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Review Article

REVIEW OF INTERNET OF THINGS TOWARDS SUSTAINABLE DEVELOPMENT IN AGRICULTURE

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Abstract
Agriculture is back bone of world's economy and human life to survive. Agricultural Industry has more or less remained dependent on conventional methods of farming. The farming conditions have changed significantly over last few decades. Soil Fertility, Amount of Water for Irrigation and other resources have become scarcer but the global population has increased immensely. This calls in need for implementation of better farming methods like precision farming which increase the overall yield. In recent years there had a gradual increase in the usage of such systems. WSNs tell us about some problems like interoperability, communications, scalability and connectivity. The main aim for precision farming (PA) is to increase the farming production by concerning climate, water quality, terrain, weather and crop status. In recent years farmers are using information systems for the improvement of crop management and to increase productivity. This leads to create a platform for managing farm activities and to improve biodiversity and to reduce the usage of water. Such new invention should be made to enhance and develop the farming. This paper analyses and reveals how IoT can lay a strong foundation towards sustainable development in agriculture.

Keywords: Conductivity Sensor, Green House, Pest Monitoring, Sensors Modules, Precision Agriculture.

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INTRODUCTION

In today's world as IOT has become a boon for the society for people and country which is helping in the all-round development in various sectors one of which is agriculture or farming sector , where farming in done with the help of various sensors machine such as drone which is also known as smart farming .the arrival of farming has made the work of the farmers easy and also increased the production of the lands .various msn sensors are used to have the control over the irrigation and also to keep watch over the crops. Due to combination of IOT with the agriculture systems can help the country to grow rapidly in the economic value and can be self-dependent in terms of food products and farms , which can also help in the development.it can also help in feeding the poor in i's own country and also across theworld.it can also increase the net G.D.P of the country and also can help the people in the various hazards or food crisis .Temperature, humidity, intensity level, and soil wet may be monitored through numerous sensors. These will then be joined to systems to trigger alerts or automatize processes like water and air management. They will even be created to seem for early signs of pests or malady. The use of drip irrigation system for wetting plants eliminates waste of water and fertilizers. Sensors area unit won't to discover the wet and nutrient deficiencies of plant and soil whereas the correct amount is allowed to drop wherever it's required. As such, below or over watering is eliminated. {this will|this will|this could|this may} be aforesaid to be exactness agriculture and it can cause nice harvest even in dry /drought periods of the year. Crops that area unit naturally untouchable in time of year may be without delay created bumper through this implies. IoT technologies facilitate the pursuit of farm product from farm to fork, hence, all people concerned in production, process and transportation area unit fortified with necessary data to discharge their duties. In Nigeria, most of the farm produces aren't perpetually accessible in industrial amount particle an area at a given time. Hence, patrons or middlemen go around seeing farmers that area unit able to sell their produces at a given time and that they get from them in bits. Transporting these products is additionally an enormous challenge in Federal Republic of Nigeria, because of the very fact that they're purchased in bits; the manufacture typically might not extra service a lorry. However, with the arrival of IoT, the transporter may be radio-controlled to others within the neighbourhood in would like of this service. Also, good phones may be equipped with package that may change internet/mobile banking for each farmers and patrons to encourage cashless transactions. Weather may be a preponderant issue to be thought-about in crop and animal agriculture.Hence, prediction and watching should beaccurately foreseen therefore on do production activities to time for ultimate improved productivity. Animal agriculture is additionally affected negatively by harsh weather; in terms of copy, performance and production. Thus, foretelling and watching of weather things empower the farmer with data that may guide them in planting, gathering and alternative production activities to be dole out. Also, policy manufacturers may be fortified with data that may guide their choices correctly.

IoT is starting to slowly take over the world. It has numerous applications, but it is contribution towards agriculture is the most. The population of the world is estimated to be 9.5 billion by the year 2050. To feed such a large population, it is necessary for us to use IoT in farming. With the use of IoT, we can do several wonders in the field of agriculture. It can be used to find whether all the livestock have returned to their shelters or not. It can also check on its health. Precision farming can be done easily with IoT as it can sense the soil moisture and reduce the water

usage. It can also forecast the weather, therefore making it easy for the farmers to know exactly when to plant and yield their crops. Coming to how it helps India, as the government is ready to make technological advancements in villages first. Therefore, as most of the agricultural activities happen in rural areas it is best for them. Simple systems like checking soil moisture and predicting weather forecast itself can make a large impact on the agricultural development.

Advantage 1: High productivity
IoT devices will increase the production in agriculture. Farmers place IoT devices all over the field. They can monitor better. As a result, more production. The practice of precision agriculture has been enabled by the advent of GPS and GNSS.

Advantage 2: Smart farming
Smart farming is done by placing IoT devices and gather data in agricultural farms. Using soil maps, farmers can pursue two strategies to adjust field inputs:
Predictive approach: based on analysis of static indicators (soil, resistivity, field history, etc.) during the crop cycle.

Advantage 3: Smart management
Farmers can create smart management system by placing IoT devices. This is a very big advantage of IoT in agriculture. As a result, this can help farmers think less about stock management. We can offer IoT intelligence at three levels: IoT devices, Edge/Fog nodes, and Cloud computing. The need for intelligent control and decision at each level depends on the time sensitiveness of the IoT application.

Advantage 4: Time saving
As we have discussed earlier, famers can manage inventory easily. It saves a lot of time.

Advantage 5: Better monitoring
Weather monitoring is easy using IoT. So farmers are less worried about their crops.

LITERARY SURVEY
Gill, S. S., Chana, I., & Buyya, R. (2017). IoT in India can revolutionize the future of India's economy. As our country has such a large population, it is necessary for us to grow crops at a larger rate if we don't want to have hunger problems in the future. The lacks of knowledge of the farmers are the only drawback. It is difficult for an uneducated person to use IoT efficiently. Therefore these products should be made more simple for them so them they can also understand their working and use them properly. In India the farms are fragmented, so it not required for them to actually use IoT. For now, it is not as effective to the Indian farmers as how much it is effective to the farmers abroad. There, most farms have started to use one of the applications at least. The applications are good but a little development to make it cheaper and easier to use would make it expand exponentially in Indian farms.

TongKe, F. (2013) Since China has become a leading user of IoT in agriculture, it is good for developing countries like us to start and learn the various processes from them. Their economic development has increased rapidly due to this. There are some flaws as well. They focus too much on the hardware and they forget about the software. Since most farmers are poor, they are satisfied with the hardware that they get and they don't worry about the software. There is another matter to be discussed. Most farmers in India have farms which are small compared to that of the farms present in the foreign countries. As IoT helps mainly the big farms, it is not advisable for the small farmers to use them. Therefore, it would be better if these farmers unite and use IoT on the whole for all their farms together.

Khairoowala, Z. U. (1987). Now coming to the uses of IoT in agriculture. Mostly people think it reduces labour. That is a part of its use but it is not the main use. Almost the same amount of labour is required to do agriculture with IoT. Actually, it requires more educated people to operate these complex systems. In villages in India, many farmers are not educated and therefore it is hard for them to use the technological advancements of today's world. The main uses of these systems are for monitoring and for controlling various action. As the farms are big, it is difficult for a farmer to go to various parts if the farm to observe his plants or animals. With IoT it is not an issue. Cameras and sensors can observe this and constantly send information to the farmer about the status of the animals and plants. The shelters of the domestic animals have sensors which tells the farmer whether the animal is there in it or not and even the time in which the animal has returned after grazing.

Shirode, M., et.al. (2018) Checking the water quality is a major use of IoT in agriculture. Many plants die due to the pollution of water so it is necessary that we use good quality water. Several sensors are used in the water quality detection device. Some of them are the turbidity sensor, the temperature sensor, electric conductivity sensor and the pH sensor. pH sensor measures the pH level of water and makes sure it doesn't become acidic or basic. Conductivity sensor measures the conductivity while the turbidity sensors measure the amount of the suspended particles found in that water. All these sensors not only read the information and give it to the farmer it can also change the values sometimes. Like for example the temperature sensors not only finds the temperature of water, but it can also change the temperature to the desired value. This water monitoring system is very cheap and it is affordable even for the poor.

Na, A., Isaac, W., et.al. (2016). After water comes the soil. The soil monitoring or the soil testing is a process in which these devices test the quality of the soil. As different plants require different soil content it is necessary for us to know the soil content before we plant a particular plant. There are three tests which are taken for the test soil. One is the soil moisture content and the ability of the soil to retain moisture in it. This is very much required as the moisture content in the soil is the main factor for transpiration and respiration. The second measurement is the bulk density measurement. Density is the ratio between mass and volume. Here also it is the same. The density of the soil is very much required as it affects the seed germination and root penetration process. It is also related to the absorption capacity of the water. After this comes the respiration test where they find the gases present in the pores of the soil. As the plants breathe it is necessary to know about the compounds it is breathing as well.

Rawal, S. (2017) Coming to the next use the irrigation process. Plants require water at certain intervals. Especially different plants require water at various intervals. Though the farmer can remember the intervals it is hard to keep watering them at that particular time. With the help of IoT, it is not at all a issue. This is the most widely use application in agriculture. There is a network of sprinklers or dripping systems connected to a main device. There are sensors kept for each plant as well. Once the moisture content in the soil of a particular plant goes below the programmed level, the dripping system is turned on automatically and the plant receives sufficient water. With this machine, the process of watering the plants can be forgotten. This can be semi-automated or fully automated as well. Fully automated is not recommended as it does not read the weather conditions. If a rain is going to come and the soil is dry, it will still give water. To avoid such wastages, semi-automated is better.

Akkaş, M. A., & Sokullu, R. (2017) Altering the temperature with IoT in green houses is a minor use. It works on a simple principle like how the smart AC's work. Sensors are kept on the outer part of the green house. According to the outer temperature and humidity, the temperature inside can be altered and therefore making it suitable for the plants to sustain.

Shi, Y., et.al. (2015). Scientific disease and pest monitoring is the most advanced use of IoT in the agricultural in industry. Pest monitoring cannot be done for all the plants in the farm as it is not feasible. The pest monitors can be kept for a group of plants or for one plant for a particular species. This detector is very specially designed and it is very costly as well. Once the device detects that the plant is affected, it immediately send out a signal. So it is very easy for the farmers to find and cure them as it would be in the early stages. Some devices even spray chemicals on the plants when they detect pests, but they are so expensive that it costs more than what the plants yield. This field needs more development and certainly the cost of such devices needs to come down to be available for a common man.

Ntafis, V., et.al. (2008) Monitoring of animals is a tiring task for the old farmers. They have to sacrifice their time while the animals are feeding on grass. The future is not going to be like that. Animals are going to go grazing on their own without human guidance. This is possible with the help of IoT. Firstly the doors of the animal shelters can be controlled through the internet and therefore the farmer can open the gate whenever he wants. Then the animals are fitted with a tracking device which lets the farmer know where his cattle is exactly grazing. There are sensors kept in the sheds so that it is easy to find whether all the animals have returned or not. Some counters are also used to keep count of the cattle. Most domestic animals cause loss to their owners because they die early due to several diseases. To avoid this, same like what they use for the plants to monitor the pests, they use devices which can detect the diseases which are going to affect a particular cow or goat. So, it can easily be cured in the early stage itself. Farm machinery can be controlled through IoT. All the machines are controlled with IoT. Machines like tractor, hog oil, reaper, winnowing machine, drag harrow and threshing machine. All these machines can be controlled through the internet, but these are too costly even for a middle-class man to buy. These machines are automated only in super farms. So, it is not applicable to use them. This can reduce man labour.

Mohanraj, I., et.al. (2016) Horticulture part in India is reducing step by step which influences the creation limit of biological system. There is an urgent need to take care of the issue in the area to re-establish dynamic quality and make it work on advanced improvements. This research suggests an e-Agriculture Application reliant on the assembly embracing of Knowledge base and monitoring modules-KM. To obtain on lucrative selections, planters need the complete data collected throughout the complete cultivating cycle. The required data is self-indulgent in diverse spots that integrate the ongoing data. To be very precis, the data should have the advertise costs and existing generation potential details together with the manageable vital harvest evidence. An information dataflow model is established, correlating altered disseminated cradles to the revenue structures. Our world is in the process of being mechanized supplanting labour-intensive methodology with the progression of innovation, as it is vitality proficient and engage negligible labor. The study also proposes the upsides of using ICT in rural division of India that demonstrates rustic ranchers the way to supplant a portion of the regular methods model of the system is completed utilizing TI CC3200 Launch pad interconnected sensors modules with other important electronic gadgets. A relative report is made between the created framework and the current frameworks. The framework defeats impediments of customary horticultural strategies by using water asset effectively and furthermore lessening work cost.

Lerdsuwan, P., & Phunchongharn, P. (2017, March). The development of Agricultural Industry in Southeast Asia is very crucial. There is a very strong need to collect data, perform analysis on this data and then apply this analysis to perform precision agriculture so as to increase crop productivity. In order to make this IoT system reliant sensors capturing the data should be able to adapt to new/ different environmental conditions without affecting the data they are collecting. The system should be able to compress and transmit this data using algorithms so as to minimise the packet drop and energy usage. Data-collection framework to increase energy efficiency includes the following methods- listening mode, collecting data mode, transmitting data mode, sleep mode and idle mode. All these modes work in a closed cycle one by one so as to reduce the energy consumption of the IoT system.

Reddy, S. A., et.al. (2018) the important thing for crop farming is water irrigation. This project aims at developing an automatic irrigation structure using sensors, with Internet we can remotely control the system using a Android smart phone or any computer device. So that the agriculture lands are irrigated automatically, without any physical presence of human. Smart irrigation for agriculture using IOT provides a solution for the old people and physically challenged people to do farming. The smart agriculture is to provide higher productivity and better resource when we compared to traditional methods which gives low results. It plays an important role in identifying the temperature according to their weather report. Data about their agriculture fields and weather report are provided by IOT sensors. Environmental conditions, which are the major factor to increase the fields of their crops and productivity, will be implemented by using IOT. IOT is the network of physical devices which interconnects the information sensing devices such as sensors etc. It exchanges the information and communicates through the wireless or wired network. The sensors collect the information on temperature, soil moisture, humidity etc. Our aim is to supply the water using IOT when the farm is dry and to remove the excess of water content. We use the sensors in IOT based smart irrigation. Sensors collects the information on temperature, soil moisture, humidity etc. and sends to the gateway. The Gateway sends the information to the smart phone or computer devices whether to supply the water when the land is dry or to observe the water when the land is of superfluous of water, Sensors controls the water management system. To avoid the entrance of other unfamiliar constituents than water, the pipes are fitted with filters.

Dlodlo, N., & Kalezhi, J. (2015) Most of the references in the domain of greenhouse horticulture deal with monitoring and control of the greenhouse climate using advanced sensors for e.g. temperature, humidity, ventilation and irrigation. Similar to other domains, applications for livestock farming are focusing on precision livestock farming, that includes monitoring, early warning systems and control. Several references pay particular attention to animal welfare. Open air horticulture focuses on monitoring & control of products. Other themes like early warning and pest management, traceability, expert systems and internet trading, micro-irrigation and Big Data. From the applications in the areas above several generic themes are found, in particular precision farming in arable- livestock farming and horticulture, food traceability, food safety and quality management and consumer interaction.

FINDINGS

IoT has many uses. Usually much technological advancement has some side effects but this one doesn't have any. Its applications are numerous and every day it's increasing. Mostly people think it reduces labour. That is a part of its use but it is not the main use. Almost the same amount of labour is required to do agriculture with IoT. Actually, it requires more educated people to operate these complex systems. In villages in India, many farmers are not educated and therefore it is hard for them to use the technological advancements of today's world. The main uses of these systems are for monitoring and for controlling various action. Checking the water quality is a major use of IoT in agriculture. Many plants die due to the pollution of water so it is necessary that we use good quality water. After water comes the soil. The soil monitoring or the soil testing is a process in which

these devices test the quality of the soil. Coming to the next use the irrigation process, plants require water at certain intervals. Especially different plants require water at various intervals. Scientific disease and pest monitoring is the most advanced use of IoT in the agricultural in industry. Farm machinery can be controlled through IoT. IoT has started to change the approach towards agriculture, making it much simpler and much easier to use. Almost all the problems faced by the farmer can easily be rectified with the IoT system and therefore making farming an exciting task.

Some of the reports are more positive after implementing IoT in agriculture. It is noted that in some places people used to call this as "Agriculture Doctor ". IoT is enabling service centres for farmers to give suggestions on planting, harvesting, agricultural spraying calendar to watering calendar. In our India, agriculture is the one of the major sector and people there have a lot of traditional farming techniques ever like ditch irrigation, terrace irrigation, drip irrigation and sprinkler system. The world needs enormous productivity solve hunger of people but poor performance and decrease availability of water can't solve this. So in order to achieve this goals to get fulfilled we can take help of the methodology like precision farming, smart green homes etc. Good food makes one's life better and the best.

Wireless sensor systems and pervasive systems, where the sensors will be associated with and constrained by inserted frameworks, where administrations embody the usefulness and give bound together access to the usefulness of the framework. The IoT building squares of automation and machine-to-machine correspondence continue being set up. The extension of the organization layer shapes the total IoT structure. Hybrid correspondence plans appear to be the best fitted answers for IoT applications. The rise of incorporated handsets which incorporate numerous correspondence advancements on a solitary chip has opened entryways for increasingly productive remote correspondence.

CONCLUSION

IoT is one of the greatest technological advancement seen today. There are many aspects that are needed to be kept in mind while implementing these IoT solutions. First and foremost, these devices should come at an affordable cost so even poor farmers with less land can implement these solutions. Secondly, these IoT devices should be easy to implement (plug-and-play) so even illiterate farmers without much knowledge can use these devices. These devices should be able to produce the processed data and suggestion in simple terms i.e. complex numerical data cannot be understood by most farmers so analysis of this data in simple form is required. Lastly, these devices should be specifically tailored for different sectors in agriculture like fruits, arable crops, trees, large scale scraps etc. We as humans have greatly advanced in the field of technology over the past centuries of existence of mankind on this planet. Reading through the various agendas that IoT possess is extraordinary. Use of IoT to monitor the various environmental changes such as soil fertility, rainfall, use of pesticides, quality and quantity of crops, behaviour of a crop etc, is being stored, processes, then decisions are being taken by the system and implemented. The data stored can be shared to farmers even in the most of remote places and can be used by them to increase and improve their produce. The response to the situation is quick and almost immediate. Use of GPS robot to help the farmers in petty problems such as weeding, spraying of fertilizers and pesticides, controlling animals and birds in the field, etc. After the crops have been produced even the transportation can be done by using IoT and then distributed to the consumers at ease. Thus, the whole process can be controlled by IoT cloud, which is extraordinary.

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