of this data analysis the farmers will be aware of the climatic conditions of the farm and accordingly will control the devices such as light and motor pump.

Each farmer will have its own account through which he can login using a unique username and password. New users can register using their email ID and create a new account.

The farmers will get the direct readings from the sensors for the node they have selected. Based on this they will also get an alert for which device should be switched on or off. The farmers can thus check for the readings and wirelessly control the devices for the field.

Apart from this the application also provides other beneficial services for the farmers as follows:

- Weather forecast: The application will provide time to time weather forecast for the farmers including the minimum and maximum temperature for the period, the humidity, wind pressure and chances for rainfall. This will well prepare the farmers for the climatic conditions and accordingly the crop parameters will be controlled.

- Agro calendar: The application provides the facility for the farmers to store in the events in the agro calendar. Events such as the date of seed sowing, harvesting, spraying pesticides, etc can be stored by the farmers. The agro calendar in change will generate notifications for the maturity of the events to occur.

- Notifications: The farmers will get app notifications for new updates regarding the weather changes. Also, notifications from the agro calendar regarding date of harvest, pesticides and fertilizers will be generated.
- Agro News: The application will also provide the latest news of agriculture and farming which again is to keep the farmers updated regarding the news.

- Multilingual: This application will be multilingual so that the local farmers can get total benefits of the services provided.

Fig.2: Environment details in app

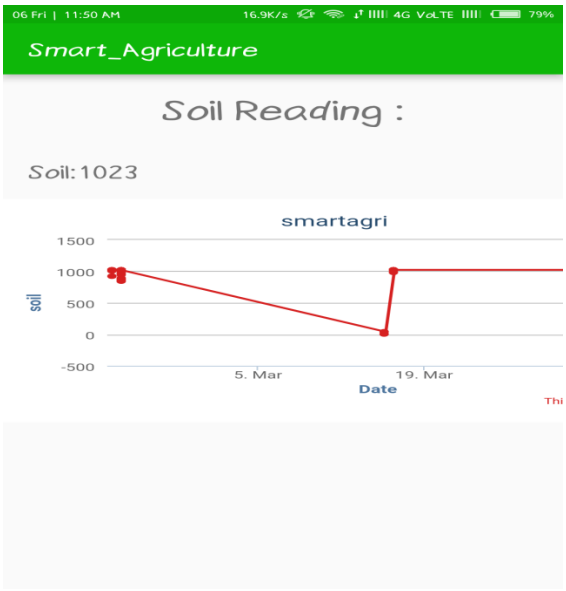

Fig.3: Soil moisture reading

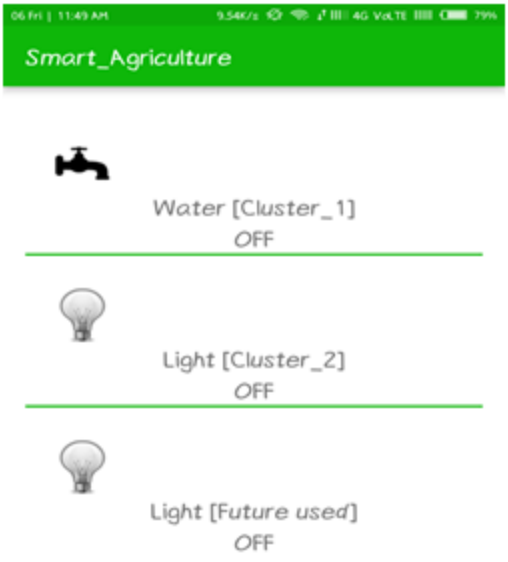

Fig.4: Device control panel

Fig.5:Applications

6. CONCLUSIONS

Through this paper we have made an attempt to lessen the manual work of the farmers and make them a smart farmer. We have implemented a system that will collect data from multiple nodes and using this sensor data the farmers will be able to control the operations on the agricultural field wirelessly and remotely anytime.

This system will be a service provided to the farmers for digitalizing agriculture. Future possible work on this system may include centralizing the data and providing services for each crop individually.

ACKNOWLEDGEMENT

We are very thankful to the staff of MET'S BKC Institute of Engineering for helping us with their views and supporting us. We are very thankful to our guide and H.O.D. Prof. N.R. Kale who guided us on the path of successfully completing this paper.

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