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Smart agriculture by monitoring moisture pH levels in soil

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ABSTRACT

Agriculture plays the major role in economics and survival of people in India. Even today, traditional methods and backward techniques are being used by different countries in the agriculture sector. In India, the agriculture technology is labor intensive, whereas the modern agriculture technology is mainly capital intensive. Production efficiency has been increased significantly with the technological advancement in agriculture. With the help of internet of things, a novel design approach to smart farming is framed that increases the productivity. IoT will play a major role in meeting this need. IoT when combined with cloud and big data, it can improve the efficient use of inputs like fertilizers, soil, and pesticides. It also helps in scanning storage capacities like water tanks, predicting related diseases, monitoring livestock, and making sure the crops are watered well. Farmers need a variety of data and services to improve crop production based on land, crop, climate conditions, finance availability, irrigation facilities etc.. Cloud computing has been used by Government and other private agencies to store agricultural data. Cloud support various services to farmers to interact with a cloud by using any cheaper ways like sensors, mobile devices, scanners etc.

Smart farming becomes an emerging concept, IoT sensors are capable of providing information about their respective agricultural fields. This proposed approach aims at making use of evolving technologies like IoT and smart agriculture using automation. The major factor that aids in improving the yield of efficient crops is by monitoring environmental factors. To monitor various agricultural activities like cutting, weeding and spraying, a remote-controlled vehicle is operated that works both in automatic and manual modes. A controller is mounted on this vehicle that monitors the temperature, soil condition, temperature and accordingly water is supplied to the field.

Keywords: *Agriculture, Wireless sensors, IoT.*

1. INTRODUCTION

Agriculture is the main source of food grains and raw materials that are essential for living. It had the less exposure to technology. Technologies like IOT, Big Data are revolutionizing the global agriculture industry. In this scenario, an internet of things system for agriculture is proving the latest technology within the industry. Indian agriculture sector is less exposed to the mechanism and technology. In India, the agriculture technology is labor intensive, whereas the modern are mainly capital intensive.IOT could play a crucial role in solving up to the problems like climate change, temperatures, rainfall, ground level. IoT will play a major role in meeting this need. IoT when combined with cloud and big data, it can improve the efficient use of inputs like fertilizers, soil, and pesticides. It also helps in scanning storage capacities like water tanks, predicting related diseases, monitoring livestock, and making sure the crops are watered well. Farmers need a variety of data and services to improve crop production based on land, crop, climate condition, finance availability, irrigation facilities. Cloud supports various services to farmers to interact with a cloud by using cheaper way like mobile devices and scanners.

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It describes how the data collected from sensors is processed and stored in the cloud and from the cloud the data will be made accessible to registered farm owners through their device in an understandable form. Also if the pH rate of soil is lower than the normal one, this application suggests the pesticides that are to be used to improve cultivation.

2. PROBLEM STATEMENT

Due to the present day Industrialization, High tech living of people and many other intentional or non-intentional deeds, atmosphere quality is reducing drastically at a much-unexpected rate. This is one of the reasons for the reduction of soil moisture. As the average temperature of Earth is increasing, which is termed as Global Warming, Soil becomes barren and crops cannot be cultivated. Along with this, Ph level of soil plays a main role in the effective growth of each and every crop. This is because the proper Ph level helps particular crop to be healthy. In this paper, we take care of the monitoring process for these two unforgettable aspects of farming.

As mentioned above, improper and insufficient knowledge of the parameters, Farmers keep using pesticides, growth chemicals to achieve greater crop production. But unfortunately, this even cause more damage to crop by reducing its quality. If consumed by a person, it will gradually show its impact on heath in long-term intake.

3. PROPOSED SYSTEM

In order to overcome the existing limitations in the agricultural monitoring system, using automatic machines the crop yield can be improved. For increasing the yield there is a need to implement technology and modern science in the agriculture field. Smart agriculture refers to, greenhouse automation, precision farming, and environment monitoring & control. The degree and extent of certain aspects of the environment are measured by farmers and researchers in various sectors. They can also be used for smart planting. Smart Sensors for forestry and agriculture play an important role today. There is a need for increasing the production and simultaneously the efforts for minimizing the impact on the environment and for saving cost. The use of sensors helps to efficiently us and exploit all available resources approximately so that hazardous pesticides can be used moderately. In farming methods, IoTs contribution is significantly increasing. Population growth and climate change made agriculture industry as one of the first industry to utilize the services of IoT. Agriculture modernization is achieved by combining traditional methods with latest technologies like the Internet of Things and Wireless Sensor Networks. Wireless Sensor Network collects the data from different types of sensors and sends it to the main server using wireless protocols. By using IoT and the integration of wireless sensors with agricultural mobile apps and cloud platforms we can expect the increase in production with low cost by monitoring the temperature and humidity monitoring, efficiency of the soil, fertilizers efficiency and impact on soil, rain fall monitoring, monitoring storage capacity of water tanks and also theft detection in agriculture areas.
The productivity is affected to great extent by many other factors. Factors include an attack of pests and insects which can be controlled by spraying the proper pesticides and insecticides and also the attack of birds and wild animals when the crop is up for harvesting. The crop yield is decreasing because of random monsoon showers, water scarceness, and inappropriate water usage. The application-based field or crop monitoring also lowers the difficulties in managing crops at multiple locations in same time. Farmers can now detect which areas have been fertilized if the land is too dry and estimate upcoming yields.

The main aim is to make agriculture smart using IoT and automation technologies. A remote-controlled robot that is fitted with GPS will perform the operations like spraying, weeding, moisture sensing. It includes irrigation with the smart control system and intelligent decision making established on smart warehouse management and precise real-time field data. It monitors humidity maintenance, temperature maintenance and theft detection in the warehouses. All the operations will be controlled by the smart device and it will be performed by ZigBee modules, camera, interfacing sensors and actuators with microcontroller and raspberry pi. All the sensors and microcontrollers are interfaced with three Nodes using wireless communication and raspberry pi. This proposed system gives information about irrigation problems, field activities and storage problems using remote-controlled robot for smart irrigation system and smart warehouse management system.

In Soil testing, the combination of IoT and cloud computing is very much familiar to applied with it.How means, with the global increase in population, the need for an increase in food production is raised. The Food and Agricultural Organization of the UN (FAO) survey predicted that increase in world population will further create poor circumstances in future with the simultaneous increase in the price of food products if proper measures will not be taken. This will result in starvation to the people who fall below the poverty line. Use of technology is constantly increasing to improve food production and commercial activities. Basically, IoT can be used to connect the objects of the world in both in an intelligent and sensory manner through combining technological development in sensors and wireless sensor networks, identification, Nano technology and embedded systems. Farmers need a variety of data and services to improve crop production based on land, crop, climate conditions, finance availability, irrigation facilities etc. Cloud computing is required in agriculture as on an individual basis it is not possible for farmers to deal with service providers. They need cost-effective service and comprehensive providers with various services. In this case, cloud computing may offer data as a service (DaaS), it costs less as compared to the fixed services which are charging on a fixed basis irrespective of utilization of service. Cloud computing provides sharing of resources at cheap cost. Cloud computing service provider may also offer services like Platform as a Service (PaaS), Infrastructure as a Service (IaaS) and Software as a Service (SaaS) with affordable cost. Cloud computing has been used for storage of agriculture records by Government and private agencies. Use of IOT along with Cloud Computing can help an IoT to Indian farmers to increase the production by providing the correct communication between objects

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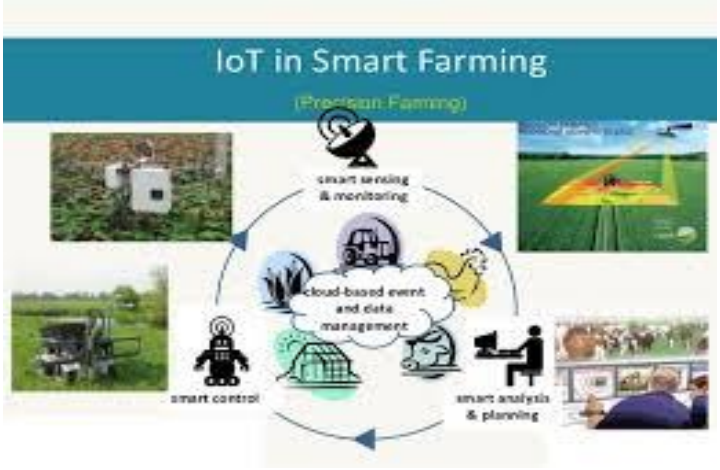

Fig: 1

4. SMART SYSTEM MONITORING ON SOIL

Monitoring of soil is very much important due to climate change affection. Monitoring the soil using IoT sensors in that, by using the same current soils pH rate, Water, temperature level can be supervised using the wireless sensors. Soil can monitor their temperature and pH rate regularly.The supervised report of their farming land can access this information from their mobiles via a wireless network and can check their pH rate at their own time. If they notice abnormalities in the data that is received, they can instantaneously notice their land and use pesticides to overcome these abnormalities. The remote monitoring of the soil temperature rate and Ph rate has been done at the very nominal cost. The values can be observed by the farmer anywhere in the world at their own time. Hence this system gives more accurate temperature and pH rate of the soil which play a vigorous role in the agriculture. The Humidity sensor, soil moisture sensor, and temperature sensor can be interfaced to the microcontroller to calculate any further data. A reliable and continuous vital sign monitoring system targeted towards the each farmer's land has been successfully built. The resulting system was also low in power and cost, provisional real-time monitoring and noninvasive on the agriculture. It is also easy to use and provide accurate measurements. Gather data from, humidity, pH and temperature sensors at regular intervals with a microcontroller and forward that data via a Wi-Fi connection to the database residing on the cloud. On the cloud platform, a server-side application will then crunch the stored values to provide a customized feedback personalized to each user via a web.

5. SOIL TESTING

There are three different methods has been carried to test the soil, they are moisture test, respiration test, and bulk density test.Soil moisture test is to be performed first because it plays a key role in the exchange of heat energy and water between the land surface and the atmosphere, plant transpiration through evaporation. By considering the soil moisture test results we can perform the further tests like soil respiration test. Soil breathes is an indicator of biological activity of soil life. This activity is as significant to the soil ecosystem as healthy lungs are to us. However, more activity is not always better; it may indicate an unstable system for efficient sampling, the soil respiration test is performed. The best time to run the soil respiration test is when soil moisture is at field capacity. The bulk density measurement of testing should be performed at the soil surface in a compacted zone. Measure the bulk density near the site of the respiration tests. Bulk density is the weight of soil for a given volume. The greater the density, the less pore space for root growth, water movement, seedling germination, and penetration. After the completion of the three tests on the soil, the results obtained by them are used to decide which crop is suitable for that particular soil. This can be done by using decision tree algorithms. After sowing the seeds it regularly checks the soil moisture levels and if moisture levels decrease we need to supply fresh water to the field in required quantity. If water is not supplied to the field the moisture levels of the soil decrease, due to this seed germination cannot be done properly.

6. SMART FARMING-IOT AND MOBILE CLOUD

As we all know, smart agriculture solution refers to greenhouse automation, precision farming, and environment monitoring & control. In many sectors, farmers, greenhouse owners, and researchers need to measure the extent and degree of certain aspects of the environment. They can also be used on smart planting. Smart Sensors for forestry and agriculture play an important role in agricultural sector today. The need for increase in the production and concurrently the efforts for minimizing the environmental impact and for saving costs make the wireless sensor systems be the best allied tool. The use of sensors in agriculture sector helps the farmers to exploit all available resources appropriately and to apply hazardous products moderately. This gets better when nutrients in the soil, humidity, solar radiation, density of weeds and all factors affecting the production are known.

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7. CONCLUSION

In this paper we obtained a survey about the applications of IoT and cloud in soil testing and soil monitoring in smart agricultural system. In addition to that how the smart planting is the put into action based on integrating IoT abilities especially with the mobile cloud services to achieve a feasible and scalable industrial system. The embedded technology helps in obtaining the nature of the soil by extracting the behavioral content of the soil using different sensors. This system reduces the farmer's difficulty in finding the right crop for their field. It provides the suggestion for the farmer to cultivate suitable crop for the land by analyzing the data provided by the sensors. The field manager will optimize the sensor values using defined threshold values for calculation. The crop images are taken and monitored in order to protect the crop from insects and other animals that destroy farm, so the farmer can monitor and increase the yield of crop from anywhere at any time using the application. The proposed system helps in increasing the agricultural production and reduces the money and time of the farmer.

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