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IoT Based Smart Agriculture System

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Abstract
Smart Agriculture system is an aborning topic in this materialistic world. This paper describes the concept of featuring and elasting an agriculture platform to the internet world. Agriculture is the most important of human life so it can be improvised by using IoT technology. IoT technology gives a grasp to enhance the power of automation systems in agriculture. Smart agriculture System that uses the advantages of cutting-edge technologies such as Arduino and Wireless Sensor Network. This paper proposes the concept and features of the sensor world in the internet of things for agriculture which is used to enhance the production of crops. The Agriculture stick being proposed through this paper is integrating with Arduino Technology, Breadboard and mixed with different various sensors and live data feed can be obtained online through mobile phone. India Monitoring environmental conditions are the major factor to improve the yield of efficient crops. The feature of this paper includes the development of a system that can monitor temperature, humidity, moisture, and even the movement of animals which may destroy the crops in agricultural fields through sensors using Arduino board. With its energy autonomy and low cost, the system has the potential to be useful in water-limited geographically isolated areas.

Keywords: *Soil moisture sensor, Temperature sensor, Concept of smart agriculture, IoT*

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I. INTRODUCTION

In this paper, we develop a smart agriculture system with the concept of the internet of things. Technology maintains the conceptual thinking of a farmer to smart agro-business which performs the path to the next era of soft computing. One of the main areas where IOT based research is going on and new products are launching on an everyday basis to make the activities smarter and efficient towards better production is in the field of Agriculture. Automation must be implemented in agriculture to overcome these problems. So, to provide a solution to all such problems, it is necessary to develop an integrated system that will take care of all factors affecting productivity at every stage. The product will assist farmers with live data (temperature, humidity, soil moisture, UV index, IR) from the farm so that the necessary steps can be taken to enable them to farm wisely by increasing their storage yields and saving resources (water, fertilizer). This paper describes the concept of the internet of things which deals with the automation of systems and further describes smart agriculture. Hence, automation must be implemented in agriculture to overcome these problems. So, to provide a solution to all such problems, it is necessary to develop an integrated system that will take care of all factors affecting productivity at every stage. But complete automation in agriculture is not achieved due to various issues. Though it is implemented at the research level and it is not given to the farmers as a product to get benefited from the resources. Hence this paper deals with developing smart agriculture using IoT Devices that can be used by farmers. Agriculture is considered the basis of the types of people as it is a basic source of food grains and so on still utilize the customary techniques for cultivating which results in low yielding of harvests and natural products. Be that as it may, wherever computerization had been executed and individuals had been supplanted via programmed hardware, the yield has been improved. Subsequently, there is have to execute present-day science and innovation in the farming area for expanding the yield. The majority of the papers imply the utilization of remote sensor organize which gathers the information from various sorts of sensors and afterward send it to the fundamental server utilizing remote convention

II. CONCEPT OF INTERNET OF THINGS IN AGRICULTURE

Using the Internet of Things in agriculture is undeniably the smartest way to feed humanity. But IoT promises even more. It's one of the few realistic ways to sustainably feed a growing population. IoT enhances crop monitoring and produces crops on the maximum power of implant. The impact of the Internet of Things (IoT) and connected devices in this modern-day world is undeniable. Today it has reached almost everywhere, from home to the health sector, smart cities, fitness, to the industrial sector. Its presence can be seen in most

industries, and the domain of agriculture is no different. IoT and connected devices can have an incredible impact on farming practices, so the farmers would no longer need to rely on horses and bullocks. IoT is much popular as consumer-connected devices, the market is yet very dynamic. The role of IoT in farming indulges the factor of high production from a lower rate to a higher rate and becomes a consequence for good farming. About 75% production of crops maintains accomplishments for the profits for farmers in the delicate of technology. Integration of Internet of Things technology in agricultural operations minimizes the requirement for manual labor with automation, accelerates machinery commands with remote & real-time monitoring, and at the same time, it allows the farmers to utilize resources much efficiently with precautionary maintenance & environmental prediction. Once these advancements are implemented in the agriculture sector, they are certain to scale up the revenues and will also enable the farmers to manage more acreage. Smart Agricultural Technology enables the farmers to have better control over the process of growing crops and rearing livestock. This way it brings massive efficiencies of scale, cuts costs, and helps in saving scarce resources, like water. Farmers and growers can reduce the waste and increase the productivity that ranges from the quantity of fertilizer utilized to the number of journeys made by farm vehicles. An IoT solution for farming and agricultural purposes, it gets essential to choose sensors for the device. This ultimately depends on the type of information that you are looking to collect and what you desire to do with the collected data. Ensure that the sensors' quality is great as that is vital for the success of your IoT solution. After all, success depends on the collected data's accuracy and reliability.

III. SYSTEM OVERVIEW

The system of smart agriculture consists of different nodes which are node1, node2, node3, and node4. They are the monitoring system that provides accurate information on their crops to farmers. In the current framework, each hub is equipped with more diverse sensors, gadgets and is connected to a single focus server using remote communication modules. The server sends and receives data from the end of the client using the web network. Arduino IDE is an open-source software program that allows users to write and upload code within a real-time work environment and upload it to the board. As this code will thereafter be stored within the cloud, it is often utilized by those who have been searching for an extra level of redundancy. The Environment is written in Java and based on Processing and other open-source software. The system is fully compatible with any Arduino software board.

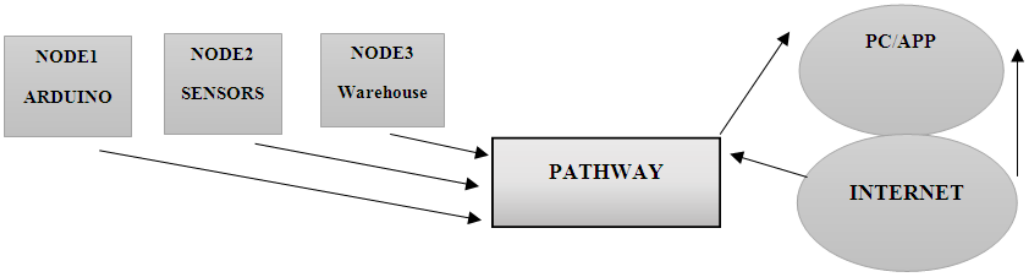

Figure 1 Description

IV. ANALYSIS OF SMART AGRICULTURE

For development in the future, it can be enhanced by developing this system for large acres of land. Also, the system can be integrated to check the quality of the soil and the growth of the crop in each soil. The sensors and microcontroller are successfully interfaced and wireless communication is achieved between various nodes. Future work also includes focusing more on increasing sensors on this stick to fetch more data especially concerning Pest Control and by also integrating GPS modules in this IOT Stick to enhance this Agriculture IOT Technology to a full-fledged Agriculture Precision ready product. As they speak, the number of companies that will help empower their IoT (Internet of Things) ideas. And as a result, we hear of new ideas and solutions that are already solving business challenges through M2M (Machine to Machine) communications. In a recent post, we discussed some of our favorite IoT industrial applications. Measuring soil moisture is important in agriculture to help farmers manage their irrigation systems more efficiently. Not only are farmers able to generally use less water to grow a crop, but they can also increase yields and the quality of the crop by better management of soil moisture during critical plant growth stages.

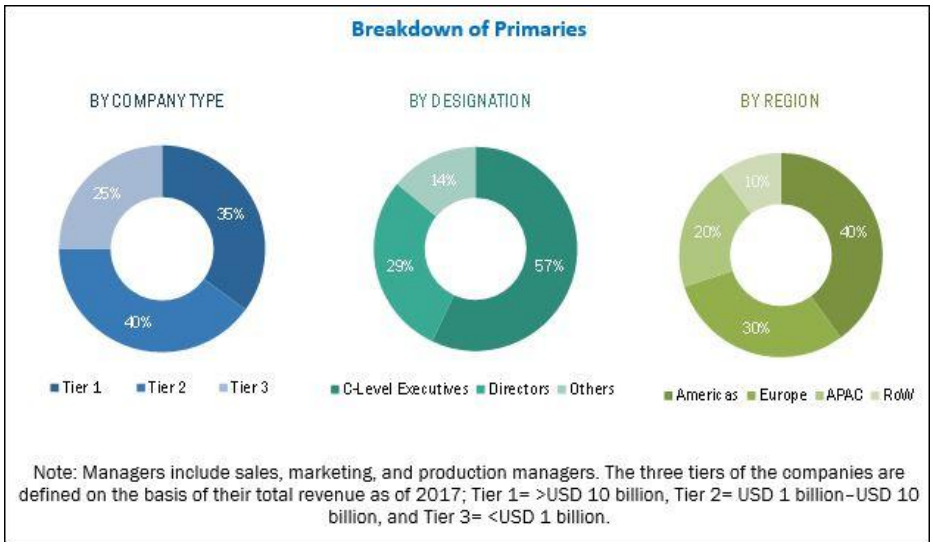

Figure 2 Analysis of marketing in Smart Agriculture

V. METHODOLOGY

The basic building blocks of an IoT System are Sensors, Processors, and applications. So the block diagram below is the proposed model of our project which shows the interconnection of these blocks. The sensors are interfaced with Microcontroller, data from the sensor is displayed on the mobile app of the user. A mobile app provides an access to continuous data from sensors and accordingly helps the farmer to take action to fulfill the requirements of the soil. Farming is a labor-intensive task that requires lots of time and effort. Usually, these tasks are repetitive and monotonous. Farmers can delegate these labor-intensive tasks to robotics and automation-based solutions. Such solutions can perform tasks that range from seeding and watering to harvesting and sorting.

Eventually, this technology integration would result in higher productivity with minimal resource wastage.

Robotic Machinery also helps in supporting farm machinery. It is useful for sowing, harvesting, and other services and helps in avoiding human errors. Farms can utilize robotic systems for pesticide spraying, harvesting, cultivating, and other such activities.

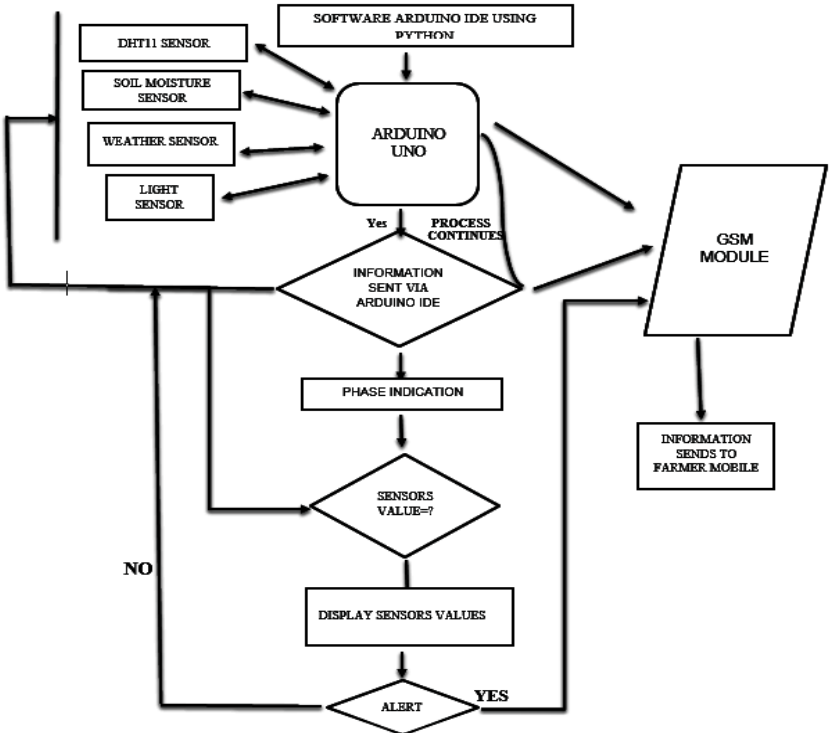

Figure 3 Data flow diagram

VI. BENEFITS

IoT enables easy collection and management of large amounts of data collected from used sensors with the help of joining experimental distribution such as cloud storage, agricultural field maps, and other details that can found anywhere and everywhere that enables live monitoring and end-to-end connections. IoT is considered an important part of clever farming because by accurately using sensors and smart gadgets, farmers can increase production by 72% by the year 2050 as described by experts. With the use of IoT creations, the costs can be reduced to a dramatic level that will increase productivity and survival. With the use of Io efficiency, it will be greatly increased until water, soil, fertilizer, pesticides, etc. are used.
Here are some points:

- **Efficiency:-** IOT-enabled agriculture allows farmers to monitor their products and conditions in real-time. They get insights fast, can predict issues before they happen, and make informed decisions on how to avoid them. Additionally, IoT solutions in agriculture introduce automation, for example, demand-based irrigation, fertilizing, and robot harvesting.

- **Expansion:-** By the time we have 9 billion people on the planet, 70% of them will live in urban areas. IoT-based greenhouses and hydroponic systems enable short food supply chains and should be able to feed the people. Smart closed-cycle agricultural systems allow growing food everywhere—in supermarkets, on skyscrapers' walls and rooftops, in shipping containers, and, of course, in the comfort of everyone's home.

- **Reduced resources:-** Plenty of IoT solutions are focused on optimizing the use of resources—water, energy, land. Precision farming using IoT relies on the data collected from diverse sensors in the field which helps farmers accurately allocate just enough resources within one plant.

- **Clean process:-** Not only do IOT-based systems for precision farming help producers save water and energy and, thus, make farming greener, but also significantly scale down on the use of pesticides and fertilizer. This approach allows getting a cleaner and more organic final product compared to traditional agricultural methods.

- **Agility:-** One of the benefits of using IoT in agriculture is the increased agility of the processes. Thanks to real-time monitoring and prediction systems, farmers can quickly respond to any significant change in weather, humidity, air quality as well as the health of each crop or soil in the field. In the conditions of extreme weather changes, new capabilities help agriculture professionals save the crops.

- **Improved product quality:-** Data-driven agriculture helps both grow more and better products. Using soil and crop sensors, aerial drone monitoring, and farm mapping, farmers better understand detailed dependencies between the conditions and the quality of the crops. Using connected systems, they can recreate the best conditions and increase the nutritional value of the products.

VII. CONCLUSION

Smart Farming IOT Based Agriculture Stick for Live Monitoring of Temperature and Soil Moisture has been proposed using Node MCU Chip, Wifi Module, and various other Hardware Devices. The stick has high efficiency and accuracy in fetching the live data of temperature, humidity, and soil moisture. The IoT-based Agriculture stick being developed through this paper will help farmers in increasing the agriculture yield and take efficient care of food production as the stick will always provide a helping hand to farmers for getting accurate live feed of environmental temperature and soil moisture with accurate results. With the help of these systems, various problems faced by farmers in daily life are being solved to a greater extent. Therefore, this system avoids excessive irrigation, under irrigation, soil erosion, and reduces water wastage. The main advantage is that the action of the system can be changed depending on the situation (plants, climate, soil, etc.). Through this program, agriculture, agricultural fields, parks, gardens, golf courses can be measured. Therefore, this program is cheaper and more efficient compared to other types of automation systems. For larger applications, higher sensitivity can be performed in large areas of agricultural land. A soil moisture level monitoring system was developed and the project provided an opportunity to study existing systems, as well as their features and constraints. The proposed system can be used to turn off / off the water spray according to soil moisture levels thus making the irrigation process one of the most time-consuming agricultural activities. Agriculture is one of the biggest uses of water.

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